The effects of an early history of otitis media on children’s language and literacy skill development

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Background. Otitis media (OM) or middle ear infection is a common childhood illness and is most frequent during the crucial first 3 years of life when speech and language categories are being established, which could potentially have a long-term effect on language and literacy skill development.

Aims. The purpose of the current study was to ascertain the effects of a history of OM in early childhood on later language and literacy skill development.

Sample. Forty-three children from Grade 1 and Grade 2, between 6 and 8 years old with an early history of OM and 43 control children, matched for chronological age, gender and socio-economic status, participated in this study.

Methods. Children were tested on multiple measures of phonological awareness, semantic knowledge, narration and reading ability. The performance of children with and without a history of OM was compared on the different measures.

Results. There was a general tendency for children with a history of OM to achieve lower scores on phonological awareness skills of alliteration, rhyme and non-word reading, semantic skills of expressive vocabulary and word definitions and reading than non-OM children.

Conclusion. These findings highlight the potential problems an early history of middle ear infection can have on school-aged children’s later language and literacy development.

Otitis media (OM) or middle ear infection is the most common childhood illness; approximately 70% of children have had at least one episode of OM before they are 3 years old, and for many children OM is a recurrent problem (Roush, 2001; Teele, Klein, & Rosner, 1984). Otitis media is the general term for a range of common paediatric conditions affecting the middle ear. Acute otitis media (AOM) is a clinically identifiable infection of the middle ear that has sudden onset and brief duration associated with intense pain and increased pressure in the ear, often accompanied by a fever (Bluestone...
& Klein, 2001). After an episode of acute infection, fluid may remain and accumulate in the inner ear either as a reaction to the infection or due to immature Eustachian tube drainage. This condition, known as otitis media with effusion (OME) or glue ear is characterized by an accumulation of fluid, which impedes normal sound wave transmission, often resulting in conductive hearing loss. Most children with middle ear effusion experience a mild to moderate hearing loss, usually between 15 and 40 dB (Bluestone & Klein, 2001) with losses of more than 35 dB reported in about 20% of children (Roberts, Gravel, et al., 2002). Although this accumulation often clears within a month, 20% of children may continue to have OME at 2 months and 10% 3 months after the initial infection. Hence, it can be seen that the effect of OM varies between individual children in terms of its severity, duration and frequency. In a longitudinal study of 114 children during the first 3 years of life, the hearing and OME status were sampled bimonthly from 5 to 36 months of age (Gravel & Wallace, 2000). Results revealed that children who were classified as bilaterally OME positive in their first, second and third years of life had significantly poorer hearing than children classified as bilaterally OME free in each of these time periods. The fluctuating nature of hearing loss from OME, which may alternate with periods of normal hearing, leads to an inconsistent sound stimulus to the auditory central nervous system.

The occurrence of OM is most frequent during the first 3 years of life with peak incidence occurring between 6 and 18 months, which is the most critical period of language development when the infant is ‘tuning in’ to the speech sounds that characterize their native language (Menyuk, 1986). This process subsequently allows young children to ‘break into’ the stream of speech and eventually map sound on to meaning (Werker, 1995, 2001; Werker & Tees, 1999). Fluctuating hearing loss due to OM during the early years of life presents the child with an intermittent speech signal that is difficult to process, particularly in this crucial period when children are refining their perceptual attention to the particular sounds of their native language (Menyuk, 1986). Menyuk found in her study that there appears to be a more long lasting effect with four or more episodes of OM during this crucial period.

In support of the perspective that early recurrent OM could result in a phonological deficit, several studies have reported that school-aged children with histories of chronic otitis media have impaired categorization of speech stimuli (e.g. Eimas & Clarkson, 1986; Groenen & Crul, 1996; Menyuk, 1986; Mody, Schwartz, Gravel, & Ruben, 1999; Nittrover, 1995; Nittrover & Burton, 2005; Petinou, Schwartz, Gravel, & Raphael, 2001). This suggests that the disruption of input caused by the early occurrence of OM has a subtle but long-term effect on speech perception. Nittrover (1995) also found that children with an early history of OM had reduced phonological awareness, which is the ability to identify sounds in language and to manipulate these sounds. Extensive research has indicated that phonological awareness is a necessary skill for skilled reading (e.g. Bryant, MacLean, Bradley, & Crossland, 1990; Stanovich, Cunningham, & Cramer, 1984; Wagner, Torgesen, & Rashotte, 1994). Hence, phonological deficits due to the hearing loss associated with the early occurrence of OM could affect the reading acquisition process, as children may have difficulty mapping the sounds of their native language on to strings of graphemes when later learning to read (Roberts, Gravel, et al., 2002). The effects of OM in early development may thus lead to the formation of ‘fuzzy’ or incomplete phonological categories, hence ‘weakening the infrastructure’ upon which the foundation for the subsequent development of language and literacy skills is built (Mody et al., 1999, p. 1070).
Deficits in the phonological encoding of speech sounds could in addition have secondary effects on other language skills, including semantic knowledge and narration (Feagans, Sanyal, Henderson, Collier, & Appelbaum, 1987; Friel-Patti & Finitzo, 1990; Schwartz, Mody, & Petinou, 1997). The hearing loss associated with OM could affect speech perception and hence cause the child to misperceive words, and not develop a strong semantic database of words, which could hinder the child’s ability to read fluently, comprehend what has been read and to tell narratives (Feagans et al., 1987; Friel-Patti, 1990; Schwartz et al., 1997; Snow, Tabsor, Nicholson, & Kurland, 1995). Furthermore, there is a widely held belief that the ability to tell narratives forms an important connection between oral language and the acquisition of literacy in children, and that narrative discourse proficiency may be a predictor of reading achievement and later academic success (Bishop & Edmundson, 1987; Feagans & Appelbaum 1986; Feagans & Short 1984; Paul & Smith, 1993; Snyder & Downey, 1991; Westby, 1991). An additional factor to consider is that the varying developmental phase during which a child is affected by OM may produce different long-term effects on language and reading achievement (Maw & Counsell, 1997). For example, early OM during the 6 to 12-month phonetic stage may have a long-term effect primarily on phonological skill development, whereas disruptions during the semantic vocabulary learning phase in the second year may affect lexical or semantic development (Burnham, Tyler, & Horlyck, 2002).

The relationship between oral language skills and reading appears to not be uniform over time but to change during the developmental period of early reading. Initially, phonological awareness plays a major role in word decoding, and then later higher-order oral language skills, such as semantic knowledge and narration, become more influential as children make the developmental transition into fluent reading at about 8-9 years of age when reading comprehension becomes more important (Snyder & Downey, 1991; Roth, Speece, Cooper, & La Paz, 1996; Roth, Speece, & Cooper, 2002). Hence, we can expect that initially in beginning readers, regardless of their history of OM, that phonological skills will play a crucial role, and later, as reading progresses, semantic and narrative skills will play a more influential role.

Some researchers suggest that higher-order semantic skills, such as giving word definitions are better than lower-order semantic skills (i.e. receptive and expressive vocabulary) in predicting reading and comprehension abilities (Snow et al., 1995). Snow and colleagues found that the semantic skill of defining words in kindergarten was the strongest language predictor of word decoding and reading comprehension in Grade 1. This study indicated that the higher-level decontextualized language skills of both defining words and narrative ability are important for later success in reading.

Many investigators have reported adverse effects of OM on later language and literacy development (e.g. Finitzo, Gunnarson, & Clark, 1990; Friel-Patti & Finitzo, 1990; Gravel & Wallace, 1995; Luotonen, Uhari, Lukkaroinen, Luotonen, & Uhari, 1998; Menyuk, 1986; Teele, Klein, Chase, Menyuk, & Rosner, 1990). A mild, fluctuating hearing loss throughout infancy has been found to disrupt semantic skills, both expressive and receptive language acquisition (Friel-Patti & Finitzo, 1990; Roberts et al., 1995; Teele et al., 1984; Wallace et al., 1988). Roberts and Wallace’s (1997) review of research indicates that, in comparison with children who infrequently experienced OM, children with OM score lower on tests of speech production, receptive language and expressive language with expressive language more affected by a history of OM than receptive language. Roberts et al. (2000) found that children with a history of OM performed significantly worse than age-matched controls on measures of expressive language in preschool; however, by the time they had reached second grade, these
deficits had repaired themselves, and they were as competent at expressive language skills as the control group of children. In addition, Feagans (1986) found that the frequency of OM from birth to 3 years was predictive of children’s narrative skills at ages 5 and 7. In relation to reading, Teele et al. (1990) found that there is a higher incidence of reading difficulties among children with a history of OM than those without. However, it is important to note that other studies found only a moderate correlation between those children with a history of OM and reading difficulties (Wallace & Hooper, 1997), and other studies did not find a relationship at all (see Paradise et al., 2001; Roberts et al., 2000; Roberts, Burchinal, & Zeisel, 2002).

The use of retrospective studies has been questioned due to the potential unreliability of parental recall of the incidence and severity of children’s history of OM (e.g. Menyuk, 1986; Roberts, Gravel, et al., 2002). Researchers have found that parents tend to exaggerate the number of episodes in otitis-prone children (Alho, 1990; Daly, Lindgren, & Giebink, 1994). However, other researchers have found parental information to be reliable (Luotonen et al., 1998). Results from prospective studies are also contradictory and have been criticized on the basis of the language assessments used. They often rely on standardized tests or parental checklists, which are not always sensitive enough to detect impairments in specific language areas (Briscoe, Bishop, & Norbury, 2001; Nitttrouer & Burton, 2005). Retrospective studies do allow researchers to investigate higher language and literacy skills in older children, which is of particular concern to both parents and educationalists. Furthermore, previous studies have typically focused on only one or two measures of language, whereas the present study attempts to address this shortfall by using multiple measures at three different linguistic levels; phonological, semantic and discourse levels. In addition, reading is often assessed based on reading of single words without context, whereas in the present study, reading ability was assessed using passages of text.

The current study aims to investigate the effects that an early occurrence of OM has on the later development of a range of language skills at three different linguistic levels; phonological, semantic and narrative in conjunction with reading ability in school-aged children. The present study uses a variety of language and reading measures, which allows us to ascertain which particular levels or aspects of language and reading are affected, if any, by an early occurrence of OM. This study is a retrospective study and uses a combination of both parental recall and medical records to classify children as having had a history of chronic OM.

Method
Participants
Participants were 86 children from Grades 1 and 2, between the ages of 6 and 8 years from schools in the western suburbs of Sydney, Australia. Of these, 42 children were recruited from Grade 1 and 44 children were recruited from Grade 2. There were 38 girls and 48 boys in total. All children spoke English as their first language. We recruited 43 children who had a history of repeated episodes of OM with four or more episodes of OM and/or who had grommets inserted before the age of three. Of the children, 14 had grommets inserted from 18 to 36 months. The selection of OM participants was based on a combination of both parental recall and medical records. Parents were asked to record and rate the severity of OM in the child’s first 3 years (see questionnaire in Appendix A) and to provide any supporting medical records available, so that children
who were most severely affected in the first 2 years were recruited. The comparison group was recruited based on the criteria that they had experienced only one or no episodes of OM before age three. They were selected from the same class as the OM children in conjunction with classroom teachers, and were matched with the OM children for age and gender. School records indicated that all of the children had normal hearing (children’s hearing was tested by Community Health Services at the beginning of the year) and were not intellectually impaired. A comparison of the characteristics of the OM and non-OM children, which includes parental occupation and level of education, are provided in Table 1. Children were from predominantly middle-SES backgrounds. Results of two separate chi-squared analyses revealed no difference between mothers or fathers of the two groups in terms of education level. Children who had a cold or ear infection at the time of testing were not included in the study.

<table>
<thead>
<tr>
<th>Table 1. Characteristics of the OM and non-OM groups</th>
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<td>OM group</td>
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<td>Paraprofessionals and tradespersons</td>
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<td>Service occupations</td>
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<td>Process workers and labourers</td>
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<td>Student</td>
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<td>Unemployed/pension</td>
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<td>Domestic duties</td>
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<td>Father</td>
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<td>Management and professional</td>
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Procedure
Children were assessed individually in a separate room of the school on: the phonological awareness skills of alliteration, rhyme and non-word reading; semantic skills of receptive vocabulary, expressive vocabulary and word definitions; narration through both a retell and personal experience recall task and reading ability. For the standardized tests, responses were recorded on to test sheets and scored according to the relevant manual. Narratives were recorded on to a small, portable walkman via a clip on microphone and were later transcribed verbatim. Sessions lasted generally between 50 and 60 minutes. If the child tired, then the session was broken into two separate sessions. The language and literacy measures used are explained in greater detail in the following section.

Measures

Phonological awareness
Phonological awareness was assessed using the subtests of alliteration, rhyme and non-word reading from the phonological assessment battery (PhAB; Frederickson, Frith, & Reason, 1997). The alliteration subtest was used to assess the child’s ability to identify initial sounds in words. The child was required to identify two words from a choice of three that began with the same sound (e.g. ship, fat, fix). A maximum score of 10 could be obtained. The internal consistency reliability using a Cronbach coefficient alpha for the alliteration subtest is .90 (PhAB; Frederickson et al., 1997). Construct validity was good with moderate positive correlations found between alliteration and other measures of phonological awareness ($r = .53$ to $.60$). The rhyme subtest was used to assess the child’s ability to identify words whose endings sound alike. The examiner said three words and the child identified the two words that rhymed (e.g. made, hide and fade). The maximum score that could be obtained was 21. Internal consistency reliability for the rhyme subtest for ages 5–8 years is high with a Cronbach coefficient $\alpha$ of .92 (PhAB; Frederickson et al., 1997). The non-word reading subtest of the PhAB was used to assess the child’s phonological decoding skills. The child was required to read single syllable and two syllable non-words (e.g. gat and haplut). There was a maximum possible score of 20. The internal consistency reliability for the non-word reading subtest is very high at .95 (Cronbach coefficient $\alpha$; PhAB; Frederickson et al., 1997).

Semantic knowledge
Three tests were used to assess semantic ability. The first test was the Peabody Picture Vocabulary Test, third edition (PPVT-III; Dunn & Dunn, 1981), which was used to assess receptive vocabulary. The examiner said a word and the child was required to point to the picture which best represented the word. The internal consistency reliability for the PPVT-III using a Cronbach $\alpha$ coefficient ranges from .92 to .98 (median = .95; Dunn & Dunn, 1981). This indicates that it is a highly reliable measure. The PPVT-III has moderate positive criterion validity with other tests of receptive vocabulary ($r = .63$ to .83; Dunn & Dunn, 1981). The Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983) was used to assess expressive vocabulary through word retrieval abilities. Children were shown line drawings of objects and asked to name them. There were 60 items, which became progressively harder. The word definition subtest of the Test of Language Development – Primary: Third Edition (TOLD-P;3; Newcomer & Hammill, 1997) was used to assess the child’s ability to define words orally. This subtest requires
the child to define 24 familiar words, for example, *What is a bed?* The word definitions subtest of the TOLD-P-3 is a reliable measure as it has an internal consistency, Cronbach α coefficient value of .86 (Newcomer & Hammill, 1997). The subtest is a valid measure of word retrieval ability \( r = .65 \) to \( .78 \).

**Narration**

As oral narration consists of a range of subgenres and varies depending on the elicitation context, two different tasks were used to assess narrative ability: a retell task and a personal experience recall task. The story retell task required children to retell a story using a wordless picture book, whereas the personal narrative recall task required children to recall a past personal experience. These two narrative tasks are explained in greater detail.

**Narrative retell task**

*Procedure:* For the narrative retell task, the child was told the story *Harry the Dirty Dog* by Gene Zion and illustrated by Margaret Bloy Graham (1956) without the written text. Prior to the assessment, a simplified script was prepared based on the original story to shorten the task and reduce cognitive load (see Appendix A). Prior to administering the task, the story was segmented into propositions and allocated points for scoring purposes, as illustrated in Appendix A. This scoring system includes points for providing contextual information or the setting relevant to the story, for example, *once upon a time, one day,* as this has been related to success in decontextualized reading tasks (Peterson, Jesso, & McCabe, 1999; Peterson & McCabe, 1996; Reese, 1995). The series of pictures were shown to the child as the researcher told the story. Immediately after hearing the story, the child was asked to retell the story with the aid of the pictures. The children’s narratives were recorded on audiotape, transcribed and later scored. The narratives were scored according to the number of propositions that were included in each of the child’s narratives. The maximum score was 39. The narrative scores were given an additional point for each of the main themes or frames of the story included in the narrative with a maximum score of 8 (these are listed in Appendix A). Hence, the composite score for each child included the number of propositions and main themes in the child’s narrative with a maximum score of 47. The children’s narratives were then segmented into T-units. The T-unit is a measure of overall sentence length, and reflects increasing syntactic complexity to some extent (Scott & Windsor, 2000). A T-unit is defined by Scott (1988) as ‘a main clause and all subordinate or non-clausal structures attached to or embedded within. All main clauses that begin with coordinating conjunctions and, but, (and) or indicate a new T-unit unless there is a co-referential subject deletion in the second clause’ (p. 55). Hence, T-units are grammatical structures ‘intermediate between a clause and a sentence’, which are determined by surface structure (Hedberg & Westby, 1993, p. 39). In this analysis, each T-unit was typed on a separate line, then the mean length of T-units (mltu) per narrative was computed by dividing the total number of words by the number of T-units in the child’s narrative. (See Appendix C for an example of the scoring system used to assess a child’s narrative transcript). Inter–rater reliability was .84 for 15% of the data.

**Narrative recall task**

In the narrative personal recount task, children were encouraged to tell a story about something that had happened to them in the past (Labov, 1972; Peterson & McCabe,
The protocol developed by Peterson and McCabe (1983) was used to elicit the oral narratives. The investigator related a simple personal narrative and then asked an open question, such as, ‘Has anything like that ever happened to you?’ Several prompts were used to elicit the stories with the children (falling off their bicycle, getting hurt in other ways, going to the doctor or hospital, getting stung, going to the zoo, playing at home). Each child’s most sophisticated or longest narrative was used for the analysis, as length is an excellent index of narrative complexity (Biddle, McCabe, & Bliss, 1996). The children’s narratives were then segmented into T-units. Each T-unit was typed on a separate line then the mltu per narrative was computed by dividing the total number of words by the number of T-units in the child’s narrative as illustrated in Appendix C. Inter-rater reliability was .87 for 15% of the data.

Reading measure
To assess children’s literacy levels the Gray Oral Reading Test (GORT-4; Wiederholt & Bryant, 2002) was administered. This is an objective norm-based test, which consists of 14 reading passages that get progressively harder. The child is timed on how long it takes to read the passage in seconds and the number of deviations from the printed text the child made whilst reading is recorded. This gives an overall oral reading score. There are five corresponding comprehension questions for each passage, which also gives a reading comprehension score. The internal consistency reliability of the GORT-4 is reasonably high for rate (coefficient $\alpha$ = .88 to .93), accuracy ($r$ = .87 to .92), fluency ($r$ = .91 to .93) and comprehension ($r$ = .94 to .96). The GORT-4 is a valid instrument for measuring reading fluency (median $r$ = .67) and comprehension ($r$ = .34 to .45; Wiederholt & Bryant, 2002).

Results
A 2 (Age: 6 years, 7 years) x 2 (Group: OM, non-OM) x 8 (measures: alliteration, rhyme, non-word reading, receptive vocabulary, expressive vocabulary, word definitions, narrative retell (score), narrative recall (mltu), narrative comprehension (mltu), multifactorial ANOVA using SPSS was used to examine the effects of age by group on performance on the multiple measures of language and reading ability. The analysis revealed a main effect of group, $F(1, 72) = 2.53, p < .01$, and a main effect of age, $F(11, 72) = 3.92, p < .01$. These effects are shown in Table 2. The main effect of group was due to the non-OM group scoring higher than the OM group, and the main effect of age was due to the 7-year-olds scoring higher than the 6-year-olds. There was not a significant interaction effect of age by group.

Test of between-subject effects revealed that there was a significant effect of group for alliteration, $F(1, 10) = 8.81, p < .01$, rhyme, $F(1, 10) = 9.42, p < .01$, non-word reading, $F(1, 10) = 12.85, p < .01$, expressive vocabulary, $F(1, 10) = 9.34, p < .01$, word definitions, $F(1, 10) = 9.50, p < .01$, reading fluency, $F(1, 10) = 23.21, p < .01$, and reading comprehension, $F(1, 10) = 23.43, p < .01$. Narrative measures were not significantly different. As multiple measures were assessed, alpha was set at .01. These effects are illustrated in Table 2. In summary, the non-OM group scored significantly higher than the OM group on all measures of phonological awareness, semantic skills of expressive vocabulary and word definitions, and reading and comprehension. There
were particularly large and significant differences for each of the two groups on non-word reading and reading measures, both reading fluency and comprehension.

There was a significant effect of age for rhyme, $F(1, 10) = 13.67, p < .01$, receptive vocabulary, $F(1, 10) = 18.45, p < .01$, expressive vocabulary, $F(1, 10) = 18.49, p < .01$, word definitions, $F(1, 10) = 7.03, p < .01$, recall narrative (mlu), $F(1, 10) = 9.71, p < .01$, reading fluency, $F(1, 10) = 17.44, p < .01$, and reading comprehension, $F(1, 10) = 20.96, p < .01$. On all measures, 7-year-olds performed better than 6-year-olds. No other effects were found to be significant. There are possible ceiling effects for the tasks used to assess the phonological awareness skills of alliteration and non-word reading. In order to gain a greater understanding of the relationship between these language measures and reading, correlations between the measures and between the measures and reading were subsequently conducted.

**Relationship among the language and reading measures**

Table 3 shows intercorrelations amongst measures, and it can be seen that, in general, measures interrelate positively and significantly. In addition, it can be seen that all the language measures achieved significance with the reading measures of reading and comprehension, with the exception of the narrative recall measures, which have low correlations with most other language and reading measures. In relation to reading measures, the most robust correlations were with the phonological awareness skills of rhyme and non-word reading, and the semantic skill of word definitions, and between receptive vocabulary and comprehension. Two standard multiple regression analyses were separately performed between the two criteria reading fluency and reading.
Table 3. Bivariate correlations between all measures

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<thead>
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<th></th>
<th>Alliteration</th>
<th>Rhyme</th>
<th>Non-word reading</th>
<th>Receptive vocabulary</th>
<th>Expressive vocabulary</th>
<th>TOLD word definitions</th>
<th>Narrative retell score</th>
<th>Narrative retell (mlu)</th>
<th>Narrative recall (mlu)</th>
<th>Reading fluency</th>
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<tr>
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<td>.519**</td>
<td>.545**</td>
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<td>Boston express. vocab</td>
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<td>.611**</td>
<td>.551**</td>
<td>.563**</td>
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<tr>
<td>TOLD word definitions</td>
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<td>.622**</td>
<td>.545**</td>
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<td>.230</td>
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</table>

*N* = 86, *p* < .01, **p** < .001.
comprehension, and the 11 predictor variables; alliteration, rhyme, non-word reading, receptive language, expressive language, word definitions, retell narrative (score), retell narrative (mltu), recall narrative (mltu), group and age. Table 4 displays the multiple regression coefficients of the language and reading measures of alliteration, rhyme, non-word reading, receptive language, expressive language, word definitions, retell narrative (score), retell narrative (mltu), recall narrative (mltu), group and age as predictors of reading fluency and reading comprehension, respectively. From Table 4, it can be seen that group and non-word reading are the only significant, unique predictors of both reading fluency and comprehension.

**Discussion**

The present study found that there were significant differences between children with an early history of OM and children without a history of OM on all phonological awareness skills, the semantic skills of expressive vocabulary and word definitions and the reading measures. There were particularly large significant differences on non-word reading and reading fluency and comprehension. This study confirms the notion that early recurrent OM may have long-term effects on language and literacy skill development of children from 6 to 8 years of age. Results indicate that the delay in reading is not in general ameliorated with age in this particular cohort of children.

Non-word reading and group (i.e. whether the child had or had not experienced OM) were the only unique predictors of reading, which suggests that the development of phonological awareness skills, in particular decoding skills, is a crucial factor which underlies the acquisition of reading in the children affected by OM. It appears that these children are having particular difficulty with word decoding skills and mapping phonemes on to graphemes, which extensive research has indicated is an essential skill for success in reading. This gives qualified support for the presupposition that there is an association between early recurrent OM and deficits in the phonological encoding of speech sounds, which can lead to later problems in mapping phonemes to graphemes when learning to read.
It was noticeable that the narrative skills of retell and recall were not significantly different between the OM and non-OM children, which could indicate that these skills are not affected by early OM or it could be due to the age of the children in the present study, as researchers have found that narrative ability plays a more important role in older children’s reading (Roth et al., 2002; Snyder & Downey, 1991). Reading is a dynamic process and initially phonological awareness plays a major role in word decoding, and later higher-order oral language skills, such as semantic knowledge and narrative ability, play a more influential role as reading acquisition proceeds (Roth et al., 1996). There were also greater differences in the semantic measures of expressive language than receptive language in the OM children in comparison to the non-OM children, which concurs with Roberts and Wallace’s (1997) findings that expressive language is more affected by a history of OM than receptive language. There was a slightly stronger relationship between word definitions and reading measures than the other semantic skills, which partly supports Snow et al.’s (1995) findings that higher-order semantic skills play an important role in predicting reading. Differences in language skills affected by OM could be explained in terms of the particular stage of language development affected by the occurrence of OM, for example, the occurrence of OM in the first year could primarily affect phonological skill development, and in the second year, affect lexical or semantic development and the laying down or mapping of words to sounds. However, this needs to be investigated further, ideally through a prospective study in the future.

Results from the present study concur with previous studies that have found a relationship between a history of OM in the early years of a child’s life and delays in later language and literacy development (e.g. Friel-Patti & Finitzo, 1990; Luotonen et al., 1998; Menyuk, 1986; Nittrouer & Burton, 2005). However, these results do not support the conclusions drawn from the large prospective studies conducted by Roberts and colleagues, and Paradise and colleagues (e.g. Roberts, Burchinal, & Zeisel, 2002; Paradise et al., 2001), who concluded that an early history of OM does not affect later language development. In these studies, the children were from predominantly low-SES backgrounds, whereas in the present study, children were from predominantly middle-SES backgrounds, which can significantly affect results (Menyuk, 1986; Nittrouer & Burton, 2005). In addition, the language and literacy measures used could partially explain this anomaly in results. In these larger studies, standardized tests and parental checklists were used to assess language skills, which may not be sensitive enough to detect more specific language deficits (Nittrouer & Burton, 2005). Briscoe et al. (2001) found that children with language impairment can perform within normal limits on standardized tests and yet have phonological awareness or processing deficits.

In summary, the present study gives evidence for an early occurrence of OM having an effect on the later development of phonological awareness skills, semantic skills and reading ability, but not narrative skills. However, results need to be interpreted with caution as the number of participants included in this study was relatively small. Results from the present study supports the view that if a child experiences OM during the crucial first years of life, then this may have long-term effects on subsequent language and literacy development. It appears that although some speech and language deficits may be ameliorated with age, other effects may persist beyond preschool years (Mody et al., 1999).
References


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**Appendix A**

**Questions from the parental questionnaire**

1. When was the first middle ear infection that your child experienced?
2. How many times did your child have middle ear infections in their first year?
3. How many times did your child have middle ear infections in their second year?
4. How many times did your child have middle ear infections in their third year?
5. How severe were your child’s middle ear infections in their first year?
   - □ Mild  □ Quite severe  □ Very severe
   - or  □ No infection in their first year
7. How severe were your child’s middle ear infections in their second year?
   - □ Mild  □ Quite severe  □ Very severe
   - or  □ No infection in their second year
9. How severe were your child’s middle ear infections in their third year?
   - □ Mild  □ Quite severe  □ Very severe
   - or  □ No infection in their third year
6. Has your child ever had grommets? YES NO (please circle)
   - At what age did he/she have grommets?____________
7. Has your child been to an audiologist (hearing specialist)? YES NO (please circle)
8. Has your child been to a speech pathologist / therapist? YES NO (please circle)
9. Does your child have problems pronouncing some words? YES NO (please circle)
   - Can you give some examples please. __________________________
10. Does your child speak any language other than English? YES NO (please circle)

**Appendix B**

**Transcript of Harry the Dirty Dog story**

This is a story about Harry the Dirty Dog.

*Picture 1*

Once upon a time (1) there was a dog called Harry (1). Harry was a white dog with black spots (1) who liked everything except having a bath (1).
Picture 2
So one day (1) he took the scrubbing brush and buried it in the back garden (1). Then he went to play (1).

Picture 3
He played where they were mending the street (1) and got very dirty (1).

Picture 4
He played tag with other dogs (1) and became dirtier still (1). In fact, he changed from a white dog with black spots, to a black dog with white spots (1).

Picture 5
At the end of the day (1) Harry felt tired and hungry (1), so he ran back home (1). When Harry got home he sat looking at the back door (1). The children looked out at Harry (1) and said, ‘There’s a strange dog in the back garden (1) . . . by the way has anyone seen Harry?’ (1) They didn’t know it was Harry (1).

Picture 6
When Harry heard this he tried very hard to show them he was Harry (1). He started to do all his old clever tricks (1). He flip-flopped and he flop-flipped (1). He rolled over and played dead (1).

Picture 7
He did these tricks over and over again (1) but everyone shook their heads and said, ‘Oh no, it couldn’t be Harry’ (1).

Picture 8
Harry didn’t know what to do (1). Then he had an idea (1). He dug up the scrubbing brush in the garden (1).

Picture 9
He carried the scrubbing brush in his mouth into the bathroom (1). He jumped into the bathtub (1) and sat up begging with the scrubbing brush in his mouth (1), a trick he certainly had never done before. ‘This little doggie wants a bath!’ cried the little girl (1) and her father said, ‘Why don’t you and your brother give him one?’ (1).

Picture 10
The children gave Harry a bath (1), and then noticed that the dog was Harry (1). ‘It’s Harry! It’s Harry! It’s Harry!’ they cried (1).

Picture 11
The children combed and brushed him (1). He was a white dog with black spots once again (1).

Main themes in Harry the Dirty Dog story
One point is allocated for each of the following main themes included in the child’s narrative

Harry is a dog who doesn’t like having baths (1)
So he hid the brush (1)
Went to play (1)
Got very dirty (1)
Went home and family didn’t recognize him (1)
So he dug up the scrubbing brush (1)
Went into bath and begged to have a bath (1)
After the bath, they recognized him (1)

Appendix C

Example of the scoring system used for the retell narrative task

Age: 7;7

Once upon a time (1) there was a dog called Harry (1)
He liked everything except a bath (1)
So one day (1) he buried the scrubbing brush in the garden (1) and went off to play (1)
He went off to play where they were fixing the road (1)
And he got really really dirty (1)
He turned from a white dog with black spots to a black dog with white spots (1)
After he finished playing he went home (1) because he was tired and hungry (1)
They said there is a little dog (1) outside have you seen Harry by the way? (1)
When he heard this he tried to do some of his old tricks (1) doing flip flops and flop flips (1) and rolling over and playing dead (1)
They still didn’t notice him (1)
Then he unburied the scrubbing brush (1) and ran up the stairs with the scrubbing brush in his mouth (1)
He went up to the bathroom (1) and was sitting in the tub begging there for a bath (1)
The little girl said that we’d better give him a bath (1)
Then he went into the bath all scrubbed off (1)
Then the little children shouted it’s Harry it’s Harry (1)
Number of T-units = 15; number of words = 191; mean length of T-units = 12.7.
Score for the number of propositions included = 23.
Score for the number of main themes included = 8.
Total score = 31.

Example of the scoring system used for the recall narrative task

Age: 6;11

I was at my friend’s house
And I was going
And my friend said ‘Let’s have a race’
I was riding really fast
And I crashed into his gate
And my head nearly hit the bricks
And I had a big bruise there
And then we went home
And then he gave me a cold washer
I had to go to the doctor’s because I had that crash
Number of T-units = 10; number of words = 69; mean length of T-units = 6.9.
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