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Children's Memory for Medical Emergencies: 2 Years Later

Carole Peterson
Memorial University of Newfoundland

Long-term recall of medical emergencies (including both injury and hospital treatment) by 2- to 13-year-olds was assessed 2 years after injury. Event identity was important: Children recalled injury details better than hospital treatment. Ninety-six children were interviewed 3 times prior to the 2-year recall; amount recalled decreased only for hospital treatment details, although accuracy of recall decreased for both injury and treatment. Twenty-one children were interviewed only twice prior to the 2-year interview. An extra interview 1 year after their injury had little effect on how much older children recalled about both injury and treatment or how much younger children recalled about injury details, but it helped younger children recall the less memorable hospital event. The extra interview also helped all children maintain accuracy when recalling hospital details but was unnecessary for the more memorable injury event. Implications for children's testimony are discussed.

The current study is a 2-year follow-up of children's memory for personal injuries that were serious enough to require hospital emergency-room treatment. Thus, the events were highly salient and personally relevant, and furthermore, they often elicited high levels of distress. Children's long-term recall of such events has recently become an important concern because of their increasing participation in courtrooms as witnesses. Frequently, children must testify about events after a considerable delay, one that could stretch for months or even years (Myers, 1987). An important question concerns the effect of such long delays on the amount and accuracy of children's recall. The legal profession appears to believe that the passage of time makes children's memories especially vulnerable and that the younger the child, the more deleterious the effect (Flin, Boon, Knox, & Bull, 1992). Indeed, a long history of memory research conducted in laboratories with stimuli such as word lists suggests that the younger the child, the more information is forgotten and the more quickly it is forgotten. However, events that are highly salient, personally relevant, and distinctive, such as the sorts of experiences about which children testify in court, seem to be more memorable, and some investigators have suggested that the belief held by the legal profession in the particular vulnerability of young children's memories about forensically relevant events has undergone relatively little empirical investigation (Flin et al., 1992).

Events having high personal salience sometimes are remembered for many years by children (Fivush, Peterson, & Schwarzmueller, in press). Prospective research systematically investigating such lengthy delays in children's recall is rare, however, for a number of reasons. It is difficult to do and inevitably involves methodological compromises such as considerable loss of research participants and lack of control over events that intervene between the target event and its recall (Poole & White, 1993). Nevertheless, such longitudinal research is crucial for the provision of information about children's ability to accurately recall the details surrounding target events long after those events have occurred.

First, what is the effect of long delays between event occurrence and subsequent recall? A few studies have focused on very long-term recall—specifically, after delays of 5–11 years (Gold & Neisser, 1980; Hudson & Fivush, 1991; Pillemer, Picariello, & Pruett, 1994; Sheingold & Tenney, 1982). These studies showed that children could recall details of personal events many years later, although the amount recalled was usually quite sparse, albeit reasonably accurate. Several other studies investigated children's recall of documented events over delays more likely to be forensically relevant, that is, 1–2 years. In 2-year follow-up studies, both Poole and White (1993) and Warren and Swartwood (1992) found that children recalled substantially less 2 years later and were also proportionately less accurate.

In 1-year follow-up studies, Fivush asked preschoolers about the same events twice, a year apart (Fivush & Hamond, 1990; Fivush & Shukat, 1995). No systematic questions were asked, and 70–75% of the information provided in the two interviews was different, albeit mostly accurate. The different content was attributed to children's changing interests over time as well as to different questions asked by interviewers. These studies underline the need for more research in which the same questions are asked over a long time span. This procedure was followed by Goodman, Hirschman, Hepps, and Rudy (1991) and by Salmon and Pipe (1997), who reinterviewed children (4–7 years and 3–5 years, respec-

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Correspondence concerning this article should be addressed to Carole Peterson, Department of Psychology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X9. Electronic mail may be sent to carole@play.psych.mun.ca.

tively) about medical or quasi-medical events; the amount and accuracy of information provided by the children decreased significantly. (For recent reviews, see Fivush et al., in press; Fivush & Schwarzmueller, 1995; Poole & White, 1995.)

In sum, there are still few studies that have examined children's recall of real-life events over delays extending at least a year and especially few studies in which children have been interviewed similarly at the initial and delayed recall episodes. More research clearly needs to be done, and this is one purpose of the present study. Children who were earlier recruited from the emergency room of a children's hospital for trauma injuries (and whose data from their initial and 6-month follow-up interviews were reported in Peterson & Bell, 1996) were reinterviewed 2 years later. This article presents data from interviews conducted 2 years after injury as well as data from initial interviews for comparison.

An important question concerns whether long delays have different effects depending on the ages of the children (Poole & White, 1993), or more specifically, whether the legal profession's belief in the considerably heightened forgetting by younger children is valid (Flin et al., 1992). In laboratory studies, interactions between age and delay have consistently been found (see Brainerd, Reyna, Howe, & Kingma, 1990). However, no age differences were found between 6- and 10-year-olds by Poole and White (1993), between 4- and 7-year-olds by Goodman et al. (1991), or between 5- and 10-year-olds by Warren and Swartwood (1992). More research is needed on children from a wider age range.

Very young preschoolers may pose a particular difficulty for forensic interviews because of the phenomenon of infantile amnesia. Specifically, older children and adults remember little if anything from before the age of about 3½ years; furthermore, if they do recall earlier events, what they recall is quite fragmentary (Mullen, 1994; Pillemer & White, 1989). Although studies of children's narrative development have consistently found that children as young as 2 years are able to participate in conversations about past events (Eisenberg, 1985; Miller & Sperry, 1988; Peterson & Dodsworth, 1991), some investigators suggest that in these young children event memories are fragmentary and fragile until they become organized into autobiographical memory (e.g., Nelson, 1992). Thus, memory for events experienced as a 2-year-old seems to be particularly fragile, whereas recall of events occurring at the ages of 3 or 4 years may be more robust. Peterson and Bell (1996) found data to support this proposed difference in recall between 2- and 3-year-olds.

In the current study, some of the children were 2 years old at injury, and to my knowledge, this is the first systematic 2-year follow-up of children this young. Some of their data were also reported in Peterson and Rideout (1998), where they were compared with data from even younger children. In this article, they are compared with data from older children whose ages at the time their injuries occurred spanned preschool ages as well as some school ages. Thus, assessments of interactions between delay and age are possible across a wide age range.

Not only are children in forensic situations often questioned long after the target events occurred, but they are also typically interviewed repeatedly (Myers, 1987). The effect of such repeated interviews has been the focus of a number of studies (see recent reviews in Fivush et al., in press; Fivush & Schwarzmueller, 1995; Poole & White, 1995). Simply asking children to recall an event again and again does not seem to undermine their recall of those events as long as the questioning is not misleading, suggestive, or coercive (but see Brainerd & Reyna, 1996). This finding is consistent with experimental research suggesting that repeatedly recalling an event is a form of rehearsal that can help buffer against forgetting (Brainerd & Ornstein, 1991). However, in almost all of the studies cited here, the repeated interviews took place over relatively brief durations of days or weeks. Such repetition led to improved long-term recall by children, although the number of interviews played a role.

An issue that has been ignored is the effect of widely spaced repeated interviews. Even in studies that had 2-year follow-ups, earlier interviews all took place shortly after the target events occurred (Poole & White, 1993; Warren & Swartwood, 1992). In contrast, in the present study children were interviewed shortly after the target event and then 6 months later. During the design of the study, the plan was to reinterview children again at 1 year and then at 2 years. Ninety-six children participated in all four such interviews. However, an additional 21 children were unavailable for the 1-year interviews because of vacations, although they were available for the 2-year interviews. Because so little is known about the effect of widely spaced reinterviews, it seemed instructive to compare the 2-year recalls of these children who had no intervening interview between 6 months and 2 years postinjury with those of children who were also interviewed 1 year postinjury. To my knowledge, no studies have used such widely spaced multiple interviews to assess long-term recall.

There is another issue that may well cloud the picture of how well children recall events over long periods of time—namely, the children's emotional distress at the time those events occurred. Few of the previously cited studies on children's long-term recall focused on events that were distressing to the children, and many involved events that may not have been particularly salient or memorable to the children. Some investigators have questioned whether research on innocuous or pleasant events can be generalized to the recall of events that were clearly highly distressing (Goodman et al., 1991; Peterson & Bell, 1996; Yuille & Tollestrup, 1992). Children have been shown to have long-term memory for extremely traumatic real-life events, such as abduction, rape, murder, and natural disasters (see review in Howe, 1997). However, it is unclear how extensive or accurate children's memories are for emotionally distressing events that do not fall into the range of extreme, life-threatening trauma. And even in studies of children who did suffer such extreme trauma, the focus of the investigators was often not on the completeness or accuracy of recall, and many of the details provided by the children were not verifiable. Thus, important questions remain about the reliability of children's recall of stressful experiences after long intervals of time. In the current study, children suffered physical injury that was serious enough to necessitate hospital emergency-room treatment, and they were also often quite upset (even hysterical) about what had happened to them. Thus, the target events studied were highly salient and aversive.

The type of event may also interact with children's long-term recall. Components of medical treatment in the hospital—that is, things that are sanctioned by parents and doctors (whom children believe have their best interests at heart)—may be recalled differently than other things that take place in other places, such as the components of the injury. Furthermore, the injury event was completely unexpected, whereas the medical treatment event was not only expected but probably preceded by considerable verbal rehearsal of what the doctor was likely to do. In Peterson and Bell's (1996) earlier analysis of children's recall of their injuries and subsequent treatment, children recalled more about their injuries than their treatment. In the present study, as in the earlier one, children's recall of injury was contrasted with their recall of hospital treatment.

In keeping with earlier studies in which recall was assessed after the passage of years, I hypothesized that children would recall less (and with less accuracy) over time. Key questions included how much deterioration would be seen in both amount and accuracy of recall because these questions are relevant to assessing children's potential as eyewitnesses. Furthermore, what is the pattern of recall in very young preschoolers? Theoretical discussions of infantile amnesia lead one to expect that 2-year-olds will have considerably poorer recall than older preschoolers, but in the study by Peterson and Bell (1996), age differences between all older groups were surprisingly small. With regard to event type, because children recalled their injuries better than their treatment in the Peterson and Bell study, I anticipated that the same would hold true here. In predicting whether an additional interview 1 year postinjury would have a facilitative effect on children's recall, there was little extant research to guide me because intervening reinterviews have not been as widely spaced in other studies as in the present study.

Method

Participants

The children in this study were recruited from the emergency room of the only children's hospital in Newfoundland, Canada. They were mostly White and from backgrounds of mixed socioeconomic status. They had experienced trauma injuries that were treated in an outpatient manner, including lacerations requiring suturing, bone fractures, and "other injuries," which included second-degree burns, dog bites, and crushed fingers requiring drainage and bandages. Table 1 specifies the sorts of injuries suffered by children of different ages. There were 96 children (45 girls and 51 boys) who participated in all four interviews. In the initial study, 2-year-olds were substantially different from 3-year-olds in every analysis, whereas 3-year-olds were almost never different from 4-year-olds. Accordingly, 2-year-olds constituted a separate age group in all analyses, whereas I combined ages among older children. The five age groups of children who had all four interviews were as follows: (a) eleven 2-year-olds (mean age at injury = 2 years 5 months; range = 2 years 2 months to 2 years 11 months), (b) eighteen 3–4-year-olds (mean age at injury = 3 years 9 months; range = 3 years 2 months to 4 years 9 months), (c) twenty-six 5–6-year-olds (mean age at injury = 5 years 9 months; range = 5 years 1 month to 6 years 11 months), (d) twenty-two 8–9-year-olds (mean age at injury = 8 years 9 months; range = 8 years 0 months to 9 years 11 months), and (e) nineteen 12–13-year-olds (mean age at injury = 12 years 7 months; range = 12 years 0 months to 13 years 6 months).

There were also 21 children (9 girls and 12 boys) who participated in only three interviews, having missed the 1-year follow-up interview. Because they were so few, they were divided into younger (3–6 years) and older (8–13 years) age groups. There were three 3-year-olds, three 4-year-olds, three 5-year-olds, and two 6-year-olds in the younger group (mean age at injury = 4 years 7 months; range = 3 years 0 months to 6 years 7 months), and there were seven 8–9-year-olds and three 12–13-year-olds in the older group (mean age at injury = 10 years 0 months; range = 8 years 2 months to 13 years 4 months).

Procedure

As described in detail in Peterson and Bell (1996), parents and children were recruited in the emergency room and then visited at home. At this time the children were interviewed about what they recalled of their injuries and subsequent treatment; parents were also interviewed in order to provide a standard against which to evaluate the accuracy of the children's information. In cases where both parents witnessed the events, they never disagreed about prototype details, nor did their information ever disagree with the information contained in the children's hospital charts. Consequently, adult statements were taken as the "gold standard" against which the children's accounts were compared. It is of course possible that an occasional parental statement could have been inaccurate, but it is unlikely to have been frequent enough to pose a problem for this data set. Children were always interviewed first, with the standardized interview described below. The same standardized interview was given to adult witnesses. Although a parent always witnessed hospital treatment, for 53 children a parent did not witness the injury and nonparental witnesses were interviewed. These included a babysitter, teacher, or relative, all of whom knew the child well. In addition, parents and other adult witnesses were asked to rate the children's degree of distress both at the time of injury and at hospital treatment, although the data from these ratings are not discussed further here.

The first interview took place within a few days of the injury (mean delay = 7.3 days; range = 1–20 days). All children were next interviewed 6 months later (mean delay = 6 months 3 days; range = 5–8 months). Ninety-six children were also interviewed 1 year later (mean delay = 12 months 2 days; range = 10–14 months). Finally, all children were interviewed 2 years later (mean delay = 24 months 6 days; range = 20–28 months). The 2-year follow-up contact was unexpected by the parents and children. When telephone contact was made for each visit, the interviewer asked the parents not to rehearse the events with children prior to her visit because she was interested in their memories. No such instructions were given at the hospital emergency room preceding the first home visit, however, because such instructions would have been universally ignored. The children's injuries were undoubtedly widely discussed with relatives and friends within the first couple of days of their occurrence because sutures and bone fractures are "big news" events within families. However, parents almost universally reported at our visits 6 months, 1 year, and 2 years postinjury that the target events had not been mentioned for several months previously because they were in effect "old news." In fact, at the 1-year and 2-year interviews, most parents claimed that the last time the events had been discussed had been on the occasion of the interviewer's previous visit. Although reminders of the injury may well have taken place in spite of parental denials, we have no way of knowing whether they did or how frequently.

The format of each interview was the same: free recall ("Tell me about when you hurt yourself. What happened?" "Tell me about when you went to the hospital. What happened?") followed by probed recall using *wh*-questions ("Where were you when it happened? Who was with you? What did you do when you first got hurt?"). For return visits months later, free-recall probes reminded the children of the target injury ("Remember that time when you broke your arm? Tell me about it. What happened?"). If children provided information about a specific element in free recall, they were not subsequently asked about it in probed recall. Every effort was made to avoid yes–no questions as much as possible, although a few were asked. However, for the majority of such questions the accurate response was "yes," and other research has suggested that preschoolers are likely to have response biases when responding to yes–no questions; in particular, they are likely to answer "yes" to such questions (Fay, 1975; Peterson & Biggs, 1997; Peterson, Dowden, & Tobin, 1999). Because relatively few yes–no questions were asked and the responses are suspect, none of the responses to these questions is analyzed further. The questionnaire itself was the same for each interview regardless of time delay or whether the interview was of the child or the parent. A detailed list of items queried is found in the Appendix. The interviews were audio-recorded and subsequently transcribed verbatim. In situations in which the child responded nonverbally to a question (e.g., "How many stitches did you get?" and the child help up three fingers), the interviewer stated the child's response for the tape recorder ("You are holding up three fingers"), and this was counted as the child's providing a content response. All scoring was done from the transcripts.

Scoring of Recall Data

Although each child's injury and hospital treatment were unique, they conformed to a prototypical pattern that included a number of components within each of the two emotional episodes of injury and hospital treatment. In the study by Peterson and Bell (1996), data on children's recall of events that occurred after leaving the hospital were included in the analyses. However, because these events occurred outside of the emotion-laden events of injury and treatment, they are excluded from all current analyses.

Through a search of adult transcripts, it was determined which prototype items applied to each child. Although most prototype items applied to all children (an injury occurred and in a specific location, someone responded, the child was transported to the hospital, etc.), some items of the prototype applied to only a subset of the children. For example, "getting a cast" was not relevant to a child who got sutures, and "person who caused injury" was not relevant for a child who fell off the top of a slide with no other children nearby. Because of this variation in how many prototype elements applied to their individual situations, different children had different numbers of scorable items that were relevant to them and thus could potentially be present in their recall of each of the two emotional events.

After determination of which components of the prototype applied to each child, the child's transcripts were searched to determine, first, whether the child supplied information relevant to each prototype component in each interview. If such information was provided, it was then compared with the information provided by adult witnesses in order to assess accuracy. The coding of "accurate" was assigned not only for complete agreement between child and adult responses but also for close approximations. For example, if the child said that she had been injured when she was "in a restaurant" and her parent said they had been "in McDonald's," the child was credited with making an accurate response. Children who misstated the number of stitches or X rays were not credited with an error if they correctly said that they had gotten stitches or X rays, because young children often have difficulty with numbers and understanding the meaning of 14 stitches versus 12 stitches. In the rare event that a child provided information that was neither confirmed nor disconfirmed by adult witnesses, it was ignored and not scored. To establish reliability, two raters scored 10% of the transcripts. Prototype components were first identified in the children's transcripts; then the adult witness transcript was checked to verify the accuracy of the identified components. For the presence of scorable components in the children's transcripts, agreement between raters averaged 98% (range = 93% to 100%), and for the accuracy of identified components, agreement averaged 90% (range = 81% to 100%). Agreement was calculated as agreements divided by the sum of agreements plus disagreements.

The following sets of data were analyzed:

1. The numbers of relevant components of the children's injury and hospital-treatment experiences were tabulated. That is, how many components could the children potentially have recalled, according to the adult witness's report?

2. The completeness of children's recall of relevant components was determined, that is, the proportion of relevant event components that were recalled. This score was directed toward answering the question "How much of what happened did children actually remember?" (Only components that were accurately recalled were included here.) This proportion of recalled relevant components is presented separately for the injury and hospital-treatment events. The completeness of a child's recall was calculated by dividing the number of component items correctly recalled by the number of component items that were relevant for that child according to parent report and thus that could potentially have been recalled. For example, if parents identified 15 prototype components as relevant to their child's injury experience but their child recalled only 10 of those components, the child was given a proportion score of .67. In this way, the proportion of relevant components recalled from each episode was derived.

3. The accuracy of the children's recall was determined. In this analysis, only commission errors were counted, that is, instances in which a child stated information that was explicitly contradicted by the adult witness's report. The numbers of commission errors about prototype components were counted for each of the episodes of injury and treatment events separately. (A detailed description of the content of the children's errors in the initial and 6-month interviews can be found in Peterson, 1996.) Then, the percentage accuracy of the actual prototype components that had been provided by the children was calculated. Instead of using the possible components that children potentially could have remembered as the denominator in calculations (as in the first measure described above), the actual components that children did provide was used as the denominator in calculations, and the proportion of those components that were accurate was determined. That is, the number of correct prototype components was divided by the total number of components the child provided (i.e., the sum of correct plus incorrect components).

Results

Number of Scorable Components

The numbers of scorable components for the children in the different age groups (including both the children who participated in all four interviews and the children who participated in only three interviews) are shown in Table 1. On average, children's injury episodes included approximately 16 components that they could have talked about, and their treatment episodes included approximately 11 components. An analysis of variance (ANOVA) was performed on the number of scorable items for children having four interviews, with age (five levels) as the between-subjects variable and event (injury vs. hospital) as the within-subject variable. More components could potentially be scored for the injury event than for the hospital event, $F(1, 91) = 310.02$, $p < .001$. There were no other significant effects. To compare the children who had four versus three interviews, I performed another ANOVA after combining ages for the four-interview participants to create groups that were parallel to the younger and older three-interview groups (and omitting data from 2-year-olds). Group (three vs. four interviews) and age (two levels) were the between-subjects variables and event (two levels) was the within-subject variable, and again the effect of event was significant, $F(1, 102) = 227.59$, $p < .001$, with more components for the injury event than the hospital event. There were no other significant effects or interactions. Thus, age or group differences in recall cannot be accounted for by there being different numbers of components to recall.

Children Who Participated in All Four Interviews

The completeness of children's recall of relevant components, that is, the proportion of prototype components that were relevant to each child and that were in fact recalled, was assessed. (Note that only accurate components are tabulated here.) Table 2 presents the percentages of relevant components recalled, and these percentages were analyzed with an ANOVA with age (five levels) as

Table 1
Mean Numbers of Scorable Components in the Injury and Hospital Events for Each Age Group According to Type of Injury, for Children Receiving Either 4 or 3 Interviews

	Age in years at time of injury						
	Children with 4 interviews					Children with 3 interviews	
Type of injury	2	3–4	5–6	8–9	12–13	3–6	8–13
Injury							
Lacerations							
n	7	13	16	9	7	9	5
M	15.6	16.8	17.2	17.2	16.1	16.4	17.0
SD	1.3	1.9	1.4	1.1	1.1	1.1	1.2
Fractures							
n	2	3	5	10	9	2	5
M	15.5	15.7	15.2	16.3	14.2	16.5	16.2
SD	0.7	1.5	1.3	2.0	1.4	0.7	1.9
Other injuries							
n	2	2	5	3	3	0	0
M	17.0	16.5	16.4	17.7	15.3	0	0
SD	0.0	2.1	1.1	1.1	0.6	0	0
Total							
n	11	18	26	22	19	11	10
M	15.8	16.6	16.7	16.9	15.1	16.4	16.6
SD	1.2	1.8	1.5	1.6	1.4	1.0	1.6
Hospital							
Lacerations							
M	11.9	12.2	12.4	12.9	12.8	13.1	10.0
SD	1.2	2.2	1.9	1.6	1.7	0.8	0.7
Fractures							
M	10.0	11.7	12.2	11.1	10.7	12.5	13.4
SD	0.0	1.1	2.0	1.7	1.4	3.5	0.5
Other injuries							
M	13.5	8.5	10.4	10.0	9.7	0	0
SD	0.7	0.7	2.9	2.6	0.6	0	0
Total							
M	11.8	11.7	11.9	11.7	11.3	13.0	11.7
SD	1.5	2.2	2.2	2.0	1.9	1.3	1.9

Note. The numbers of children at different ages suffering from each type of injury (*ns*) are not specified for the hospital event because the numbers are of course identical to those specified for the injury event.

Table 2
Means and Standard Deviations of the Percentages of All Relevant Components That Were Accurately Recalled by the Children About Their Injuries and Hospital Treatment During the Initial and 2-Year Follow-Up Interviews

	Injury				Hospital			
	Initial interview		2-year follow-up		Initial interview		2-year follow-up	
Age group	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
2 years	40	16	56	23	21	17	23	15
3–4 years	69	18	69	16	50	17	46	17
5–6 years	77	10	77	11	60	20	58	14
8–9 years	86	7	80	10	65	19	50	18
12–13 years	84	8	80	9	71	15	62	19
All ages	75	18	74	15	57	23	51	20

the between-subjects variable and both event (injury vs. hospital) and time (initial vs. 2-year interview) as within-subject variables. The amount the children recalled differed according to the children's age, $F(4, 91) = 37.42$, $p < .001$. Mean percentages of recall of components for the five age groups (by increasing age) were 35%, 58%, 68%, 70%, and 74%. Planned comparisons showed that 2-year-olds recalled significantly fewer components than did 3–4-year-olds ($p < .001$) and that 3–4-year-olds in turn recalled fewer components than did 5–6-year-olds ($p = .002$). Although 5–6-year-olds did not differ from 8–9-year-olds, they did differ from 12–13-year-olds ($p = .013$). The 8–9-year-olds and 12–13-year-olds had equivalent recall.

Children also recalled considerably more of the components of their injury experiences ($M = 74\%$) than of their hospital treatment ($M = 54\%$), $F(1, 91) = 206.02$, $p < .001$. Surprisingly, there was no main effect of time, although there was a significant Age × Time interaction, $F(4, 91) = 3.43$, $p = .012$, as well as a significant Event × Time interaction, $F(1, 91) = 7.00$, $p = .01$. For the Age × Time interaction, analyses of simple effects were performed on the effect of time with each age group separately (see Figure 1). These analyses showed that the 8–9-year-olds recalled less 2 years after their experiences than initially, whereas all of the other age groups had equivalent recall in the two interviews. To understand the Event × Time interaction, I performed analyses of simple effects to see the effect of time with each event separately (see Figure 2). For the injury event, the effect of time was nonsignificant, whereas for the hospital-treatment event, children recalled fewer components in the 2-year interview than in the initial one ($p < .01$). Thus, the components of the injury remained just as salient 2 years later, whereas children showed more forgetting of the components of hospital treatment.

The above analysis involved quantity of recall, that is, how many of the potentially recallable components were in fact recalled. A different but equally crucial measure is the quality of recall—namely, how accurately children recall their experiences. That is, of the components that children did recall, how many were

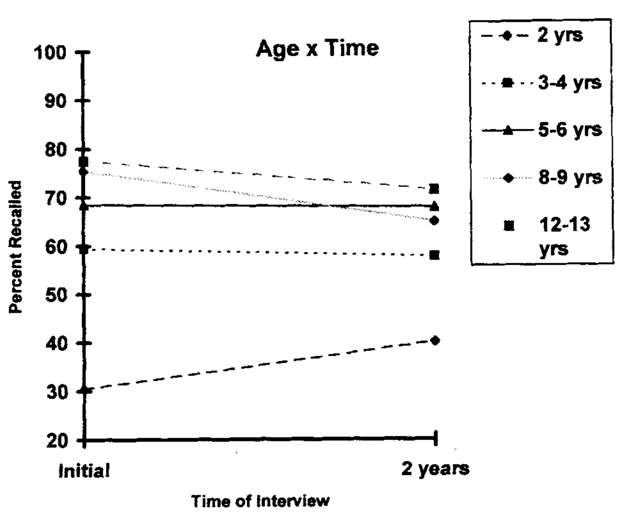

Figure 1. Age × Time interaction for the completeness of recall (i.e., the percentage of relevant components recalled) of children who were interviewed four times.

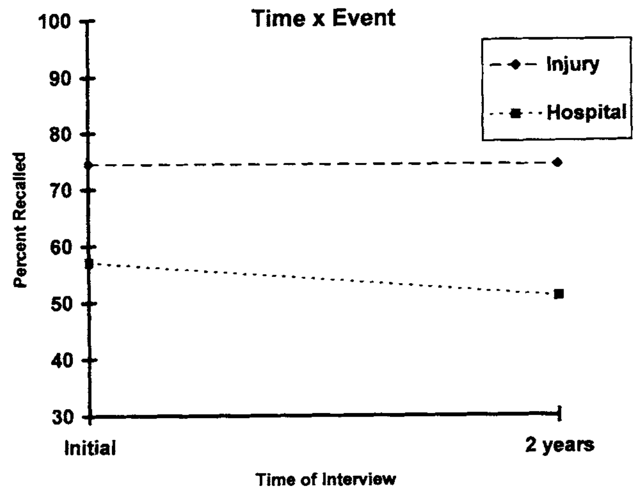

Figure 2. Time × Event interaction for the completeness of recall (i.e., the percentage of relevant components recalled) of children who were interviewed four times.

correct and how many were commission errors? Thus, what percentage of the components they recalled were actually accurate? Table 3 presents the mean numbers of commission errors per child about prototype components that were recalled in both initial and 2-year follow-up interviews and, for comparison, the mean numbers of correctly recalled components per child as well. Mean accuracy scores are also presented in Table 3.

To assess the accuracy of children's recall of prototype components, I analyzed accuracy scores by means of an ANOVA with age (five levels) as the between-subjects variable and both event (injury vs. hospital) and time (initial vs. 2-year interview) as the within-subject variables. Older children were more accurate than younger children, $F(4, 91) = 12.88$, $p < .001$. The mean accuracy scores were as follows for the different age groups, from youngest to oldest: 73%, 84%, 90%, 93%, and 94%. Paired comparisons showed that differences in accuracy rates reached only borderline significance between 2-year-olds and 3–4-year-olds ($p = .053$), but that both groups were significantly less accurate than 5–6-year-olds ($ps < .025$). Although the accuracy rates of the 5–6-year-olds did not differ from those of the 8–9-year-olds, and those of the 8–9-year-olds did not differ from those of the 12–13-year-olds, the 5–6-year-olds were significantly less accurate than were the 12–13-year-olds ($p = .047$) when recalling prototype components.

Children were also more accurate when recalling the components of their injuries ($M = 90\%$) than when recalling the components of their hospital treatment ($M = 87\%$), $F(1, 91) = 12.16$, $p = .001$. In addition, there was an Age × Event interaction, $F(4, 91) = 2.64$, $p = .039$. This interaction is depicted in Figure 3. Analyses of simple effects were performed by assessing the effect of event within each age group separately, and the middle three age groups (namely, the 3–4-, 5–6-, and 8–9-year-olds) did not differ in their accuracy when recalling components of their injuries versus their hospital experiences. The 2-year-olds and the 12–13-year-olds, on the other hand, were less accurate when recalling hospital components than when recalling injury components ($ps < .05$). Thus, the majority of children recalled components of both

Table 3
Mean Numbers of Accurately Recalled Components (Acc) and Commission Errors (Err) per Child at Different Ages, and Mean Percentage Accuracy About Injury and Hospital Treatment During the Initial and 2-Year Follow-Up Interviews

	Age of children in years at time of injury											
	2		3–4		5–6		8–9		12–13		All ages	
Measure	Acc	Err	Acc	Err	Acc	Err	Acc	Err	Acc	Err	Acc	Err
					Initial interview							
Injury												
M	7.3	1.5	14.2	1.9	16.1	0.7	17.0	0.4	14.9	0.3	14.7	0.86
SD	3.5	1.4	3.5	1.9	3.1	0.8	2.6	0.5	3.4	0.6	4.2	1.2
% accuracy	84		88		96		98		98		94	
Hospital												
M	2.6	0.4	6.8	0.9	8.2	0.5	8.1	0.1	9.3	0.4	7.5	0.4
SD	2.8	0.5	2.5	1.3	3.6	0.9	3.2	0.4	3.3	0.6	3.7	0.8
% accuracy	75		89		95		99		96		92	
					2-year follow-up interview							
Injury												
M	10.0	3.3	13.6	2.9	15.0	2.5	14.9	2.1	13.0	0.6	13.8	2.2
SD	4.9	2.4	4.2	2.4	3.1	2.4	2.7	1.6	2.1	1.0	3.6	2.2
% accuracy	75		82		86		88		96		86	
Hospital												
M	3.4	2.4	6.3	1.9	7.5	1.5	6.6	1.0	7.8	1.2	6.6	1.5
SD	2.1	1.8	2.5	1.7	2.4	2.2	2.3	0.9	1.8	1.3	2.6	1.7
% accuracy	59		76		85		87		87		81	

Note. Accuracy percentages were calculated as follows: % accuracy = number correct/(number correct + number of errors).

events with equivalent accuracy, although the youngest and oldest children were less accurate when recalling the particulars of what occurred in the hospital.

Children were also more accurate when recalling prototype components during the initial interview ($M = 93\%$) than during the 2-year follow-up interview ($M = 84\%$), $F(1, 91) = 45.68$, $p < .001$. There were no significant interactions between time of interview and either age or event, nor was there a significant three-way interaction. Thus, all children's accuracy decreased similarly over time, regardless of their age and of the event being recalled, at least in terms of the prototype components about which they were asked.

The distribution of the children's errors is an important issue. Did most of the children at various ages make similar numbers of errors, or instead was the pattern of errors one in which most children were quite accurate while a couple of children made most of the errors for their age group? The distribution of the children's errors is shown in Table 4. Importantly, many children made few errors. During the initial interview, a surprisingly large number of children made either no error at all or no more than one error when recalling their experiences: Half of the children made no errors at all when recalling their injuries, and 70% made no errors when recalling the hospital-treatment event; of the children who made no more than one error, fully 82% of them were this accurate about their injuries, and 92% were this accurate about their hospital treatment. They were not as accurate 2 years later, but 24% still made no errors at all when recalling the components of their injuries, and 32% were this accurate when recalling their hospital treatment. Of children who made no more than two errors (an impressive degree of accuracy after 2 years), 66% and 80% of them were this accurate when recalling the injury and hospital events, respectively. Thus, the majority of children were quite accurate. Because the interviews were fairly long and involved a considerable amount of information about complex events, the fact that the majority of children continued to have highly accurate recall, even after 2 years, should not be forgotten.

In summary, children seemed to recall as many components of their experiences 2 years later as they had initially, although they were less accurate 2 years later. However, the event they were recalling played an important role. For example, although 2-year-olds recalled almost half of the components of the injury event, they recalled fewer than a quarter of the components of their medical treatment in the hospital. Likewise, although 3–4-year-

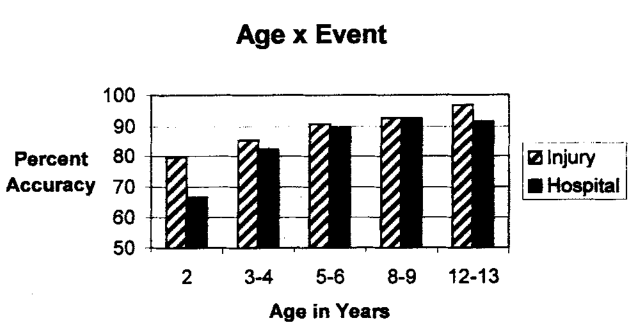

Figure 3. Age × Event interaction for the percentage accuracy of recall for children who were interviewed four times.

Table 4
Numbers of Children in Each Age Group Who Made Each Specified Number of Errors During Initial and 2-Year Follow-Up Interviews for the Injury Event (I) and the Hospital Event (H)

No. of errors	Age of children in years at time of injury: 2		3–4		5–6		8–9		12–13		All ages	
	I	H	I	H	I	H	I	H	I	H	I	H
Initial interview												
0	2	7	4	9	13	19	14	19	14	13	47	67
1	5	3	6	5	9	4	8	3	4	6	32	21
2	2	0	1	3	3	1	0	0	1	1	7	5
3	1	0	4	0	1	2	0	0	0	0	6	2
4	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	2	1	0	0	0	0	0	0	3	1
6	0	0	1	0	0	0	0	0	0	0	1	0
2-year follow-up interview												
0	0	2	1	3	7	12	3	7	12	7	23	31
1	2	1	5	6	4	9	6	9	3	6	20	31
2	3	3	5	4	2	2	7	4	3	2	20	15
3	3	2	2	1	4	1	1	2	1	3	11	9
4	0	2	1	3	5	1	3	0	0	1	9	7
5	1	0	1	0	2	1	1	0	0	0	5	1
6	0	1	1	1	0	1	1	0	0	0	2	3
7	1	0	0	0	1	0	0	0	0	0	2	0
8	0	0	2	0	1	0	0	0	0	0	3	0
9	1	0	0	0	0	1	0	0	0	0	1	1

olds recalled over two thirds of the components of their injuries, they recalled only half of the hospital details. Older children, although they recalled more, likewise recalled their injuries more extensively than their hospital treatment in spite of the fact that there were more components to recall in the injury event. The identity of the event played less of a role in the accuracy of the children's accounts, however. Rather, time delays were more important. Although most of the information provided by the children was accurate, for forensic purposes such error rates as one component out of four (for 2-year-olds in the initial interview) or one out of three components (the same 2-year-olds 2 years later) are undoubtedly too high. Three- and four-year-olds were more accurate, getting only one component wrong out of eight initially, and one out of four or five components wrong 2 years later. Older children had high accuracy rates at first—only one recalled component out of 20 or more was wrong, and this slipped to one error out of seven recalled details. However, most children made few (or even no) errors; rather, the majority of errors seemed to be made by relatively few children.

Comparisons of Children Interviewed Three Versus Four Times

Because there were only 21 children who missed the 1-year follow-up interview, they were combined into two age groups: younger (3–6 years) and older (8–13 years). Their performance was compared to that of children of the same ages who participated in all four interviews. (Note that 2-year-olds were excluded from these analyses because there were no 2-year-olds in the group of children who missed an interview.) In the analyses below, I focus on reporting the significant effects that are associated with the number of interviews the children had, that is, with membership in either the three-interview or four-interview group. Other significant main effects (e.g., due to age, event, or time) and interactions are not reported unless they differ from those already reported.

The completeness of the children's recall, that is, the proportion of relevant components of their experiences that they recalled accurately, was analyzed by means of an ANOVA with group (three vs. four interviews) and age (younger vs. older) as the between-subjects variables and event (injury vs. hospital) and time (initial vs. 2-year follow-up interview) as the the within-subject variables. (See Table 5 for the relevant means.) There was no significant main effect of group, that is, of missing the interview that took place 1 year postinjury, although there was a borderline Group × Age interaction, $F(1, 102) = 3.64$, $p = .059$ (see Figure 4). The older children in both groups recalled the same proportion of components, although the younger children who missed an interview recalled fewer components than did the younger children who had been interviewed all four times ($p = .05$).

Unlike in the prior analysis of the completeness of children's recall, which involved only children who had had four interviews, there was a significant main effect for time, $F(2, 204) = 15.42$, $p < .001$. Paired comparisons showed that children recalled more in the initial interview ($M = 71.0$ components) than in the subsequent two interviews ($Ms = 65.5$ and 63.0 components, respectively), for which recall did not differ. There were two other borderline interactions involving both group and time: a Group × Time × Event interaction, $F(2, 204) = 2.42$, $p = .091$, and a Group × Age × Time × Event interaction, $F(2, 204) = 2.50$, $p = .085$. Although neither interaction meets traditional significance levels (probably partly because of low numbers of participants in

Table 5
Means and Standard Deviations of the Percentages of All Relevant Components Recalled by Younger and Older Children Interviewed 3 or 4 Times About Their Injuries and Hospital Treatment During the Initial, 6-Month, and 2-Year Follow-Up Interviews

Time of interview	3-interview group: 3–6-year-olds *M*	*SD*	8–13-year-olds *M*	*SD*	Total	4-interview group: 3–6-year-olds *M*	*SD*	8–13-year-olds *M*	*SD*	Total
Injury										
Initial	73	11	87	7	80	74	14	85	8	79
6 months	68	17	85	7	77	72	13	80	13	76
2 years	73	9	80	9	76	74	14	80	10	77
Hospital										
Initial	54	16	72	14	63	56	19	68	17	62
6 months	43	13	66	15	55	47	16	63	17	55
2 years	35	16	54	19	44	53	16	56	19	55

one group as well as four times as many participants in the other group) and thus both interactions are only suggestive, they are nonetheless presented because they suggest intriguing relationships. The Group × Time × Event interaction is depicted at the top of Figure 5. Follow-up post hoc analyses were performed on each event separately, and for the injury event there was no significant Group × Time interaction. However, for the hospital-treatment event, the Group × Time interaction was significant ($p = .037$), and follow-up paired comparisons showed that both interview groups recalled less in the 6-month interview than initially ($ps < .03$), whereas a decrease in recall between the 6-month and 2-year interviews was true only for the three-interview group ($p = .007$). Furthermore, as the borderline Group × Age × Time × Event interaction suggests (see the bottom two panels of Figure 5), it was only the younger children who showed differential recall of hospital components depending on the number of interviews. When older children who had three versus four interviews were compared in post hoc paired comparisons, their recall never differed when they were questioned about either event, whereas when younger children who had three versus four interviews were compared, their completeness of recall was equivalent except during the 2-year follow-up interview about hospital treatment ($p = .001$). Younger children who missed the 1-year interview had less complete recall than did children who did not miss it. Thus, having the extra interview seemed to be beneficial only for the younger children and, furthermore, only when they recalled the hospital treatment event—the event that seemed to be less easily remembered by children.

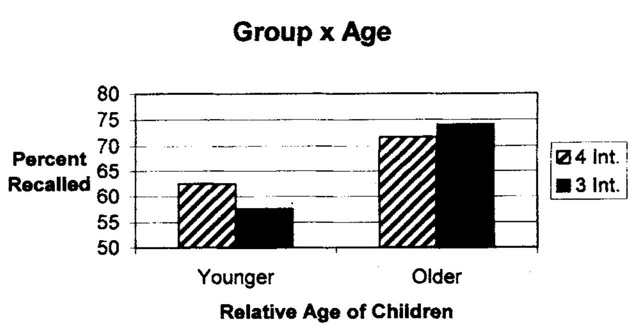

Figure 4. Group × Age interaction for the completeness of recall of children who were interviewed four times versus three times (Int. = interviews).

The quality of the children's recall, that is, the proportion of the components that they actually recalled that were accurate, was assessed by means of an ANOVA with group (two levels) and age (two levels) as the between-subjects variables and event (two levels) and time (two levels) as the within-subject variables (see Table 6). There was no significant main effect for the number of interviews that children participated in. However, there was a significant Group × Time × Event interaction, $F(2, 204) = 3.68$, $p = .027$, which is depicted in Figure 6. Post hoc analyses were conducted by analyzing each event separately, and for the injury event there was no Group × Time interaction, although such an interaction was present for the hospital event ($p = .014$). Within the hospital event, accuracy proportions were compared for adjacent time intervals; I did this separately for each of the groups. For the children who participated in only three interviews, recall was less accurate in each successive interview than in the previous interview ($ps < .05$), whereas for the children who participated in all four interviews, accuracy decreased only between the initial and the 6-month interviews ($p < .001$). In contrast to the case for the children who missed the additional interview, there was no difference in accuracy between the 6-month and 2-year interviews for these children.

In summary, the extra interview had little effect on children's recall (either quantity or quality) of the more memorable injury event, whereas it did seem to help children's recall of their medical treatment in the hospital. The recall accuracy of the children who had an extra interview 1 year postinjury did not decrease between 6 months and 2 years postinjury, whereas that of the children without the extra interview did decrease over this same time delay. There were also suggestions that the extra interview

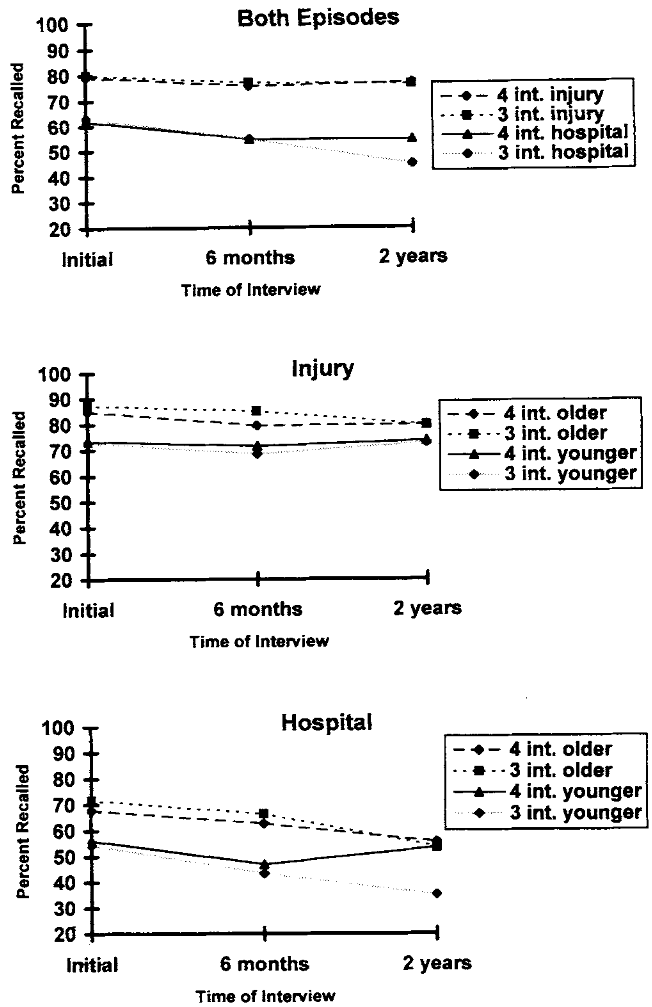

Figure 5. The completeness of recall for children who were interviewed four times versus three times (int. = interviews). The top panel shows the Group × Time × Event interaction, and the bottom two panels depict the Group × Age × Time × Event interaction by showing the Group × Age × Time interaction separately for the two events of injury and hospital treatment.

especially helped younger children recall more components of their hospital experience.

Discussion

One of the goals of this study was to assess the common belief in the particular vulnerability of young children's memory for target events after long periods of time have elapsed. Even though there were 2 years between the original events and the children's final recall, we found little support for assertions of greater decrements in younger children's recall than in older children's. There was no Age × Time interaction in any analysis except for the completeness of recall of the sample of children who had received all four interviews, and even for this interaction, it was only the 8–9-year-olds who had decreased recall over time, not the younger children. Thus, the passage of time seemed to have a comparable effect on all children regardless of age, although the levels of recall were clearly different across ages, with older children recalling more (and with greater accuracy) at every interview.

It is also noteworthy that, overall, the children seemed to recall as many accurate details of their experiences 2 years later as they had initially, a finding shown by the lack of main effects for time in children's completeness of recall. The data from which completeness proportions were derived were the number of correctly recalled prototype components divided by the number of components that children potentially could have recalled if they had demonstrated complete recall. Thus, the children did not show a decrease in the number of accurate components that they recalled over time. What they did do, over time, was add additional incorrect prototype components. Thus, over time they became a little less accurate, if one assesses accuracy in terms of the proportion of components they recalled that were accurate.

Overall, then, children demonstrated remarkable maintenance of recall over a 2-year delay. There are a number of factors that may have affected children's recall of these target events over this long a delay. First, these target events may have been more memorable than the sort of events that have been studied by other researchers. For example, both Poole and White (1993) and Warren and Swartwood (1992) found substantial decreases in recall after 2 years in the children they studied; likewise, both Goodman et al. (1991) and Salmon and Pipe (1997) also found decreases in both the amount and accuracy of recall after a shorter delay of 1 year. However, the events studied here were probably more highly salient events in the lives of the children than were the events these authors studied. Not only did many parents in the present study describe the children as highly distressed or upset (even hysterical) by their injuries and medical treatment, but these events were seen as "big news" events in their lives. Thus, right after the events occurred, the children themselves talked about them a lot with grandparents, neighbors, friends, and so forth, and they overheard parents talking about them with others as well. It is important to note that all of the children in this study had the verbal skills to talk about these events at the time they occurred; children who were slightly younger and lacked the verbal skills to do so did not show long-term recall of similar events (Peterson & Rideout, 1998). Thus, for the children in this study, an enormous amount of rehearsal occurred right after the events happened. How many continued reminders there were is unknown; the parents claimed that after the first few weeks, the events were virtually never talked about, and in fact, at the 1-year and 2-year interviews, almost all parents claimed that the last time the events had been mentioned was at the interviewer's last visit. However, there may well have been occasional reminders nonetheless. It is notable, however, that such reminders seemed to have no effect on the long-term recall of children in a study by Peterson and Rideout (1998), who were slightly younger than the children studied here. Children in that study who were under 27 months of age at the time of injury and who were over 3 years of age during their last interview recalled almost nothing of their injuries, and what they did generate in response to the interviewer's questions was as likely to be wrong as right. In contrast, those children in the present study who were only 2½ years old at the time of injury demonstrated considerably more long-term recall, at least of the injury event. The fact that such abbreviated reminders as may have occurred in children's lives apparently had little effect on children a few months younger

Table 6
Mean Number of Accurate Component Responses (Acc) and Component Commission Errors (Err) for Younger and Older Children Interviewed 3 or 4 Times, and Mean Percentage Accuracy of Components About Injury and Hospital Treatment During the Initial, 6-Month, and 2-Year Follow-Up Interviews

	3-interview group						4-interview group					
	3–6-year-olds		8–13-year-olds		Total		3–6-year-olds		8–13-year-olds		Total	
Measure	Acc	Err	Acc	Err	Acc	Err	Acc	Err	Acc	Err	Acc	Err
					Initial interview							
Injury												
M	12	0.6	14.5	0.3	13.2	0.5	15.3	1.2	16.0	0.3	15.6	0.8
SD	1.8	0.7	1.6	0.5	2.1	0.6	3.4	1.5	3.1	0.5	3.3	1.2
% accuracy	95		98		97		93		98		95	
Hospital												
M	7.0	0.0	8.3	0.4	7.6	0.2	7.6	0.6	8.7	0.2	8.1	0.4
SD	1.9	0.0	1.9	0.5	2.0	0.4	3.2	1.1	3.4	0.5	3.3	0.9
% accuracy	100		96		98		92		97		95	
					6-month interview							
Injury												
M	10.0	0.6	14.3	1.0	12.0	0.8	11.9	1.5	12.7	1.3	12.3	1.4
SD	2.6	0.5	1.6	1.3	3.1	1.0	2.3	1.4	2.3	1.5	2.3	1.4
% accuracy	94		93		94		89		91		90	
Hospital												
M	5.5	0.6	7.8	0.6	6.6	0.6	5.5	1.0	7.0	0.9	6.3	0.9
SD	1.4	0.8	2.2	0.8	2.2	0.8	2.0	0.9	1.8	0.9	2.0	0.9
% accuracy	90		93		92		85		90		87	
					2-year follow-up interview							
Injury												
M	12.0	1.6	13.2	0.8	12.6	1.2	14.4	2.6	14.0	1.4	14.2	2.0
SD	1.7	1.3	1.9	1.0	1.8	1.2	3.6	2.3	2.6	1.5	3.2	2.0
% accuracy	88		93		91		85		91		87	
Hospital												
M	4.5	1.5	6.4	1.1	5.4	1.3	7.0	1.7	7.1	1.1	7.0	1.4
SD	2.0	1.2	2.8	0.7	2.5	1.0	2.5	2.0	2.1	1.1	2.3	1.6
% accuracy	75		85		80		80		86		83	

Note. Accuracy percentages were calculated as follows: % accuracy = number correct/(number correct + number of errors).

suggests that these reminders probably do not explain children's excellent long-term recall. It is also the case that such reminders were unlikely to cover anything but the major events that had occurred (how the injury occurred, going to the hospital, getting stitches), not relatively minor details such as which particular person got to the child first, where the child was taken before the hospital, who the secondary onlookers were and what they did, and so on. These latter facts were probably not included in such reminders even though the children themselves recalled them long-term.

Although we do not know how often the parents, despite their denials, might have reminded the children of the target events, the children nevertheless had extensive reinstatement of all of the components of their experiences during our follow-up interviews. Unfortunately, we cannot compare children who received the reinstating interview 6 months postinjury with those who did not, because all children received this interview. However, we can compare children who were and were not interviewed 1 year postinjury. Thus, for one group of children, fully 18 months elapsed before the final interviews, whereas for the other children, only 1 year elapsed. The intervening interview 1 year postinjury seems to have helped the children's accuracy of recall because children who had the extra interview seemed to maintain accuracy and completeness of recall more successfully over time than children who did not—at least for the hospital-treatment event. (No differences between the groups were found for recall of the injury event.) Thus, extensive reinstatement seems to have helped the children's recall. However, it was surprising how relatively little it helped. Children recalled the details of their injuries just as completely and as accurately whether a year or a year and a half had elapsed between interviews and whether they had two or three prior interviews. It was only the apparently less memorable medical treatment event that seemed to be recalled better when there was an additional interview.

One of the most robust findings of this study is that the event being recalled has an important effect. The main effect of event was significant in every analysis and was part of most interactions as well. Children clearly recalled the components of their injuries better than the components of their medical treatment at the hospital, and they maintained recall of these injury components

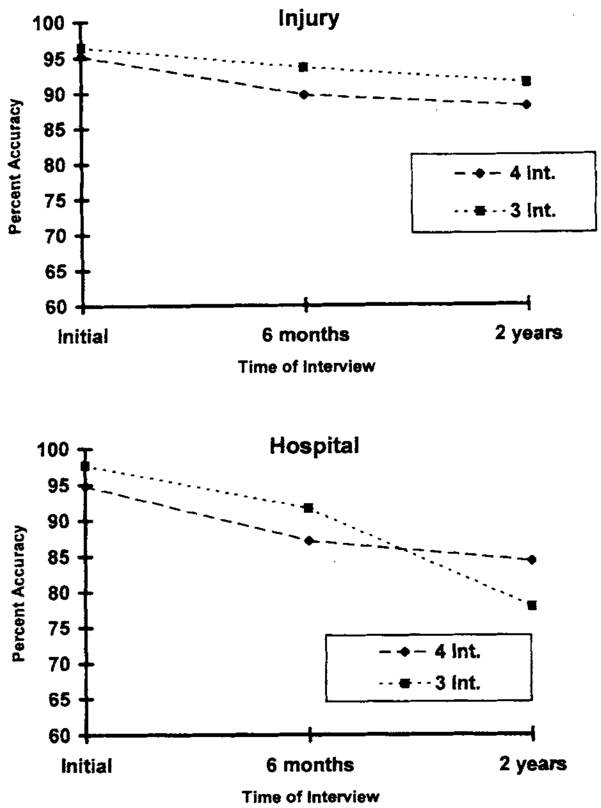

Figure 6. Group × Time × Event interaction for the percentage accuracy of recall for children interviewed four times versus three times (Int. = interviews). The Group × Time interaction is shown separately for the injury and hospital events.

more successfully over a 2-year delay. This finding may have important implications for comparisons of this study with others that have investigated children's long-term recall of salient events, especially events that caused distress to children and have been seen as ecologically valid analogs to abuse (Goodman et al., 1991; Steward et al., 1996). Most of the studies that have investigated children's recall of emotionally distressing events have used events that are similar to the hospital-treatment episode in this study—specifically, children's recall of the details of medical checkups or of minor medical or dental procedures, all of which happen in hospital clinics, doctors' offices, or dental offices (see Peters, 1997). All of these studies have documented more forgetting and less accuracy over time by children than were found here.

A number of factors might have contributed to the differences in children's recall of their injuries relative to their recall of their medical treatment at the hospital. It may be that the injury event is seen by children as more coherently organized in terms of causal linkage between components. That is, whereas adults may see the causal linkage between different aspects of treatment (registration upon entering the hospital, waiting in the waiting room, going to a treatment room, waiting for the doctor, being examined, going to the X-ray room, waiting there, being x-rayed, returning to the treatment room, etc.), such causal links may not be transparent to young children. Children may not understand why they get injections (of local anesthetic), why they are bound up in papoose boards or otherwise physically restrained for treatment, and so on. However, they may see the relationship between successive injury components as more apparently causal. For the injury, the child is injured, cries, or signals distress, and a person responds to that signal, administers immediate aid, and so on. Thus, hospital events may have less coherence in children's memories and subsequently may not be as easy to recall. Indeed, children have been found to have better recall of causally related sequences than of arbitrarily related sequences (Bauer & Mandler, 1989), and children who had a better understanding of target events recalled them better 5 years later than did children with less understanding of the causal relationships inherent in those events (Pillemer et al., 1994).

Children may also have been reminded more often of their injuries than of their hospital treatment. Some children (although not all) probably repeatedly revisited the locations where they were injured in their everyday lives. Some children's behavior (or parental admonishments) may have changed because of their prior injuries; for example, in some cases children may have avoided the specific behavior that caused their injuries (playing with a knife, doing handsprings, etc.). This is unlikely to have been true in all cases, because some children were injured when they inexplicably fell (e.g., in their living rooms) and objects happened to be located where they could cause lacerations.

Another contributor to the greater recall of injury events may have been the uniqueness of the events. The injury events may well have been more unique to the children than the hospital events, for although the major hospital event may have been the child's only cast or set of sutures, virtually every child had been in that same emergency room before. In fact, at the time of injury, the children had averaged six other visits to that emergency room for other injuries or for illness and five visits to the specialist clinic adjacent to the emergency room (see Peterson & Bell, 1996, for details). All such visits no doubt had some similar components, such as registration, waiting in the waiting room, going to a treatment room, being seen by a doctor, and so on. Thus, hospital procedures and treatments may become more likely to be confused or less likely to be recalled because of this repetition of similar-but-different experiences (Hudson & Nelson, 1986; Price & Goodman, 1990). However, it is notable that when Peterson and Bell (1996) assessed the effects of number of prior visits to the emergency room and the attached clinics on children's recall, virtually no effects were found.

Regardless of why children may have found the components of their injuries to be more memorable than the components of their treatment, the present study nevertheless underscores the importance of studying a wider range of events when assessing children's long-term recall, especially if one sees those events as relevant to forensic events such as abuse. Because of the need to understand children's credibility as eyewitnesses, a number of researchers have focused on children's recall of medical or dental events, seeing these events as analogs of the sorts of traumatic events about which children may testify in court. There are clear methodological advantages to such locales, because the child's treatment can be observed, recorded, and even videotaped as it occurs. Such methodological cleanliness was not possible in the present study, in which I had to rely on witness report. However, the fact that children's recall of events that took place within a medical institution was notably worse than their recall of events that took place outside it suggests the need for more research that focuses on events taking place outside of medical establishments. In other words, a range of research settings and event content is needed.

There is another difference between the current study and others—namely, the sort of information that was scored. In this study I disregarded all simple responses of "yes" or "no" because other research had suggested that for preschoolers, such responses may not be reliable (Brainerd & Reyna, 1996; Fivush et al., in press; Peterson & Biggs, 1997; Peterson et al., 1999). Thus, the interviewers did everything they could to avoid asking questions with a yes–no format. If such a question was unavoidable, elaboration was required of the child; that is, a content-rich response was required or the child's response to the question was discarded. It is important to realize that very few data were discarded because of this scoring decision: Fewer than 3% of children's responses about their injury were discarded (with the exception of the 2-year-olds, 10% of whose responses were in yes–no format and thus were discarded). There were more simple yes–no responses to the questions about hospital treatment, but still, only about 10% of the children's responses (again with the exception of the 2-year-olds' responses) were in this form. Thus, the majority of children's responses to the interviewers' questions were content-rich, meaning that the children themselves had to generate the information rather than simply affirm or deny information that was provided by the interviewer.

An important finding of this study was the presence of considerable individual variation in accuracy, and future research needs to explore the explanatory parameters of such variability. Goodman, Quas, Batterman-Faunce, Riddlesberger, and Kuhn (1994) made an excellent beginning in this direction when they documented better recall of a stressful medical procedure by children who had supportive parents who discussed the procedure with the child extensively. More work in this direction is clearly needed.

The present study has implications for forensic situations in which children are interviewed as eyewitnesses. In this study, children were not asked misleading questions or interviewed in coercive ways, and no responses relied on recognition memory ("yes" or "no" responses). Thus, this study can add nothing to the debate about children's suggestibility. However, it does suggest that children who are as young as possibly 2 and certainly 3 years of age at the time of event occurrence can recall personally salient events for a long period of time if they are questioned in appropriate ways. In fact, these young children showed remarkable long-term recall of their experiences. Furthermore, reminding them by means of an additional interview after a long delay seems to help them retain their memories. For most children, the adage "I remember it almost like it was yesterday" seems relevant to their recall of serious injuries sustained 2 years earlier.

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Appendix

Prototype Components of Injury and Hospital Treatment

Injury		Hospital Treatment	
Item	Example	Item	Example
Time of day	"*Right after lunch*"	Registration	"A nurse *checked me in*"
Place	"In my *backyard*"	Vitals measured	"I got my *blood pressure* taken"
Who was with you?	"*Mom* and my *brother* Joe"	Waiting period	"I had to *wait a long time*"
Who else was around?	"My *friend Anna* was playing there too"	Actions while waiting	"I *watched the TV*"
Actions prior to injury	"I was *running*"	Initial exam	"Finally somebody *looked at my cut*"
The injury	"I got a big *cut* on my leg"	Hospital personnel	"It was a *girl doctor*"
How it occurred	"I was *tripped*"	X-rays	"I got *X-rays* because they thought something was still in my knee"
Who did it?	"By my *brother*"	Cast	(not relevant)
What objects involved?	"I hit a *piece of the porch* that was sticking up"	Needles	"I got 4 *needles* to put my knee asleep"
Cry	"I had to just *scream*"	Stitches	"And then I got 14 *stitches*"
Blood	"It was *bleeding* all down my leg"	Bandage	"I got a big *bandage* all down my leg"
Who first responded?	"*Mommy* heard me cry"	Procedural details	"The doctor *washed out my cut* first"
Where you went before hospital	"She took me into the *kitchen*"	Other treatment objects	"With *soap*"
Actions to treat injury	"She *wiped* my knee"	Cry	"That made me *cry*"
Objects of home treatment	"And put a *cloth* on my knee to soak up blood"	Popsicle	"The nurse gave me a *yellow popsicle*"
Anyone else look/help?	"My *brother* was watching"	Family in treatment room	"My *Mom* was in there with me"
Went to hospital	"Then I went to the *hospital*"		
Who took you to hospital?	"*Mom* drove me there"		
Who else went along?	"My *brother* had to come too"		
Time of hospital trip	"We got to the hospital *half an hour later*"		

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