

Do Middle Ear Infections Matter? Student Self-reported Perceptions of Behaviour, Including Social Skills, Following Experience with Otitis Media with Effusion

Janice S. Stenton (stenton@usq.edu.au)

Faculty of Education, University of Southern Queensland, Australia

This article has been anonymously peer-reviewed and accepted for publication in the *International Journal of Pedagogies and Learning*, an international, peer-reviewed journal that focuses on issues and trends in pedagogies and learning in national and international contexts. ISSN 1833-4105.

© Copyright of articles is retained by authors. As this is an open access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

Abstract

Children frequently experience fluctuating conductive hearing loss during and following episodes of otitis media with effusion. With the prevalence of the disease increasing in the non-Indigenous population in Australia, many children may be at risk of long-term problems related to their behaviour. There are conflicting findings in the research literature regarding the effects of this type of hearing loss. For some students it appears that experience with otitis media with effusion with or without tympanostomy tube (grommet) insertion is associated with various educational problems, including inappropriate behaviours. A current concern is whether or not these possible effects would continue to influence the behaviour of children as they continue into their high school years. A study was undertaken to identify the impact of otitis media with effusion and its associated sequelae on the behaviour of high school students. Self-reporting by high school students in Years 8 and 9 attending a Brisbane school provided information about their perceptions of various aspects of their behaviour (including social skills). Three groups were formed: a Non-OME/Non-Grommet Group ($n = 28$), an OME/Grommet Group ($n = 17$) and an OME/Non-Grommet Group ($n = 32$). Analysis of the results revealed a range of mild effects; in particular, girls with a history of grommets exhibited a lack of confidence in their social skills and boys (with or without grommets) an increase in behaviour problems. The study identifies a number of associated teaching and learning issues, including noise levels in childcare environments and school classrooms, current teaching and learning methodology and the training of new teachers.

Introduction

This study originated in the field of education. On numerous occasions parents were heard expressing the opinion that having middle ear infections as a child had compromised the potential of their child to learn academically and/or to behave appropriately at high school. They did not appear to understand how or why this had happened but they were convinced that, in their view, when they compared the child with a history of middle ear infections with siblings and classmates who did not have such a medical history, there was a difference in school grades and behaviour. Otitis media is a widespread disease that frequently accompanies middle ear infections. When effusion accumulates in the eustachian tube, children experience a fluctuating, conductive hearing loss. The effusion can be slow to clear in young children so grommets are inserted to drain the effusion.

This paper reports on perceptions obtained from students regarding their behaviours (including social skills) and linking them with middle ear disease and fluctuating, conductive hearing loss. It concludes with a discussion of the impact of the outcomes from this disease on pedagogy and learning and implications for educational practice.

Literature Review

Murphy and Blogg (1995) reported that 83% of Australian children experience an episode of acute otitis media by the age of three, with peak incidence between six and twelve months of age and with another smaller peak at four and five years. Prevalence of the disease declines with age (Daly *et al.*, 2002). Moore and Best (1988) in a study of 1,111 children in Melbourne, Victoria found that 33% of the children had an undetected hearing loss of at least 35 dB. A further 20% had normal hearing combined with some degree of middle ear dysfunction, demanding careful follow-up. They found this unexpectedly high incidence of otitis media with effusion and abnormal ear dysfunction surprising because parents or teachers had suspected neither the hearing loss nor the middle ear dysfunction. Children with an Indigenous Australian heritage are highly likely to contract otitis media as they frequently experience early, persistent and severe middle ear infections (Morris *et al.*, 2007). Research into the impact of otitis media on children's development has been conducted for over 30 years, frequently with contradictory and controversial outcomes (Casby, 2001; Paradise *et al.*, 2007).

Feagans (1986) argues that young children with a mild hearing loss from otitis media do eventually learn to talk quite well but she suggests that they also learn to "tune out" language and instead attend to less auditory aspects of the environment. This may become a persistent way of interacting with the world and can lead to less attention being paid to language in situations requiring sustained attention. According to Vernon-Feagans (1999), these children possibly understand language quite well in a one to one situation or in a quiet environment but when confronted by noisy situations or other children talking they may well behave differently. Roberts *et al.* (1998) suggest that children with persistent otitis media may actually alter the way that parents and caregivers respond to them by creating a different pattern of interaction that is possibly less effective than the interaction used between healthy children and caregivers. In a review of the literature, Vernon-Feagans (1999) suggests that one of the major impacts of otitis media on school age children may be their lack of attention to language, which could manifest itself as inappropriate behaviour. A child who tends not to pay adequate attention to language may appear to ignore or confuse directions and interact inappropriately in social situations.

A recently developed model, the Cumulative Risk/Interaction Model (Vernon-Feagans, Hurley, & Yont, 2002), which builds on the Interactive Language and Attention Model (Vernon-Feagans, 1999), stresses that the accumulation of a variety of risks in early childhood rather than just one particular risk, such as hearing loss resulting from otitis media, may provide an explanation for various developmental outcomes in children. The child is seen as being able to cope with mild risks or just one risk but accumulated risks can become overwhelming and place the child at much greater risk of poor outcomes. For example, in a situation where a child has persistent otitis media and attends day care either on a full time basis or frequently for short-term care, a noisy day care environment where competition for adult interaction is a

problem may put a child at risk of a number of developmental problems with the poor quality environment being a negative moderator on the situation. On the other hand, children with chronic otitis media who are in high quality childcare may be buffered against the negative effects of the otitis media (Vernon-Feagans *et al.*, 2002).

The Deafness Forum of Australia maintains that children with fluctuating, conductive hearing loss are often identified by their behaviour, including poor concentration and attention, disobedience, irritability and poor social skills. The consequences of otitis media may even contribute to behaviours that fit nine diagnostic criteria for Attention Deficit Disorder (Howard, 1995). Further Australian research by Dermody (1992) addressing issues related to middle class urban children and the possible language consequences of middle ear problems suggests there is evidence of attention and behaviour problems associated with otitis media with effusion. Bench and Harrold (1995) assert that, because the child is disadvantaged in learning situations that require auditory attention and comprehension, other problems, such as metalanguage difficulties, develop that lead to learning problems and social and behavioural problems.

Only a few studies have considered whether behavioural sequelae of otitis media continue into the teenage years. Bennett, Haggard, Silva and Stewart, (2001) using a large cohort and a longitudinal design (the Dunedin Study), reported that the most significant finding was parent-reported inattentive behaviour at ages 11, 13 and 15 as well as some antisocial behaviour and hyperactivity at age 15. Teacher-reported behaviour problems associated with a history of otitis media included antisocial, neurotic and inattentive behaviours at age 13 but hardly any at age 11. It appears that there is the possibility of a relationship between early lack of attention as reported by some studies and later behavioural problems in teenagers.

When students cannot listen effectively in school, they find it difficult to stay on task in the classroom (Berg, 1993). Listening to auditory information requires a great deal of effort and concentration. If the signal is hard to hear, young children in particular become irritated and “tune out” when they should be listening (Kaderavek & Pakulski, 2002). If children do not develop the ability to listen in noise until they reach the teenage years as claimed by Kaderavek and Pakulski (2002), possibly high school students with a previous history of conductive hearing loss in childhood may have even more difficulties than previously thought. An aspect of the current study was to identify if students who have had a history of otitis media with effusion in early childhood report continuing problems with behaviour, including social skills, in school through to adolescence. Implications for pedagogy and learning outcomes implicate pre-service teacher education practices, the management of classroom space and teacher knowledge.

Subjects and Methods

The study was retrospective, undertaken in a large, non-government, coeducational school situated in an average socioeconomic area near Brisbane, Australia to compare the outcomes on academic and behavioural measures for students with and without histories of otitis media and/or the insertion of tympanostomy tubes (grommets). Participants in the study were selected from all students in Years 8 and 9 (ages 12-15 years) at the school and met the following criteria based on responses from a parent questionnaire: no sensorineural hearing loss; first language English; and no

Indigenous Australian heritage. Seventy-seven students met these criteria. On analysis of parents' responses they were assigned to one of three otitis media groups:

- Non-OME/Non-Grommet Group: students with no history of otitis media with effusion or tympanostomy tubes insertion: $n = 28$ (36.4%), girls = 17, boys = 11.
- OME/Grommet Group: students with a history of otitis media with effusion and tympanostomy tubes inserted when younger: $n = 17$ (22.1%), girls = 12, boys = 5.
- OME/Non-Grommet Group: students with a history of otitis media with effusion but no tympanostomy tube insertion: $n = 32$ (41.6%) girls = 17, boys = 15.

For some variable combinations, the sample numbers were small (for example, number of boys in the OME/Grommet Group = 5). The study used a reported history of middle ear infections as a proxy for otitis media with effusion.

A Student Self-Report Survey Form was devised and used to obtain information about the students' behaviour, including social skills. The Survey Form asked the students to compare their behaviour with that of other students in the class by responding to questions relating to attitude to doing homework, general behaviour in class and relationships with other students. Students replied using a five-point Likert scale (*well below average, below average, average, above average and well above average*). Responses were examined according to year level, otitis media group and gender as well as gender by otitis media group (reported here). Frequencies of responses to each question are reported as numbers and percentages.

While care was taken in the construction of the three otitis media groups and in allowing maximum separation according to the reported incidence of otitis media, it is recognised that the study was undertaken in a single school with a single cohort of students. While the selected participants appeared representative of the school's students in general (given that some groups of students were not included – for example, Indigenous students and students with sensory hearing loss), the groups cannot be considered a random sample of a larger population. In addition, for some variable combinations, sample numbers were small. Care has been taken in reporting appropriate descriptive statistics.

Results

Results by number and percentage for the Student Survey Forms by gender and otitis media group appear in Table 1 below. An examination by gender and otitis media group for the question related to homework performance shows that girls and boys in the Non-OME/Non-Grommet Group consistently rated themselves more frequently in the *above average* and *well above average* ranges than did girls or boys in the other two groups. However, girls in this group showed more confidence in their homework performance (approximately 75%) compared with boys in the same group (approximately 45%). Girls and boys in the OME/Grommet Group and the OME/Non-Grommet Group tended to rate themselves more frequently in the *average* or *below average* ranges, with this tendency being strongest for boys in these groups.

Table 1: Student responses for gender by otitis media group

Gender	Otitis media group	Well below average	Below average	Average	Above average	Well above average	n
Homework Performance							
Girls	Non-OME/Non-Grommet Group	0 (0%)	0 (0%)	4 (23.5%)	11 (64.7%)	2 (11.8%)	17
	OME/Grommet Group	0 (0%)	2 (16.7%)	6 (50.0%)	4 (33.3%)	0 (0%)	12
	OME/Non-Grommet Group	0 (0%)	0 (0%)	11 (64.7%)	5 (29.4%)	1 (5.9%)	17
	Total	0	2	21	20	3	46
Boys	Non-OME/Non-Grommet Group	1 (9.1%)	1 (9.1%)	4 (36.4%)	4 (36.4%)	1 (9.1%)	11
	OME/Grommet Group	0 (0%)	0 (0%)	4 (80.0%)	0 (0%)	1 (20.0%)	5
	OME/Non-Grommet Group	1 (6.7%)	3 (20.0%)	7 (46.7%)	4 (26.7%)	0 (0%)	15
	Total	2	4	15	8	2	31
Behaviour in Class							
Girls	Non-OME/Non-Grommet Group	0 (0%)	0 (0%)	4 (23.5%)	10 (58.8%)	3 (17.6%)	17
	OME/Grommet Group	0 (0%)	1 (8.3%)	8 (66.7%)	2 (16.7%)	1 (8.3%)	12
	OME/Non-Grommet Group	0 (0%)	1 (5.9%)	7 (41.2%)	6 (35.3%)	3 (17.6%)	17
	Total	0	2	19	18	7	46
Boys	Non-OME/Non-Grommet Group	0 (0%)	0 (0%)	2 (18.2%)	5 (45.5%)	4 (36.4%)	11
	OME/Grommet Group	0 (0%)	2 (40.0%)	2 (40.0%)	1 (20.0%)	0 (0%)	5
	OME/Non-Grommet Group	0 (0%)	2 (13.3%)	5 (33.3%)	6 (40.0%)	2 (13.3%)	15
	Total	0	4	9	12	6	31
Social Skills							
Girls	Non-OME/Non-Grommet Group	0 (0%)	0 (0%)	3 (17.6%)	10 (58.8%)	4 (23.5%)	17
	OME/Grommet Group	0 (0%)	0 (0%)	6 (50.0%)	5 (41.7%)	1 (8.3%)	12
	OME/Non-Grommet Group	0 (0%)	0 (0%)	5 (29.4%)	4 (23.5%)	8 (47.1%)	17
	Total	0	0	14	19	13	46
Boys	Non-OME/Non-Grommet Group	0 (0%)	0 (0%)	1 (9.1%)	8 (72.7%)	2 (18.2%)	11
	OME/Grommet Group	0 (0%)	0 (0%)	1 (20.0%)	3 (60.0%)	1 (20.0%)	5
	OME/Non-Grommet Group	0 (0%)	0 (0%)	4 (26.7%)	9 (60.0%)	2 (13.3%)	15
	Total	0	0	6	20	5	31

For the question relating to behaviour in class, there is a similar pattern of self-rating for girls and boys in each group. Students in the Non-OME/Non-Grommet Group consistently rated themselves more highly than did students in the other two groups, with both boys and girls rating themselves in the *above average* and *well above average* ranges approximately 80% of the time. They showed confidence in their ratings for behaviour in class. The similarity between groups continues with girls and boys in the OME/Grommet Group self-rating approximately 75% of the time in the *below average* and *average* ranges and approximately 50% of girls and boys in the OME/Non-Grommet Group self-rating in these ranges.

Boys in each otitis media group were slightly more confident than girls in a similar otitis media group for the question related to social skills. Boys in the Non-OME/Non-Grommet Group showed the most confidence for this question. Girls in the OME/Grommet Group reported approximately 50% of the time in the *average* range, indicating that they had the least self-confidence in their social skills of students across all the otitis media groups.

There are a number of outcomes associated with these results. Firstly, the girls generally have higher ratings across all of the questions than the boys; that is, the girls are seen to do their homework better, to be better behaved and to have better social skills than the boys. Secondly, the girls in the OME/Grommet Group are less confident of their social skills than the rest of the students. Thirdly, the boys in the OME/Grommet Group appear to have more behaviour problems than the remainder of the students.

Discussion

The boys in both the otitis media groups considered themselves poorer at behaviour in class and doing their homework than the other students. As they also received more detentions and registers than other students, these perceptions have a realistic basis (Stenton, 2003).

The girls who had grommets showed little confidence in any of their behavioural or social skills. Although it is considered normal for girls to have lower perceptions of their own abilities than those of boys (Woolfolk, 2001), it is interesting that these girls had even less confidence than the girls in the other two groups. It is possible that experience with early middle ear problems may be different for boys and girls and perhaps they react differently to not being able to hear clearly and consistently the signal in their environment. Early illness and grommet insertion may have limited social activities for the girls and boys in previous years – for example, not being able to participate in swimming, a major Australian pastime. The girls may become unsure of themselves, exhibiting a lack of confidence, while the boys may develop inappropriate behaviours and experience more behaviour problems.

From a listening aural interpretation, the gender differences might be related to differing developmental expectations where girls and boys received different responses from adults when they cannot hear clearly and consistently. For example, parents may expect boys to ignore instructions at times, whereas girls are expected to be more obedient. As a result the girls who find it difficult to do as they are told owing to inconsistent hearing may be given negative feedback about it more often

than boys. This would lead the girls to believe that they were not as good as they should be and the result would be a lack of confidence in the teenage student.

Given the positive influence of supportive home and school environments, it would appear that a multifactorial/cumulative risk approach to the issues surrounding otitis media with effusion is appropriate and practical. Known risk factors for behavioural problems include poor quality childcare, low socioeconomic status, gender and low parental educational levels (Vernon-Feagans *et al.*, 2002). Fluctuating, conductive hearing loss resulting from this disease may well prove to be 'the straw that breaks the camel's back' for children from less than supportive environments who also have a number of negative risk factors for the development of behavioural problems in their lives.

Implications for Pedagogies and Learning

The increasing prevalence of the disease and the problems associated with consistently identifying and diagnosing it suggest that there will be children, especially in the early years of childcare and schooling, who frequently experience the disease and its sequelae without being identified in educational settings. In fact, it would be realistic for childcare workers and educators to assume that they have such children in their classes and to adjust their pedagogical practices accordingly. Roberts *et al.* (1998) found a strong correlation between the quality of home and childcare environments and experience with otitis media with effusion. This suggests that those involved in the childcare industry and the education of young children need the knowledge and skills to use appropriate pedagogy and learning methods if they are to work effectively with these children. The ongoing education of carers and teachers of young children and of preschool and primary school students is necessary so they can identify at risk children, identify environments that are inappropriate because they are too noisy and know how to implement appropriate teaching and learning strategies for children who experience fluctuating, conductive hearing loss. Carers and teachers should be able to understand the educational issues associated with mild hearing loss and the possible implications that it has for children's behaviour, including social development.

Frequently the acoustic and reverberation levels of the teaching and learning environments of students with fluctuating conductive hearing loss are not identified. Allied with this is the need to identify early childhood environments, including childcare centres and classrooms, where the noise levels are too high for the optimal academic and social development of children who have hearing loss related to otitis media with effusion. For example, the acoustic environment of the educational setting becomes increasingly important when it is recognised that a number of children in early childhood classes experience a fluctuating, conductive hearing loss. The built environment needs to contribute to their opportunities to learn rather than being a hindrance because of poor acoustics and high reverberation levels. Recommended acoustic levels for school classrooms set by the Australian/New Zealand Standard, 2017:2000 are 35dB (A) as satisfactory and a maximum of 45 dB (A) (Standards Australia, 2000). Recommended reverberation times are 0.4 to 0.5 seconds (Standards Australia, 2000). It is likely that students with a conductive hearing loss require higher standards than those set in order to access the curriculum. It is clear that inappropriate noise and reverberation levels in classrooms will have an impact on attention skills,

the ability to discriminate speech and language signals and therefore learning, behaviour and social skills.

As this study highlights, it is possible that there are some secondary school students whose behaviour outcomes may have been affected by their earlier middle ear history. In order to respond appropriately to these outcomes, secondary school teachers may need to adapt their teaching and behaviour management strategies in order to become effective teachers of these students. All these issues implicate current pedagogy and learning methodology and the education of new teachers.

Conclusion

As this study has shown, students with a history of otitis media with effusion are at risk of developing poor behaviour and lack of confidence in their social skills. The implications for pedagogy and learning outcomes are that teachers and pre-service teachers need to become more aware of this condition and its sequelae and learn how to accommodate these students' needs. Also the acoustics of classroom spaces need to be examined regarding noise and reverberation times and adjustments made where required so children have the optimum opportunities to reach their potential.

An area for future research in the field is the examination of possible differences in the effects on girls and boys of grommet insertion – in particular on their behaviour and social skills. Another area to investigate is the amount of school time missed owing to illness. An educational perspective in future research could encourage the investigation of appropriate teaching and learning environments for students with conductive hearing loss as well as identifying appropriate resources for this process. Associated with this is the need to research teacher education programs regarding their effectiveness in ensuring that future teachers are equipped to teach students with conductive hearing loss or who are experiencing any effects of otitis media with effusion.

References

- Bench, J., & Harrold, E. (1995). *How does otitis media lead to the development of the deemed behavioural sequelae?* Paper presented at the 2nd national conference on childhood fluctuating conductive deafness/otitis media, Ormond College, Parkville, Vic.
- Bennett, K. E., Haggard, M. P., Silva, P. A., & Stewart, I. A. (2001). Behaviour and developmental effects of otitis media with effusion into teens. *Archives of Disease in Childhood*, 85(2), 91-95.
- Berg, F. S. (1993). *Acoustics and sound systems in schools*. San Diego, CA: Singular Publishing Group.
- Casby, M. W. (2001). Otitis media and language development: A meta-analysis. *Journal of Speech-Language Pathology*, 10, 65-80.
- Daly, K. A., Casselbrant, M. L., Hoffman, H. J., Ingvarsson, L. B., Kvaerner, K. J., Tos, M., *et al.* (2002). Epidemiology, natural history, and risk factors: Panel reports. *The Annals of Otolaryngology, Rhinology & Laryngology*, 111(Suppl.)(3), 19-25.

- Dermody, P. (1992). *Assessment of the effects of middle ear problems on receptive language abilities in young children*. Paper presented at the 1st national conference on childhood fluctuating conductive deafness/otitis media, Melbourne, Vic.
- Feagans, L. V. (1986). Otitis media: A model for long term effects with implications for intervention. In J. F. Kavanagh (Ed.), *Otitis media and child development* (pp. 192-208). Parkton, MD: York Press.
- Howard, D. (1995, September 28-30). *Otitis media and the construction of school behaviour problems*. Paper presented at the 2nd national conference on childhood fluctuating, conductive deafness/otitis media, Parkville, Vic.
- Kaderavek, J. N., & Pakulski, L. A. (2002). Minimal hearing loss is not minimal. *Teaching Exceptional Children, 34*(6), 14-18.
- Moore, D. C., & Best, G. F. (1988). Fluctuating conductive hearing loss in young children: Incidence and effects. Report on a study of 1 111 pre-school and young school age children from Melbourne, Victoria. Melbourne: Funded by the Deafness Foundation of Victoria, and carried out under the auspices of Monash University, Clayton.
- Morris, P. S., Leach, A. J., Halpin, S., Mellon, G., Gadil, G., Wigger, C., *et al.* (2007). An overview of acute otitis media in Australian Aboriginal children living in remote communities. *Vaccine, 25*(13), 2389-2393.
- Murphy, E., & Blogg, S. (1995). *Guidelines on the management of pediatric middle ear disease – development, implementation and evaluation*. Paper presented at the 2nd national conference on childhood fluctuating conductive deafness/otitis media, Parkville, Vic.
- Paradise, J. L., Feldman, H. M., Campbell, T. F., Dollaghan, C. A., Rockette, H. E., Pitcairn, D. L., *et al.* (2007). Tympanostomy tubes and developmental outcomes at 9 to 11 years of age. *New England Journal of Medicine, 356*(3), 248-261.
- Roberts, J. E., Burchinal, M. R., Zeisel, S. A., Neebe, E. C., Hooper, S. R., Roush, J., *et al.* (1998). Otitis media, the caregiving environment, language and cognitive outcomes at 2 years. *Pediatrics, 102*(2), 346-354.
- Standards Australia. (2000). Acoustics – recommended design sound levels and reverberation times for building interiors. Australian/New Zealand Standard 2107:2000. Sydney, NSW: Author.
- Stenton, J. S. (2003). *The long term effects of the fluctuating, conductive hearing loss caused by otitis media with effusion on learning and behaviour for adolescent students*. Unpublished Doctor of Philosophy thesis, Griffith University, Brisbane, Qld.
- Vernon-Feagans, L. (1999). Impact of otitis media on speech, language, cognition and behavior. In R. M. Rosenfeld & C. D. Bluestone (Eds.), *Evidence-based otitis media* (pp. 353-373). Hamilton, Ontario: B. C. Decker.
- Vernon-Feagans, L., Hurley, M., & Yont, K. (2002). The effect of otitis media and daycare quality on mother/child bookreading and language use at 48 months of age. *Journal of Applied Developmental Psychology, 23*(2), 113-133.
- Woolfolk, A. (2001). *Educational psychology*. Needham Heights, MA: Allyn and Bacon.