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Memory for Medical Emergencies Experienced by 1- and 2-Year-Olds

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Children (13–18 months, 20–25 months, and 26–34 months) who had experienced trauma injuries were recruited in a hospital Emergency Room and subsequently interviewed about them within days (if verbal) and after 6, 12, and 18 or 24 months. The youngest children demonstrated little long-term verbal recall, whereas a few children in the intermediate group, who could not narrate about past events at time of injury, could verbally recall the target events 18 months later. Most of the oldest children, who had narrative skills at time of injury, demonstrated good verbal recall 2 years later. Illustrative case histories were described. Accuracy of recall was low for the youngest children, and although the majority of older children's recalled information was accurate, there were still many errors.

Infantile amnesia, or the inability of adults and older children to recall events of their early childhood, is a puzzling phenomenon. Surveys suggest that the average age of earliest memory is about 3½ years, but some people can recall an occasional salient event from the age of 2 years (McCabe, Capron, & Peterson, 1991; Mullen, 1994; Pillemer & White, 1989; Usher & Neisser, 1993). However, there seems to be a barrier at about 2 years, with informants not reporting memories of events that occurred before age 2. Over the years, a number of explanations have been proposed for why older individuals cannot retrieve memories from below 2 years of age, and many accounts included the notion of qualitative changes in memory structures between infancy and older childhood. Thus, according to these theoretical accounts, adults cannot access memories of events occurring before their 2nd birthday because these memories either are not present in memory or are not in a form that is accessible (Mullen, 1994; Nelson, 1992; Pillemer & White, 1989).

The area of infant memory has seen an explosion of research recently, much of it showing that there is no sudden shift in memory structures at age 2. Instead, continuity rather than discontinuity across the age-2 boundary characterizes much of the research (Bauer, 1995; Bauer & Wewerka, 1995; Howe & Courage, 1997). In elicited imitation tasks, young children have shown good memory for sequences of events (such as constructing toy windmills or manipulating toys in specific ways) that they experienced months earlier (Bauer, Hertsgaard, & Dow, 1994; Bauer & Wewerka, 1995; Meltzoff, 1995; Sheffield & Hudson, 1994), and some children even showed memory for objects and toy-manipulation procedures they saw as much as 2 or 4 years previously (Myers, Clifton, & Clarkson, 1987; Myers, Perris, & Speaker, 1994). Thus, 1- to 2-year-olds clearly have memory skills, and these skills are affected by the same things that affect memory in older children, such as logical order of events, repetition of similar experiences, and active participation in the events (Bauer, Hertsgaard, & Wewerka, 1995).

Because there is ample evidence that infants can retain memories for some events experienced during their first 2 years, why then are older children and adults unable to recall autobiographical experiences from the first 2 years of their lives? One possible explanation is the advent of language. In general, children begin producing their first words around their first birthdays, and during the succeeding year they increase their language competence remarkably. Not until around their 2nd birthday, however, do children typically form multiword grammatical utterances (Fenson et al., 1994). Thus, the linguistic skills of the children in the memory studies referred to above were generally fairly limited. And for the most part, the toddlers in these studies did not demonstrate later verbalization about their prior experiences, except for an occasional label (Fivush, 1994; Nelson, 1994). But the lack of language skills may not be a complete explanation in and of itself. For example, Bauer and Wewerka (1995) assessed language ability in toddlers between 13 and 20 months of age and then showed them sequences of toy manipulations. They found that although language measures were modestly correlated with nonverbal measures of memory many months later, better language skills at the time of encoding were associated with better subsequent verbal memory. Other researchers have provided anecdotes about child verbalizations (mostly isolated labels) about events or objects that had been experienced much earlier, well before appropriate verbal skills had developed (My-

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ers et al., 1987; Nelson & Ross, 1980; Todd & Perlmutter, 1980). Thus, there has been little research investigating children's later verbal recall of events that had been experienced much earlier in their lives, that is, well before age 2. Current studies of children's verbal recall of events across this age 2 boundary show mostly null effects (Nelson, 1994).

According to Brown (1973), an important shift in language use occurs around a child's 2nd birthday. Prior to that, language is used to describe the here-and-now; subsequently, children begin to use language to talk about the there-and-then, that is, events that are distantly removed from the child's immediate context. Such language is a fundamental component of the ability to tell narratives about past events. Few investigators have elicited narratives from very young narrators, but for those who have, the age at which this shift occurs typically is identified to be around a child's 2nd birthday. For example, in research in which children were assessed longitudinally, this shift occurred between 25 and 27 months for a number of children (Eisenberg, 1985; Miller & Sperry, 1988; Peterson & Dodsworth, 1991; Sachs, 1983), although it could be as late as 33 months (Eisenberg, 1985) or even considerably earlier, before the child's second birthday (Miller & Sperry, 1988; Veneziano & Sinclair, 1995). Others have also documented narrative skills in children who were between 24 and 30 months of age (Hudson, 1993; Peterson & Bell, 1996; Peterson & Dodsworth, 1991).

Thus, it may well be that one important contributor to the offset of infantile amnesia is the ability to use language to talk about events that are considerably removed in time and space from the immediate context, rather than just linguistic ability per se or skill at talking about the here-and-now. That is, for the purposes of later autobiographical recall, the ability to talk about distant there-and-then events may be crucial. Children who have achieved this milestone at the time of an event's occurrence may well be considerably better at describing these events when interviewed much later. In other words, lack of this skill may be an important contributor to the barrier in autobiographic memory retrieval that seems to occur before 2 years of age.

Although age 2 (or more specifically, attainment of the ability to narrativize the past) may be an important milestone, it is possible that there is another milestone prior to this age, specifically around 18 months. Piaget (1952) was one of the earliest to comment on differences in the cognition of toddlers who are older versus younger than approximately 18 months, namely, the attainment of Substage 6 of sensorimotor intelligence. In terms of language, children older than 18 months generally have considerably more skill at encoding their experiences linguistically by means of labeling component objects and actions compared with younger 1-year-olds. Also, although the age when children can produce verbal accounts of their past experiences is generally placed at about 2 years of age, younger children can make limited reference to the past. Before the age of 18 months, children typically make few, if any, references to past events, and those few are mostly partial imitations of adult utterances (Veneziano & Sinclair, 1995). However, from 18 months to 2 years, such references begin to appear, mostly in regard to absent objects, recently completed events, in the supportive context of conversational routines or games, or in response to structured adult questions (as reviewed in Fivush, Pipe, Murachver, & Reese, 1998). Another attainment that takes place in the middle of the child's 2nd year and that may well influence memory is a concept of self. Some investigators have proposed that a cognitive self can serve as an organizer around which memories for personal life events are elaborated (Bruner, 1990; Fivush, Haden, & Adam, 1995; Howe & Courage, 1993, 1997; Snow, 1990). Discussions of the cognitive self differentiate between the "I," or the existential self, the thinker, and agent of activity, and the "me," or the categorical self composed of a physical body with social and cognitive attributes (Butterworth, 1990; Damon & Hart, 1988). The most common instruments for measuring the concept of "me" identify an age around 18 months. At approximately this age, children begin to engage in mark-directed behavior when confronted with a mirror, begin using gestures indicating the self, and begin using "I/me/you" pronouns (Bates, 1990; Butterworth, 1990; Howe & Courage, 1993).

The changes that take place in both language and sense of self at around 18 months of age have been implicated in the development of autobiographical memory. Thus, a comparison of children who are younger versus older than 18 months would be informative. Such a comparison should ideally include three groups: (a) children who were younger than 18 months at the time of the target experience, (b) children who were older than 18 months but still not able to verbally report on or narrativize about the experience, and (c) children who were over 2 years of age and who also could produce narratives about the target events.

There is another issue that may play an important role as well, namely, the content of the experience. As any perusal of court proceedings will attest, it is widely perceived by many people that one category of early experience may well be particularly memorable from earlier ages, namely, traumatic experience. Memory for such experiences is sometimes seen as transcending other memories because of emotional impact or salience, and there have been a number of court cases in which plaintiffs claim to recall instances of trauma that occurred before 2 years of age. Thus, it is important to investigate memory for highly stressful experiences that occurred to very young children in situations in which the actual traumatic events are documented. This is obviously difficult to do.

Few studies have systematically studied memory for early traumatic experiences that were documented. Terr (1988) studied the recall of children for early traumatic experiences that were documented by medical or police reports at the time or by video or photographic evidence. Only 1 of the 6 children who were prenarrative at the time of the events (under 26 months) showed some limited verbal recall of the experience many years later, and 1 child retained only minimal, spot memories of those events. In contrast, all but 1 of the 14 children who were at least 27 months of age at the time of trauma had some verbal recall of their experiences. Thus, Terr's data are supportive of the notion that for some children there may be some (albeit spotty and fragmentary) long-term memory for personal experiences that occurred between 18 months and 2 years of age. Gaensbauer (1995) also found that older children typically could reenact their trauma in play, whereas children under 18 months could not verbally recall much if anything of what had happened to them. (But see Bernstein and Blacher's, 1967, single case history of a 3-month old at the time of a traumatic experience.) It is clear that more research on children's recall

of very early, highly stressful experiences is needed. This is the impetus for the research reported here.

In the present study, we investigated children's verbal recall for documented cases of early stressful experience, namely, instances in which young children injured themselves seriously enough that they needed to be taken to a hospital Emergency Room for medical treatment (mostly sutures for lacerations and casts for broken bones). The trauma involved is clearly not as severe as in Terr's (1988) or Gaensbauer's (1995) research, nor do the events cause long-term disability or major loss. Thus, the lack of such trauma severity is a limitation of the study. However, the children's reactions to their medical emergencies were rated by their parents at the time of either injury or treatment as showing extreme distress. In addition, these experiences have the advantage of being documentable by interviewing adult witnesses shortly after the injuries took place as well as by consulting medical records.

We investigated the verbal recall of three groups of children: (a) younger toddlers who were 18 months of age or younger; (b) older toddlers who were more than 18 months of age at the time of their injuries and who simultaneously could not verbally report or narrativize those experiences; and (c) 2-year-old narrators who could verbally describe their injury experiences. Furthermore, we tracked the children's verbal recall longitudinally for 1½ to 2 years. An earlier report included discussion of 5 of the 1-year-olds included here (Howe, Courage, & Peterson, 1994); however, that report was limited to only 5 children, and there was no comparison of the verbal recall of children who were younger versus older than 18 months at injury. In addition, that report only followed the children for 6 months, so some of the children had not yet attained narrative skills. Thus, the conclusion reported in Howe et al. (1994) that the children under 2 could not produce verbal recall is not necessarily warranted. The longer follow-up reported here ensures that all children have attained substantial verbal competence.

We predicted that the younger toddlers will not be able to verbally report on their experiences after they have attained narrative skills, whereas the 2-year-old narrators will be likely to do so, even after a long delay. The age group that to our knowledge has not before been specifically investigated included our intermediate age group of children, those who were over 18 months of age at the time of their experiences but could not yet verbally describe their experiences at the time of injury. Because such children have not been the focus of prior similar research, we had no a priori hypotheses about their ability to verbally recall their experiences long after they occurred.

An interesting additional issue is what happens to these memories over time. It is possible that early traumatic experiences are somehow protected in memory, such that they will continue to be recalled over the course of the study. However, a large study (Peterson, 1996; Peterson & Bell, 1996) of older children between 2 and 13 years of age who experienced similar traumatic injuries showed not only that these older children had good verbal recall of their experiences but also that over the course of 6 months they forgot some of the details; that is, their recall of these stressful experiences conformed to the forgetting curves that describe children's memory for nontraumatic events (Kail, 1989; Schneider & Pressley, 1989). However, the data on 2-year-olds were not consistent with that of older children (Peterson & Bell, 1996, p. 3052). In the present study, the children's recall of these experiences was tracked at three different points of time: 6 months, 12 months, and either 18 or 24 months after their injuries. We predicted that children will forget the details of these experiences over time, and the younger the children, the more they will forget.

Method

Participants

All participants were recruited from the Emergency Room (ER) of a children's hospital. They were White and from mixed socioeconomic backgrounds. The children experienced trauma injuries (defined by ER personnel as mostly lacerations requiring suturing and bone fractures) that necessitated visiting the ER for treatment. All were treated as outpatients and then sent home. The study included three age groups: (a) 12 children between 12 and 18 months of age (7 girls and 5 boys; *M* age = 16.2 months—hereinafter termed *younger toddlers*); (b) 12 children between 20 and 25 months of age who were unable to narrate about their injury experience at the time it occurred (5 girls and 7 boys; *M* age = 21.2 months—hereinafter termed *older toddlers*); and (c) 12 children between 26 and 34 months of age who had some narrative skills at the time of injury and readily verbally recalled at least some information about it (7 girls and 5 boys; *M* age = 30.8 months—hereinafter termed *2-year-old narrators*). Two thirds of the children in each group required sutures, and 2 younger toddlers, 1 older toddler, and 2 two-year-old narrators had broken bones. The other injuries sustained by the children included burns (2 children), squashed finger or leg (2 children), poke near eye (2 children), bone in throat (1 child), and dislocated shoulder (1 child).

Procedure

Parents and children were approached in the ER, and the study was explained to them. Most parents (85%) agreed to participate. Informed consent forms were signed and telephone numbers provided by parents so that home interviews could be set up. The parents were then telephoned by a research assistant within a few days of the injury to set up a home interview. During this phone call, the parents were asked to not rehearse the events with their child prior to the interviewer's visit, because she was interested in how much the child could recall. When visiting the home, the interviewer first established rapport with the child, and then attempted to elicit from the child information about the injury and hospital treatment. If all attempts to elicit such verbal recall failed, she then attempted to elicit information about other past events, such as the previous day's activities. If this also failed, she asked the parents if their child talked about past events with them. None of the children under 26 months of age narrated about the target experience or any other experience to the interviewer, and parents claimed that they did not do so to them either. In contrast, all of the children in this study who were older than 26 months did. Thus, for the sample of children in this study, 26 months was the age which divided children into toddlers versus 2-year-old narrators. (For other samples of children, this division may well be different, and there may also be overlap between the ages of the children in the two groups—something we did not find in this sample.) For children in the two toddler groups who could not be interviewed about the target event shortly after it occurred, the interviewer just talked with the parents. All interviewers used the same standardized interview (see the Appendix).[1]

[1] Seven different interviewers were involved in data collection. All were extensively trained, including interviewing children with similar but less serious injuries (e.g., bruises or sprains) before conducting interviews with the participants in this study. To ensure consistency, all interviewers used the same standardized interview, and the tapes of all interviews were reviewed by one research assistant. Each child had a succession of interviews; for some interviews, the interviewer was the

The interviews for the children in the 2-year-old narrator group as well as the parents followed a standardized format that began with free-recall probes and then queried specific pieces of information by means of both *wh-* (who, what, when, where, why) and yes/no questions. Each child's injury and hospital treatment were unique in some respects; nevertheless, all of the experiences conformed to a prototypical pattern, which is found in the Appendix. Because of this prototypical pattern, a questionnaire was used that specifically asked about each prototype component. In this way, the information elicited from different children was similar across children. The questions are included in the Appendix. Note that most are *wh-* in format. Because answers to yes/no questions may be particularly suspect in young children (Peterson & Biggs, 1997), if at all possible we elicited information by means of *wh-* questions, although for a few items of information we were forced to use a yes/no question because no *wh-* question seemed appropriate. These included questions such as "Did you cry? Did it bleed?" If the child or parent provided information relevant to any question during free recall or while expanding on an earlier question, it was not reasked. That is, if the respondent already described where the injury took place, he or she was not asked "Where were you when it happened?" All parents readily answered all questions; however, this was not the case for the 2-year-olds. If they did not answer a particular question, it was repeated two or three times. *Wh-* questions were then reasked in yes/no format. If the child still did not respond, the interviewer moved on to the next question. All questions of the interview were asked. During the entire interview with the child, the interviewer also incorporated play activities as well as talk about the child's current activity, to make the interview more enjoyable for the child and to optimize cooperation. All children readily talked with the interviewer during the interviews about here-and-now activities (although less readily about past events), and nonresponses by the child to specific questions took the form of simply ignoring the question and responding with comments about the here-and-now. (For additional information about the interviews, see Peterson, 1996, and Peterson & Bell, 1996.) A parent was present during the interviews, although he or she was asked to remain silent (unless asked for translation or clarification of an incomprehensible word used by a child).

If someone other than a parent witnessed the child's injury (e.g., the baby-sitter or grandparent), this person was interviewed as well. In addition, the parent who witnessed the injury and treatment (or other witness, if no parent did so) was asked to rate the child's degree of distress at both the time of injury and of hospital treatment on a 6-point scale, from 1 (*not distressed at all*) to 6 (*extremely upset, very distressed*). (Doctors were not asked to rate the child's degree of distress because they did not witness the injury, and if both parents witnessed the event, their distress ratings always agreed.) Note that this scale differs from that used by Goodman and her colleagues (Goodman, Hirschman, Hepps, & Rudy, 1991) in that a neutral state is described as 1 and all higher numbers describe increasing degrees of distress. Goodman et al. also used a 1-to-6 scale, but 1 represented the state of being *extremely happy* whereas 6 represented *extremely upset*. Thus, the neutral point in that scale was 3.5. None of our children were ever described as happy by parents, only distressed; thus, our scale is expanded on the negative affect side.

The families were visited again three more times: 6 months after the initial injuries (*M* delay = 6.3 months, range = 5.0–8.7), 12 months after the injuries (*M* delay = 12.6 months, range = 11.2–14.6), and either 18 or 24 months afterward. The children in the youngest two age groups were visited at 18 months (*M* delay = 18.4 months, range = 16.2–20.5), whereas children in the oldest age group were visited at 24 months (*M* delay = 23.3 months, range = 20.0–25.3). (The longer delay for the oldest children was due to their inclusion in a larger study of children between 2 and 13 years of age, for whom a 2-year delay was used.) All of the children were available for the 6-month interview; and all but 1 in the older toddler group and 2 in the 2-year-old narrator group were available for the 12-month interview. However, the last interview included only 7 younger toddlers and 8 older toddlers but all 12 two-year-old narrators. (The children who remained in the study versus those who dropped out did not differ in how distressed they were reported to be at the time of injury; rather, most attrition was due to the family having moved.) When all return home interviews were set up, the interviewer asked the parents to not rehearse the events with the children because we were interested in their verbal recall for the target events. Almost all parents stated that the children's earlier injuries had not been discussed in months, and most also doubted whether the children would be able to remember anything about them. When the children were revisited and either interviewed for the first time or reinterviewed, the same standardized interview format was followed, including the same questions and procedures as before.

At the end of the 6-month follow-up interview, the child was presented with four photographs, two male and two female, one of which was the medical person who treated the child at the hospital. The remaining pictures were of other hospital medical personnel who were not in the hospital at the time of the child's visit and thus were not seen. These four pictures were presented in random order, then picked up, shuffled, and later presented again. The child was asked to indicate the person who treated them at the hospital after the first presentation. At the second presentation, the interviewer claimed that she did not remember what the child had said earlier, and asked the child to indicate his or her doctor. This memory task was done only at the 6-month interview so that there was a significant delay between the children's interaction with the doctor and the recognition test. It was not repeated on subsequent visits because recognition of the pictures presented earlier may have contaminated later recognition memory tasks. A child was scored as correctly identifying the doctor if both choices identified the correct individual.

Scoring of Recall Data

All interviews were audiorecorded and later transcribed verbatim. The transcripts of the children were searched for information that was relevant to their injury and hospital treatment, and it was checked against the transcripts of the adult witnesses for accuracy. The hospital records of the children were also available, but there was never a disagreement between those records and the witness reports.

Scoresheets were derived that focused on each of the prototype components of the injury and hospital experience (and about which specific questions were asked in the interview unless the information was volunteered earlier), and the child was scored as providing correct information about each prototype unit, incorrect information, or no information. Note that the child's response to each item of the prototype was globally scored as *correct* versus *incorrect* versus *no response*. Furthermore, the type of response was coded. If children responded to a yes/no question with a simple *yes* or a *no*, this was scored as a yes/no response. Thus, all yes/no responses in our data are simple affirmations or denials of propositions contained in yes/no questions. If, on the other hand, a child responded to free-recall probes or to any form of question by providing content details relevant to any of the prototype items, these were scored as *wh-* responses. Thus, a *wh-* response was a content-laden response, one in which the children had to generate the appropriate information themselves. Only details that were specifically contradicted by informa-

same person as in the previous interview, and for some interviews, the interviewer was a different person. The proportion of successive interviews conducted by the same person was 64%, 68%, and 52% for the three age groups. To see if variation in same versus different interviewers biased the results, we conducted preliminary analyses that compared interviewer (same or different) with the data from successive interviews (6 month vs. 12 month, and 12 month vs. 18 or 24 month). No effects based on whether successive interviewers were the same or different were found.

tion in witness reports were included as errors; likewise, only information that was confirmed by witness reports was included as correct. The rare detail provided by children that was neither confirmed nor disconfirmed by witness report was ignored.

Two numerical scores were derived for the children during each interview: (a) the proportion of correct prototype units provided and (b) the number of errors of commission (i.e., the number of prototype items responded to with erroneous information). Two raters scored 15% of the transcripts, and interrater reliability was 92%.

Results

Proportion of Prototype Items Recalled Accurately

The mean proportions of prototype items that were correctly recalled by each group during each interview are shown in Table 1.[2] Both *wh-* responses and yes/no responses are shown. Note that only accurate items are shown—errors are not, and will be discussed later. Although the children were visited four times (and the oldest group interviewed four times), only three levels of delay are included in all analyses below. This is because there are simply no data for two thirds of the children at the initial interview. Thus, only the three delayed interviews are analyzed. The proportion of prototype items that were correctly recalled by the children was analyzed by means of Group (between subjects: 3 levels) × Time (within subjects: 3 levels) analyses of variance (ANOVAs) for each type of response (*wh-* response or yes/no response) separately. Because the number of children interviewed at each age level differed during the different delays, there are a number of missing values in the data set. The analysis that was used was a general linear model as carried out by SAS, which partitions the sums of squares using weights (based on sample sizes), hence taking account of unequal sample sizes across cells.[3]

Table 1
Mean Percentages and Standard Deviations of Prototype Items Accurately Recalled by the Three Age Groups of Children During Their Initial Interview and Three Delayed Interviews (at 6, 12, and 18 or 24 Months Postinjury), Separated by Type of Response

		Type of response			
		Wh content		Yes or no	
Interview/group	*n*	%	*SD*	%	*SD*
Immediate interview					
Younger toddlers	12	0.0	0.0	0.0	0.0
Older toddlers	12	0.0	0.0	0.0	0.0
2-year-old narrators	12	32.5	18.8	4.2	3.3
6-month delay					
Younger toddlers	12	2.3	4.5	3.0	7.1
Older toddlers	12	11.8	14.2	7.4	5.6
2-year-old narrators	12	27.3	13.2	9.2	6.2
12-month delay					
Younger toddlers	12	9.7	13.8	1.8	2.3
Older toddlers	11	14.7	12.6	5.6	4.9
2-year-old narrators	10	35.0	15.6	3.5	1.3
18- or 24-month delay					
Younger toddlers	7	10.9	9.4	10.7	7.2
Older toddlers	8	21.5	9.5	10.6	5.6
2-year-old narrators	12	41.9	17.2	7.2	5.2

First, the proportions of the prototype components for which children recalled *wh-* content information were analyzed; the older the children, the more details they provided, $F(2, 87) = 36.45$, $p < .001$. Follow-up Neuman–Keuls showed that the 2-year-old narrators recalled more than did either toddler group, which did not differ from each other. Children also verbally recalled more as time went by, $F(2, 87) = 5.43$, $p = .006$. Follow-up t tests for matched pairs of means showed that children recalled less at the 6-month delayed interview than at either other delayed interview ($ps < .02$), but their recall was equivalent at the 12-month and 18- or 24-month delayed interview. There was no Group × Time interaction.

Next, the proportions of all the prototype components for which children provided only a yes or no response to yes/no format questions were analyzed. There was no significant age effect—all groups of children were providing the same amount of information in yes or no format. Nor was there a Group × Time interaction, although there was a significant time main effect, $F(2, 87) = 8.79$, $p < .001$. Follow-up t tests for matched pairs of means showed that the children recalled less in the 12-month delayed interview than they did at either the 6-month or 18/24-month delayed interview ($ps < .02$), and these latter two did not differ from each other.

In summary, when we look at the proportion of prototype interview items that children accurately recalled after delays of up to 2 years, we find that children who were older at the time of their injuries had more extensive verbal recall of the content of those injuries than did children who were younger when the injuries occurred. Older and younger children did not differ in their yes or no responses, but these were only asked if a content response was not elicited. In addition, children recalled more as they got older.

The above analyses investigated children's verbal recall of their experiences after set periods of time had elapsed. That is, the length of time since injury was controlled for. However, there is an important confound in the data: As the delay between injury and interview increased, the children were also getting older and more verbally competent. Thus, it may be that the better recall of the group that was oldest at the time of injury was due to the fact that at every interview, this group of children was more linguistically competent as well as more compliant with interviewing procedures than were children in the other groups.

To address this confound, we calculated a regression analysis in which the proportion of variance attributable to time delay was determined; subsequently, we could see if any unique variance was accounted for by age at the time of experience. Data from all three interviews of the children were included, and a general linear model (using SAS) was used to partition the variance, with the use of sequential sums of squares (based on

[2] No differences in the recalls of children who remained in the study versus those who dropped out were found in t-test comparisons for any of the analyses. Furthermore, preliminary analyses conducted with versus without these children did not differ.

[3] Three of the children (one older toddler and two 2-year-old narrators) who were interviewed after a delay of 18 or 24 months were not interviewed after 12 months. Analyses were conducted both with and without these participants, and there were no differences between the sets of analyses.

the model) to estimate first the effects of delay and then the effects of age controlled for delay. For children's *wh-* responses, 10% of the variance was due to the time delay of the interview and 41% of variance was uniquely attributable to age at the time of experience. For yes/no responses, 14% of variance was due to delay and only an additional 5% of variance was uniquely attributable to age at the time of experience. Although there is potentially a third predictor variable—number of interviews—the contribution of this predictor variable could not be assessed because it is highly correlated with the delay predictor variable. Thus, overall, the age of the child at the time of their injury contributed the most to the variance in how much children later recalled in their content-rich *wh-* responses.

In summary, it is not the case that the older children (who were linguistically more competent as well as behaviorally more cooperative with interviewing procedures) simply provided the most information, regardless of the time that had elapsed between injury and interview or their age at the time of their injuries. Rather, children who were older at the time of their experience recalled more, even when their age at the time of recall is controlled for. Thus, there is converging evidence from all analyses presented above: Children who were older at the time of their injuries recalled more content-rich *wh-* information about those injuries later on.

Accuracy of Recall

We turn now to a consideration of how accurately children recalled their experiences. This requires a comparison of accurate and inaccurate information; that is, the number of correct details are compared with the number of commission errors. Commission errors were factually incorrect details. The raw frequencies of correct and erroneous prototype items provided by each age group during each interview are shown in Table 2. Note that these data are summed across all children. In Table 1, the average number of items recalled by each child in a particular age group is provided; in contrast, Table 2 provides the total number of items recalled by all of the children within each age group. In addition, the percentage of items that are correct is given, that is, the number of correct items divided by the sum of correct and incorrect items. It can be seen that the children were making a lot of errors, although the majority of the recollected information was still accurate.

This data set cannot be analyzed by ANOVAs in ways that are similar to our previous analyses. This is because we are comparing the proportion of information that children actually provide that is either correct or in error. Any such proportion requires that the children provide at least some information. When the child recalls nothing, a zero entry is meaningful for the above ANOVAs that analyze the proportion of relevant prototype items recalled by the child, because all children have many prototype items that are potentially recallable. Thus, the denominator in all such proportions is never zero. In contrast, when comparing the numbers of accurate versus incorrect items provided by the children, as one must when assessing accuracy, one divides by the total number of details actually recalled by each child, and clearly one cannot divide by zero in cases in which the child recalls nothing. Because of this problem, we cannot include data from individual children in the ANOVAs. Instead we compared the frequencies of both correct and incorrect details that were produced by the age groups.

To analyze the number of children's correctly recalled items versus commission errors, we conducted a series of heterogeneity chi-squares, using G or non-Pearsonian chi-squares. These provided a likelihood ratio and were directed toward answering the question, "How likely are groups to differ from each other by chance alone?" To conduct these analyses, we compared the number of correct responses and the number of errors for a particular group with those same two frequencies for a comparison group. To do such comparisons, one must have the same number of participants in the two groups that are being compared. Because the number of participants in various interviews

Table 2
Summed Total of All Items Provided by Each Age Group, Including Correct Details (C), Errors (E), and Percentages Correct (% C) for Responses Elicited by Wh- Questions and Yes/No Questions

	Length of delay between injury and interview								
	6 months			12 months			18 or 24 months		
Response/group	C	E	% C	C	E	% C	C	E	% C
Wh- content									
Young toddlers	6	2	75	29	25	54	25	24	51
Older toddlers	41	23	64	52	32	62	50	28	64
2-year narrators	100	30	77	91	39	70	159	52	75
Yes/no									
Young toddlers	10	3	77	6	11	35	45	36	56
Older toddlers	31	16	66	23	13	64	60	35	63
2-year narrators	37	24	61	15	16	48	34	29	54

Note. There were different numbers of children contributing to the counts: 12 children at each age group contributed to the frequency counts during the first interview; 12 young toddlers, 11 older toddlers, and 10 two-year narrators contributed data during the second interview; and 7 young toddlers, 8 older toddlers, and 12 two-year narrators contributed to the frequency counts during the last interview. % C = correct details divided by the sum of correct plus error details.

and age levels differed considerably, the number of participants in the two groups compared in any one analysis was equated by randomly selecting children from the group with more participants until they matched the number of participants in the smaller group.

First, we assessed the role of age. That is, did older children make proportionately fewer errors (relative to how many correct items of information they provide) than did younger children during each interview? We calculated chi-square likelihood ratios for correct items versus errors for each response type in each of the interviews separately. At the 6- and 12-month follow-up interviews, there were no age differences in accuracy rates for *wh-* content responses. However, at the 18- or 24-month interview, the 2-year-old narrators were more accurate than the younger toddlers when recalling *wh-* content, $\chi^2(1, N = 14) = 7.52, p = .006$. (Older toddlers differed from neither group.) In contrast, the accuracy of yes/no responses did not significantly differ between these age groups at any delay interval. Thus, overall, the oldest children are more likely to provide accurate responses than are the youngest children after a delay of at least 1½ years; however, this is only true when *wh-* responses are considered. That is, *wh-* and yes/no questions were not equivalent in accuracy.

Next, we assessed the role of delay between the children's injuries and their verbal recall of those injuries in a series of heterogeneity chi-squares that compared interviews within each age group separately. None were significant. The children's accuracy rates did not differ as the delay between injury and recall increased, regardless of their age at time of injury. The children made proportionately as many errors in their later interviews as they did in their earlier interviews.

In summary, the children made a lot of errors, although the majority of the information they recalled was still accurate. The oldest children were more accurate than were the youngest children, at least when they were interviewed a year or more after their injuries. There are other caveats: This greater accuracy for the oldest children only applied to their *wh-* responses. That is, a similar age difference in accuracy was not found for yes/no responses. Surprisingly, for all age groups, the time between their injuries and their recall was not related to their accuracy rates. That is, children did not become less accurate with the passage of time.

Stress Ratings

All children included in this study were reported to be highly distressed (i.e., had a rating of 5 or 6) at the time of injury or when treated at the hospital, and 15 of them were reported to be very distressed at both times. Because the parents did not necessarily report the same degree of distress for their children at the time of injury and of treatment (and in fact the two stress ratings were not significantly correlated), the means of the two stress ratings were tabulated separately for injury or treatment. The reported mean level of distress at the time of injury and of hospital treatment for each group of children were as follows: younger toddlers, 4.83 (SD = 0.94) and 5.33 (SD = 1.43); older toddlers, 3.83 (SD = 1.85) and 5.91 (SD = 0.29); and 2-year-old narrators, 4.00 (SD = 1.47) and 5.08 (SD = 1.56).

The degree of child distress as reported by their parents had no impact on their verbal recall. The children's two stress ratings were correlated with all recall variables, and none of the correlations were significant. This may be because there was so little variance in the data—most children were quite upset.

Photo Identification

The children did not seem to be able to identify the photograph of the doctor who treated them at the hospital. On average, they identified the correct photograph only 30% of the time, which is not different from chance. The three age groups did not differ in correct versus incorrect photo identifications, $\chi^2(2, N = 31) = 0.69$.

Changes Over Time

One of the methodological problems of the current research is the lack of control groups. Over the course of time, the children's experiences could have been partially reinstated. The parents stated that although the children's injuries were often discussed during the first couple of weeks after they had occurred, they then became "old news" and were not discussed thereafter (with the exception of children who had casts removed—these children had their experiences discussed at that time as well). In spite of parents' claims, it is possible that over time, occasional reinstatement changed the sorts of information that children provided.

Furthermore, the interviews that we conducted reinstated the children's experiences on multiple occasions. To what extent did this reinstatement affect the children's later recall of the target events? The best assessment of this issue would be to have a control group that was interviewed only at the end of the study, without the prior interviews. However, the availability of such a small number of children who were injured seriously enough to be included in our study precluded any inclusion of such a control group. Indeed, it took over 3 years to recruit the children who did participate. Because of the lack of such a control group, we did the next best thing: The transcripts of the children were searched for evidence of systematic change that might be associated with multiple interviews. In particular, children may have changed earlier yes/no responses to later *wh-* responses.

To see if any sort of systematic change occurred to yes/no responses over time, we compared children's earlier yes/no responses with responses in the next interview (i.e., 6-month responses compared with 12-month responses, and 12-month responses compared with 18- or 24-month responses) to see if they remained yes/no in format, changed to *wh-* responses, or became null responses. The data are presented in Table 3. The younger toddlers' yes/no responses mostly became null responses with time. Although this was less true for older age groups, a null response was the predominant change for them too. Less than a third of the yes/no responses for older toddlers and 2-year-old narrators changed to *wh-* responses over time. Particularly for the oldest children, their earlier yes/no responses were as likely to remain yes or no as to change to a *wh-* response, and of course even more likely to become a null response.

Qualitative Analysis

In addition to the quantitative analyses presented above, an overall assessment of the children's verbal recall of their injury

and treatment was made from the transcripts for each interview. This was done because the number of items recalled does not necessarily reflect the quality or coherence of the children's recall. Some children may not have recalled very much information, but what they did recall included the fundamentally important components of what they injured (e.g., broke arm, cut head), how they did it (e.g., fell down stairs), and what medical treatment was applied (stitches, cast). Other children may have had a similar number of items scored on their scoresheet but they provided less central information, such as who was there at the injury and at the hospital. (Indeed, a response such as "mommy" in response to "Who was there?" may be just a guess on the part of the child, but because mom is around so much, it is more likely than not to be correct.) Or the children's responses may have been only in yes or no format. To judge a child as having a coherent verbal recall of their experiences, we required the child to provide a content-oriented response, that is, a correct response in *wh-* format. Furthermore, the child had to provide at least two of the key components of what they injured, how they did so, and medical treatment. To provide a feel for the quality of the children's recall, we gave each transcript an overall classification as one of the following: (a) It provided (in *wh-* format) at least two of the fundamental components listed above; (b) it provided spot recall of isolated details although either none or at most one of the major components was recalled; and (c) it indicated no verbal recall of the target experience. The classifications were derived from the scoresheets used for the quantitative analyses. The classifications of all of the children's transcripts are shown in Table 4. This classification scheme is similar to that used by Terr (1988).

The young toddlers were at most 1½ years old at the time of injury; during the first interview 6 months later, they were still nonnarrative in linguistic skills. Not surprisingly, there were no children in this group who showed good verbal recall of their injury and treatment at this age, although several provided a few isolated details about the events. A year after their injuries, when all of the children had appropriate narrative skills, only 2 of them provided the essential outline of their experiences ("yes" in Table 4); both stated what they injured, and one stated how it happened whereas the other stated what treatment was done. Nevertheless, a couple of these children who could not describe their experiences in language shortly after they occurred could describe them narratively a year later, whether or not this recall could be maintained over time. However, by 18 months, 1 of the children who had good verbal recall at 1 year no longer verbally recalled anything but a couple of isolated details. In the other case in which the 12-month transcript is classified as "yes," no 18-month interview exists, so it is unclear if verbal recall was maintained for this child. Although there were only 7 children for whom we had 18-month follow-up data, none of them demonstrated good verbal recall of the major components of their experiences. Thus, children this young did not seem to have long-term verbal recall of early medical emergencies.

Nonnarrative children over 1½ years of age seemed to have somewhat better verbal recall of their experiences than did younger children. Six months after their injuries, all of them had appropriate narrative skills, and although most provided spot details, only 3 indicated good verbal recall for the target events by specifying what was injured and how it was done. Two of these children maintained good verbal recall over time, whereas the 3rd child showed no evidence of recalling the target event 1½ years after it occurred. A 4th child who had provided only limited spot details during the first interview had good verbal recall of two of the required major events at 18 months postinjury. Thus, a few of the children in this intermediate group could later verbally recall events that could not be narrativized at the time of their occurrence, and 3 of the 8 children for whom we had 18-month follow-up interviews demonstrated long-term verbal recall of their experiences.

The story is quite different when one considers the verbal recall of the children who were narrators at the time of injury. All of the 2-year-olds who had narrative skills at the time of injury could provide at least some verbal information about their injury experiences 6 months later, and half verbally recalled the main events. By 2 years postinjury, all but 1 of the children displayed good verbal recall for these events. Thus, most 2-year-olds with narrative skills remember early traumatic events, at least for the subsequent 2 years. Whether these memories will be retained over a longer period of time is unknown.

Discussion

Studies of infantile amnesia point to the age of 2 years as the cutoff age for memories of early personal experiences, and even events from this young age are rarely recalled by people (Mullen, 1994; Pillemer & White, 1989; Usher & Neisser, 1993). In the present study, the long-term verbal recall of a medical

Table 3
Number and Percentage of Yes/No Responses That Remained Yes/No Responses in Subsequent Interviews, Changed to Wh- Responses, or Became Null Responses for the Three Age Groups

	Changes in responses					
	Yes/no to yes/no		Yes/no to *wh-*		Yes/no to null response	
Group	No.	%	No.	%	No.	%
Younger toddlers	1	4	5	23	16	73
Older toddlers	20	32	11	18	31	50
2-year-old narrators	34	29	39	33	46	39

Table 4
Classification of Children's Long-Term Verbal Recall of Medical Emergencies as No Recall, Minimal (Spot) Recall of Isolated Items, or Verbal Recall of at Least Two Central Events

Child	Age (months)	6 months	12 months	18/24 months
Young toddlers				
1	13	No	No	No
2	13	No	Spot	Spot
3	14	No	Yes: a, b	Spot
4	16	No	?[a]	Spot
5	16	Spot	No	No
6	17	No	No	—
7	17	Spot	No	—
8	17	No	No	No
9	18	Spot	Yes: a, c	—
10	18	No	No	—
11	18	Spot	No	—
12	18	No	No	No
Older toddlers				
13	20	Spot	No	—
14	21	Spot	Spot	Spot
15	21	Yes: a, b	Yes: a, b	No
16	22	Yes: a, b	Yes: a, b	Yes: a, b
17	23	Spot	—	Yes: a, b
18	23	No	No	No
19	23	Spot	No	Spot
20	23	Spot	Spot	Spot
21	24	No	Spot	—
22	24	Spot	No	—
23	25	Yes: a, b	Spot	Yes: a, b, c
24	25	No	No	—
2-year narrators				
25	26	Yes: a, c	Yes: a, c	Yes: a, c
26	26	Spot	—	Yes: a, b, c
27	28	Yes: a, b	Yes: a, b, c	Yes: a, b
28	30	Spot	Yes: a, b, c	Yes: a, b
29	32	Spot	Spot	Yes: a, b, c
30	32	Yes: a, c	Spot	Yes: a, b, c
31	32	Spot	Yes: a, b, c	Yes: a, b, c
32	32	Spot	Spot	No
33	32	Spot	No	Yes: a, c
34	33	Yes: a, c	Yes: a, c	Yes: a, b, c
35	33	Yes: a, b, c	—	Yes: a, b, c
36	34	Yes: a, b, c	Yes: a, b, c	Yes: a, b, c

Note. The central events included the following: (a) what was injured; (b) how the injury occurred; and (c) the major medical treatment (the response "yes" followed by a, b, and/or c). Dashes indicate no interview at that delay interval.
[a] This child was prompted by the parent for essential items during the interview, and it was not clear if the child would have provided them without prompting.

emergency was assessed in a group of 2-year-olds, and 11 of the 12 children were able to recall the major highlights of their experiences fully 2 years later. This supports earlier work suggesting that highly salient events experienced by children as young as 2 years can be recalled long term. These children recalled the fundamental components of what happened, how, and what treatment was applied, and embedded these components within a number of other details. Importantly, most of the items they recalled were content rich; they were *wh-* responses in which the children had to generate the appropriate information themselves.

The children in this oldest group all demonstrated some narrative skill to their interviewers during the initial visit that took place shortly after their injuries occurred, and this ability to narrativize experience may well be an important skill contributing to their successful verbal recall of earlier events. After all, children who can readily talk about the there-and-then can reminisce with parents and others about their experiences. In other words, their personal experiences enter the realm of conversational topics at times far removed from when they occurred.

This study also included a number of children who were under approximately 2 years of age (more specifically, under 25 months) and who did not display narrative skills at the time of their injuries. By the end of the follow-up period, all of these children had acquired narrative skills, that is, they talked about past events with the interviewer. Of more significance is the fact that they seemed to be considerably less able to talk about the events that had occurred before their achievement of narrative skills, that is, prior to the age of 2 years, than did older children who displayed narrative skills when target events occurred. A possible explanation for the poorer performance of the children from younger age groups is that at every interview they were

less linguistically mature and less able to fully cooperate with interview procedures. However, this is an unlikely explanation because when we analytically controlled for age at the time of the interviews, the children who were older at the time of their injuries still recalled more. Another possibility is that the children who had narrative skills when they were injured could consolidate those experiences linguistically by talking about them at the time. Therefore, they had the opportunity to verbally encode those experiences and discuss them over the succeeding days. Because these experiences were "big news" at the time they occurred, they were undoubtedly talked about with relatives and friends for the next couple of weeks. Children who are able to narrate about the past can be included in such discussions in a way that younger children cannot be.

In our sample, "prenarrative" children were divided into two groups: young toddlers between 13 and 18 months of age and older toddlers between 20 and 25 months. This division was made because of converging suggestions that there may be a transition in child cognition at about 18 months of age. We had predicted that the younger toddlers would not be able to verbally recount the target events in long-term follow-ups, and for the most part, this is what we found.

Even though these very young children were not verbally recalling their experiences, they may well remember them in other ways. A case history of one child illustrates this. A 16-month-old (Child 5) fell and cut his forehead. The most traumatic part of his injury, however, took place at the hospital. Standard procedure for suturing young children is to wrap them in a papoose board so they will remain motionless. As the child was being restrained and sutured, he cried so hard that he ruptured a number of blood vessels in his neck, back, and chest. After going home, he showed sleep disturbances for a week and became hysterical when blankets were put on him. He developed a fear of strangers, refused to leave the house, and did not like to enter any buildings. At the 6-month delay interview, he was 22 months of age and still did not have narrative skills, but as soon as he heard the word *hospital* he immediately pointed to his forehead where the stitches had been. In addition, he was able to identify his treating doctor from a set of pictures provided by the interviewer. He picked up the picture and went to show it to his father, saying "Doc, Doc." He was still afraid of strangers, still refused to leave the house, and still did not like to enter buildings. At the 12-month and 18-month delay interviews, he had no verbal recollection of ever being at the hospital or of having stitches in his forehead. However, the behavioral changes noted by his parents still persisted, although they were beginning to decrease by the last interview except for his refusal to be wrapped in a smock (e.g., to get his hair cut). Thus, a nonnarrative child was able to indicate that he remembered the incident after 6 months; later when his linguistic skills improved he showed no signs of verbal recall of the events, although other suggestions of memory seem to remain. This is parallel to findings by Terr (1988) and Gaensbauer (1995).

Only 2 of the children from this young age group were scored as having "good" verbal recall once they had attained narrative skills, that is, in their 12-month delay interview. As an example, Child 3 fell and painfully displaced his elbow, which had to be put back in place. At the 12-month follow-up (his first after acquiring some narrative skills), he was able to describe how he had hurt his arm. "I jumped on the chesterfield, and I hurt myself. That's why." He also stated that his mother was there and that she had spoken to him. Then they "jumped in the van and went to the hospital." At the hospital he recalled that the doctor who had helped him was male. But at 18-months postinjury, he demonstrated almost no verbal recall of the details surrounding the event.

The 2 younger toddlers who demonstrated verbal recall at 12 months postinjury may well be showing evidence of later verbal encoding and recall of experiences that were not verbally encoded at the time. The first child in particular seemed to generate a number of items relevant to his experience. However, an alternative explanation that cannot be dismissed is that the children are simply recounting what they have been told by their parents. The parents of both children stated that the target experience had not been talked about for many months and certainly not since the children had become narrators. Both also thought that their children would verbally recall nothing and were surprised at what they did recall. At the present time, it is impossible to decide among these alternative explanations. However, it is notable that the first child, who seemed to recall so much at his interview after a 12-month delay, showed no evidence whatsoever of verbally recalling the target experience when he was reinterviewed after an 18-month delay. Thus, even if children this young can show some verbal recall of their experiences that occurred so far in the past, such recall seems to be tenuous at best.

We turn now to the older toddlers. If one assesses qualitative categorization, we find that although the majority of the children showed minimal recall of their injuries, more of these older toddlers provided spot details than did the younger toddlers. However, this recall did not seem to be organized into a coherent account of what had happened to them, and thus is unlikely to be maintained long term by most of the older toddlers.

Three of these older toddlers showed good verbal recall $1\frac{1}{2}$ years after their injuries. For example, Child 16 who had burned his hand on the exhaust of the lawnmower remembered the main events of his injury across all three delayed interview sessions. At the initial interview, he was limited to showing his hand and saying "hot, hot!" At the 6-month delay interview, he said that he burned his hand on the lawnmower, stated who was there, and said that he saw a doctor. At the 18-month interview, he added that he burned his hand on the lawnmower because he wanted to see if it was hot. Thus, this child who was under 2 years of age at the time of his injury seemed to retain an excellent memory for it, at least for the succeeding 18 months.

In summary, although the majority of the children in this intermediate age group did not show long-term organized verbal recall of their injury, a few did so. Perhaps these particular children had parents who were more likely to remind the children of their injury, although the parents denied this. It is also possible that these 3 children were misclassified as nonnarrators; however, the interviewer was unable to elicit verbal recall of the experience at the time. Overall, long-term verbal recall seems to be found in some children who are under 2 years of age at the time these events occurred, but they are only marginally younger.

The children in the three groups differ not only in age and verbal skills at the time of injury but also in the opportunity to verbally reminisce about their experiences. When we interviewed the children, the target events were reinstated and the

children were given the opportunity to verbally reminisce about them. The mechanism of memory reinstatement has been shown to be important in both infants and preschoolers (Bauer et al., 1995; Fleckenstein & Fagen, 1994; Howe, Courage, & Bryant-Brown, 1993; Rovee-Collier & Shyi, 1992), and the target events were reinstated for the older toddlers after the passage of only half a year whereas they were not similarly reinstated for the younger children (because of their delayed attainment of narrative skills in comparison with the older children) until a full year had passed. In addition, the narrating 2-year-olds had had their memories reinstated after only a week as well as after both 6 and 12 months. Thus, the time and frequency of memory reinstatement may be an important contributor to our pattern of findings.

The events that people remember from their early childhood are those that were somehow very salient and meaningful, and in particular these early memories tend to be accompanied by strong emotions (McCabe et al., 1991; Pillemer & White, 1989). Because the children in this study displayed very high levels of emotional distress during their injury or treatment or both, these events are more likely to be ones that are recalled long term. They are also the sorts of events that enter into the family story—"Remember once when Johnny broke his arm?" Inclusion of an event in the family story means that it will be referred to at various times during the succeeding years. In this way, children are reminded of their experiences. However, it is unlikely that inclusion of an experience in the family story can fully account for our results for two reasons: The children in our three groups had experiences that would equally enter into the family story, and yet there was a large difference in the long-term verbal recalls of these age groups. Furthermore, some of the details recalled by the children were the sort of peripheral information that was unlikely to be included by parents when reference is made to the children's experiences (e.g., gender of the doctor, the fact that he put cream on the injury, and who the onlookers were at the injury).

We had predicted that the verbal recalls of the children would decrease over time; that is, at each succeeding interview the children would recall less about their experiences. Such a pattern was not found. Rather, the children were providing more information rather than less with the passage of time. This contradicts not only typical patterns of forgetting over time (Kail, 1989; Schneider & Pressley, 1989) but also the findings on older children from a similar study of children age 2 to 13 years (Peterson & Bell, 1996). In the latter study, children's recall was assessed within a week and again at 6 months after their injuries. Thus, only one follow-up interview took place, and it was at the shortest of the three time delays investigated here. In that study, the older age groups of children reported fewer details of their injury and hospital experiences with time. However, consistent with the results reported here, the 2-year-olds in that study recalled more 6 months later than they did in their initial interview. One possible explanation for the very different results with very young children reported here as compared with other studies conducted with older children is that the increased recall of details over time may not reflect more elaborated memory representations over time but rather reflect the difficulty of interviewing very young children and the fact that they become more cooperative with time. Two-year-olds are notoriously difficult to interview. Although the time delay between target events and recall increased, there was a parallel increase in the children's linguistic sophistication as well as likelihood of cooperation. Other researchers have highlighted the difference between children's memory of an event and their verbal representation of it at any particular point in time; for example, Fivush and Hamond (1990) questioned preschoolers about the same event at different times and found that the children recalled a lot of different (although still accurate) information during each interview. Thus, our findings of increased recall over time may reflect not increasing memory but increasing likelihood of the information being elicited by the interviewer as the child got older because of both linguistic and social reasons.

It is important to consider the high error rate for these children. Although it is true that the majority of the information given by the sample of children as a whole is accurate, the error rates are still high. In particular, the likelihood that information provided by the younger toddlers was correct versus incorrect was at chance levels, or in other words, about half was accurate and about half was wrong. From the point of view of the listener, it was comparable to tossing a coin to determine whether what you were told was accurate or not. This is true for both *wh-* and yes/no responses. This adds further evidence to our assertion that the children in this age group really recalled very little if anything at all of their injury and hospital experiences. Thus, it seems that children who are this young at the time when highly distressing events occur do not seem to have reliable long-term verbal recall of their experiences. This nonreliability of the children's responses has implications for the testimony of children who are testifying about events that occurred when they were under $1\frac{1}{2}$ years of age. Our data suggest that such "recall" is probably highly suspect.

In contrast, the oldest children (who were at least 26 months of age at the time of their accidents) are considerably more likely to give accurate than inaccurate information. However, there is an important caveat: The nature of the response makes a difference. Three quarters of the children's *wh-* responses were correct. These are content items that the children had to generate themselves. Although it is true that almost one in four *wh-* items provided by the children is a commission error, nevertheless it is still impressive that over three in four are accurate over a 2-year follow-up period for children who were only 2 years old at the time the events occurred.

The story is different, however, for yes/no responses. The problematic nature of yes/no responses by children this young was highlighted elsewhere (Peterson & Biggs, 1997). In that investigation, it was found that if preschool-age children said no in response to a yes/no question, accuracy was at chance levels. This high error rate for yes/no responses was replicated in another study with preschoolers (Peterson, Dowden, & Tobin, 1998). Thus, it is important to note that the increased accuracy of the oldest children in this study is limited to their *wh-* responses. This has obvious implications for the reliability of children's testimony. As argued in Peterson and Biggs (1997), interviewers often do not discriminate *wh-* from yes/no questions and responses. Yet these two formats may have quite different implications for the reliability of young children's testimony. This is an important concern when assessing children's reliability as witnesses.

Doing longitudinal research such as this is fraught with methodological problems, and these qualify the conclusions that can

be reached. For one thing, there were no control groups of children that were interviewed at only the 12-month or the 18-month follow-up period. There were simply too few children for this to be done. Thus, the procedure of reinterviewing these children necessarily reinstated their experiences every 6 months or so. Such reinstatement seemed to have no effect on the children in the youngest group because they recalled little if anything. However, such reinstatement may have had more of an effect on children in the other two groups, especially on those in the intermediate group. Although the majority of these children showed only spot verbal recall of isolated items, a quarter of them had good verbal recall from the time they could be successfully interviewed.

Another problem is the attrition rate. There is no attrition rate in the oldest group of children because we collected data on a larger sample of 2-year-olds than are included here, and we have selected from that sample the youngest 12 children from whom we had 2-year follow-ups. For the entire group of 2-year-olds that we have collected, the same attrition rate of about a third of the children holds for them as for the younger samples of children. For our younger samples of children, we have included the data from every child we could get. And for approximately a third of them, there is no follow-up that extends beyond a year. Thus, our conclusions about verbal recall with delays that are longer than a year are limited by the fact that there are not very many children in each group.

This study does not support suggestions that traumatic experiences are verbally recalled long term regardless of the child's age when they occurred. Rather, the likelihood of long-term recall and reporting seems to be related to other factors, including the child's age and whether the child is able to narrativize their experiences at the time. Children who were no more than $1\frac{1}{2}$ years of age did not seem to be able to report their experiences long term, whereas children just a few months older were much more likely to do so. In other words, the fact that the children were very upset at the time of their injuries did not insulate these experiences in special ways from forgetting—the children still could not verbally report them much later.

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(Appendix follows)

Appendix

Prototype of Injury and Hospital Treatment With Examples of Questions and Responses in the Interview

Item	Question	Example response
	The injury	
The injury	What happened when you hurt yourself?	"I got a big *cut* on my leg"
Actions prior to injury	What were you doing when it happened?	"I was *running*"
How it occurred	How did it happen?	"I was *tripped*"
Who was there	Who was with you?	"*Mom* and *Joe*"
Who else was there	Who else was around?	"*Anna* was playing there too"
Who did it	Who did it?	"By *Joe*"
What objects involved	What was it that cut you?/tripped you?/etc.	"I hit a *piece of the porch*"
Time of day	When did it happen? (before lunch, supper)	"*After lunch*"
Place	Where did it happen?	"In my *backyard*"
Cry	Did you cry?	"I had to just *scream*"
Blood	Did it bleed? How much?	"It was *bleeding* all down my leg"
Who first responded	Who came and got you? (when you got hurt)	"*Mommy* heard me cry"
Where went before hospital	Where did X take you, after you got hurt?	"She took me into the *kitchen*"
Actions to treat injury	What did X do? What else?	"She *wiped* my knee"
Objects of home treatment	(Elicited by above question)	"And put a *cloth* to soak up blood"
Others look or help	Who else was there? Who else helped?	"My *brother* was watching"
Went to hospital	Where did you go to fix injury?	"Then I went to the *hospital*"
Who took child to hospital	Who took you to the hospital?	"*Mom* drove me there"
Who else went to hospital	Who else came with you?	"My *brother* came too"
Time of hospital trip	When did you go to the hospital?	"We got there *in a little while*"
	The hospital treatment	
Registration	What happened as soon as you got there?	"A nurse *gave me a bracelet*"
Vitals measured	What else?	"I got *temperature* taken"
Waiting period	How long did you wait to see the doctor?	"I had to *wait a long time*"
Actions while waiting	What did you do while waiting?	"I *watched TV*"
Initial exam	What did the doctor do?	"Then somebody *looked at my cut*"
Hospital personnel	Was it a girl doctor or a boy doctor?	"It was a *girl doctor*"
X-rays	Did you get X-rays/pictures of your bones?	"I got an *X-ray* to check my knee"
Cast	What else did doctor do? (Did you get cast?)	(not relevant)
Needles	What else did doctor do? (Get needle?)	"I got 4 *needles* in my knee"
Stitches	What else did doctor do? (Get stitches?)	"And then I got 14 *stitches*"
Bandage	What else did doctor do? (Get bandage?)	"Got a big *bandage* all down my leg"
Procedural details	Tell me more about (the above treatments)	"The doctor *washed out my cut* first"
Other treatment objects	(Elicited by the above)	"With *soap*"
Cry	Did you cry?	"And I *cried*"
Popsicle	What treat did they give you? (Popsicle?)	"Nurse gave me a *yellow popsicle*"
Family in treatment room	Who was with you when doctor was doing X?	"My *Mom* was with me"
Went home	Where did you go when left hospital? Where else?	"We went *home*"
Stopped on way home	(Elicited by the above)	"We stopped at *McDonald's*"
Who was told/showed	Who did you tell/show your stitches/cast to?	"I called my *Dad* and my *Nana*"

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