MJA
The Medical Journal of Australia

Appendix

This appendix was part of the submitted manuscript and has been peer reviewed. It is posted as supplied by the authors.

Appendix to: Gunasekera H, Miller HM, Burgess L, et al. Agreement between diagnoses of otitis media by audiologists and otolaryngologists in Aboriginal Australian children. *Med J Aust* 2018; 209: 29-35. doi: 10.5694/mja18.00249.

Supplementary Material

Table 1. Conversion of original diagnoses to 3-category diagnoses

Diagnosis at the ear-level		Diagnosis at the child-level	
Diagnosis recorded on assessment form	Diagnosis for analysis	Diagnosis recorded on assessment form	Diagnosis for analysis
One of the following: Acute OM with perforation (Otolaryngologist:0, Audiologist:6) Dry perforation (Otolaryngologist:9, Audiologist:10) Chronic suppurative OM (Otolaryngologist:3, Audiologist:7)	*Re-categorised into:* OM with perforation (Otolaryngologist:12, Audiologist:23)	*One of the following in either ear:* Acute OM with perforation Dry perforation Chronic suppurative OM	*Re-categorised into:* OM with perforation (in one or both ears) (Otolaryngologist:11, Audiologist:19)
One of the following: Acute OM without perforation (Otolaryngologist:21, Audiologist:125) Recurrent acute OM (Otolaryngologist:0, Audiologist:7) OM with effusion (Otolaryngologist:353, Audiologist:121) Chronic OM with effusion (Otolaryngologist:10, Audiologist:35)	*Re-categorised into:* OM without perforation (Otolaryngologist:384, Audiologist:371)	*One of the following (in either ear):* Acute OM without perforation Recurrent acute OM OM with effusion Chronic OM with effusion OM (undifferentiated) *but not one of the following in*	*Re-categorised into:* OM without perforation (in either ear) (Otolaryngologist:240, Audiologist:245)

OM (undifferentiated) (Otolaryngologist:0, Audiologist:83)		*either ear:* Acute OM with perforation Dry perforation Chronic suppurative OM	
Normal (Otolaryngologist:1379, Aud:1381)	Normal ear (Otolaryngologist:1379, Aud:1381)	Normal for left and right ears	Normal in both ears (Otolaryngologist:600, Audiologist:599)

Table 2. Comparison of children with audiology assessments who did and didn't receive an otolaryngologist review

	Total n/N (%)	Otolaryngologist Review done n/N (%)	Otolaryngologist Review not done n/N (%)	p-value
Diagnosis by audiologist (child-level)				
OM with perforation in either ear	25/1224 (2.0)	25/1061 (2.4)	0/163 (0)	0.870[1]
OM without perforation in either ear	380/1224 (31.0)	324/1061 (30.5)	56/163 (34.4)	
Normal in both ears	819/1224 (66.9)	712/1061 (67.1)	107/163 (65.6)	
Diagnosis by audiologist (ear-level)				
OM with perforation	33/2477 (1.3)	33/2149 (1.5)	0/328 (0)	0.358[1]
OM without perforation	594/2477 (24.0)	503/2149 (23.4)	91/328 (27.7)	
Normal	1850/2477 (74.7)	1613/2149 (75.1)	237/328 (72.3)	

[1]Wilcoxon rank sum test

Table 3. Agreement at ear-level across audiologist and otolaryngologist pairs

	Otolaryngologist diagnosis							
Audiologist diagnosis	OM with perforation[1]	OM without perforation[2]	Normal[3]	Total (%)	p-value[4]	Agreement	Kappa[5] (95% CI)	Adjusted kappa[6] (95% CI)
Audiologist 1 & Otolaryngologist 1								
OM with perforation	1	0	0	1 (0.4%)				
OM without perforation	0	41	0	41 (16.5%)				
Normal	0	11	195	206 (83.1%)				
Total (%)	1 (0.4%)	52 (21.0%)	195 (78.6%)	248 (100.0%)	0.004	95.6%	0.86 (0.75 to 0.97)	0.97 (0.94 to 0.99)
Audiologist 3 & Otolaryngologist 1								
OM with perforation	0	1	0	1 (2.6%)				
OM without perforation	0	14	0	14 (36.8%)				
Normal	0	0	23	23 (60.5%)				
Total (%)	0 (0.0%)	15 (39.5%)	23 (60.5%)	38 (100.0%)	0.607	97.4%	0.95 (0.85 to 1.00)	0.98 (0.94 to 1.00)
Audiologist 3 &								

Otolaryngologist 2								
OM with perforation	0	0	0	0 (0.0%)				
OM without perforation	0	17	4	21 (24.4%)				
Normal	0	1	64	65 (75.6%)				
Total (%)	0 (0.0%)	18 (20.9%)	68 (79.1%)	86 (100.0%)	0.180	94.2%	0.83 (0.69 to 0.98)	0.96 (0.92 to 0.99)
Audiologist 3 & Otolaryngologist 3								
OM with perforation	0	1	0	1 (0.6%)				
OM without perforation	0	28	14	42 (26.1%)				
Normal	0	3	115	118 (73.3%)				
Total (%)	0 (0.0%)	32 (19.9%)	129 (80.1%)	161 (100.0%)	0.017	88.8%	0.69 (0.54 to 0.85)	0.92 (0.87 to 0.96)
Audiologist 4 & Otolaryngologist 1								
OM with perforation	1	1	0	2 (1.7%)				
OM without perforation	0	16	0	16 (13.9%)				
Normal	0	1	96	97 (84.3%)				

Total (%)	1 (0.9%)	18 (15.7%)	96 (83.5%)	115 (100.0%)	0.368	98.3%	0.94 (0.87 to 1.00)	0.99 (0.97 to 1.00)
Audiologist 4 & Otolaryngologist 2								
OM with perforation	8	4	2	14 (2.4%)				
OM without perforation	0	124	32	156 (26.4%)				
Normal	0	25	396	421 (71.2%)				
Total (%)	8 (1.4%)	153 (25.9%)	430 (72.8%)	591 (100.0%)	0.033	89.3%	0.75 (0.68 to 0.82)	0.92 (0.89 to 0.94)
Audiologist 4 & Otolaryngologist 3								
OM with perforation	2	2	0	4 (1.1%)				
OM without perforation	0	39	6	45 (12.9%)				
Normal	0	13	286	299 (85.9%)				
Total (%)	2 (0.6%)	54 (15.5%)	292 (83.9%)	348 (100.0%)	0.101	94.0%	0.78 (0.67 to 0.89)	0.95 (0.93 to 0.98)
Audiologist 5 & Otolaryngologist 3								
OM with perforation	0	0	0	0 (0%)				
OM without	0	24	4	28 (19.4%)				

perforation								
Normal	0	8	108	116 (80.6%)				
Total (%)	0 (0.0%)	32 (22.2%)	112 (77.8%)	144 (100.0%)	0.248	91.7%	0.75 (0.58 to 0.91)	0.94 (0.90 to 0.98)

[1] OM with perforation in >=1 ear: Acute OM with perforation, Dry perforation or Chronic suppurative OM in one or both ears [2] OM without perforation in either ear: Acute OM without perforation, Recurrent acute OM, OM with effusion, Chronic OM with effusion or OM (undifferentiated) [3] Normal in both ears [4] Stuart-Maxwell test of marginal homogeneity [5] Linearly weighted kappa statistic with bootstrap methods used to estimate standard errors taking into account the ears within children and children within families [6] Prevalence-adjusted bias-adjusted kappa statistic

Table 4. Agreement at child-level across audiologist and otolaryngologist pairs

	Otolaryngologist diagnosis							
Audiologist diagnosis	OM with perforation[1]	OM without perforation[2]	Normal[3]	Total (%)	p-value[4]	Agreement	Kappa[5] (95% CI)	Adjusted kappa[6] (95% CI)
Audiologist 1 & Otolaryngologist 1								
OM with perforation[1]	1	0	0	1 (0.8%)				
OM without perforation[2]	0	28	0	28 (22.8%)				
Normal[3]	0	6	88	94 (76.4%)				
Total (%)	1 (0.8%)	34 (27.6%)	88 (71.5%)	123 (100.0%)	0.050	95.1%	0.88 (0.78 to 0.97)	0.96 (0.93 to 0.99)
Audiologist 3 & Otolaryngologist 2								
OM with perforation	0	0	0	0 (0.0%)				
OM without perforation	0	12	2	14 (35.9%)				
Normal	0	0	25	25 (64.1%)				
Total (%)	0 (0.0%)	12 (30.8%)	27 (69.2%)	39 (100.0%)	0.157	94.9%	0.88 (0.73 to 1.00)	0.96 (0.91 to 1.00)
Audiologist 3 & Otolaryngologist 3								

OM with perforation	0	1	0	1 (1.3%)				
OM without perforation	0	16	10	26 (34.2%)				
Normal	0	0	49	49 (64.5%)				
Total (%)	0 (0.0%)	17 (22.4%)	59 (77.6%)	76 (100.0%)	0.004	85.5%	0.67 (0.49 to 0.84)	0.89 (0.83 to 0.95)
Audiologist 4 & Otolaryngologist 1								
OM with perforation	1	1	0	2 (3.5%)				
OM without perforation	0	11	0	11 (19.3%)				
Normal	0	0	44	44 (77.2%)				
Total (%)	1 (1.8%)	12 (21.1%)	44 (77.2%)	57 (100.0%)	0.607	98.2%	0.96 (0.88 to 1.00)	0.99 (0.96 to 1.00)
Audiologist 4 & Otolaryngologist 2								
OM with perforation	7	3	1	11 (3.7%)				
OM without perforation	0	87	17	104 (35.1%)				
Normal	0	10	171	181 (61.1%)				
Total (%)	7 (2.4%)	100 (33.8%)	189 (63.9%)	296 (100.0%)	0.056	89.5%	0.80 (0.73 to 0.86)	0.92 (0.89 to 0.95)
Audiologist 4 & Otolaryngologist 3								

OM with perforation	2	1	0	3 (1.8%)				
OM without perforation	0	26	4	30 (18.2%)				
Normal	0	5	127	132 (80.0%)				
Total (%)	2 (1.2%)	32 (19.4%)	131 (79.4%)	165 (100.0%)	0.574	93.9%	0.83 (0.72 to 0.93)	0.95 (0.93 to 0.98)
Audiologist 5 & Otolaryngologist 3								
OM with perforation	0	0	0	0 (0.0%)				
OM without perforation	0	13	4	17 (25.4%)				
Normal	0	3	47	50 (74.6%)				
Total (%)	0 (0.0%)	16 (23.9%)	51 (76.1%)	67 (100.0%)	0.705	89.6%	0.72 (0.52 to 0.92)	0.92 (0.87 to 0.98)

[1] OM with perforation in >=1 ear: Acute OM with perforation, Dry perforation or Chronic suppurative OM in one or both ears

[4] Stuart-Maxwell test of marginal homogeneity [2] OM without perforation in either ear: Acute OM without perforation, Recurrent acute OM, OM with effusion, Chronic OM with effusion or OM (undifferentiated) [3] Normal in both ears [5] Linearly weighted kappa statistic with bootstrap methods used to estimate standard errors taking into account the ears within children and children within families [6] Prevalence-adjusted bias-adjusted kappa statistic

Table 5: Otitis media diagnoses stratified by audiologists and otolaryngologists

By ear	**Left**		**Right**		**Total**	
	Aud.	Oto.	Aud.	Oto.	Aud.	Oto.
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
OM with perforation	14 (1.6)	6 (0.7)	9 (1.0)	6 (0.7)	23 (1.3)	12 (0.7)
OM without perforation	180 (20.5)	193 (21.9)	191 (21.3)	191 (21.3)	371 (20.9)	384 (21.6)
Normal	686 (78.0)	681 (77.4)	695 (77.7)	698 (78.0)	1381 (77.8)	1379 (77.7)
Total	880 (100)	880 (100)	895 (100)	895 (100)	1775 (100)	1775 (100)
By child[1]					**Total**	
					Aud.	Oto.
					n (%)	n (%)
OM with perforation					19 (2.2%)	11 (1.3%)
OM without perforation					245 (28.4%)	240 (27.8%)
Normal in both ears					599 (69.4%)	612 (70.9%)
Total					863 (100%)	863 (100%)

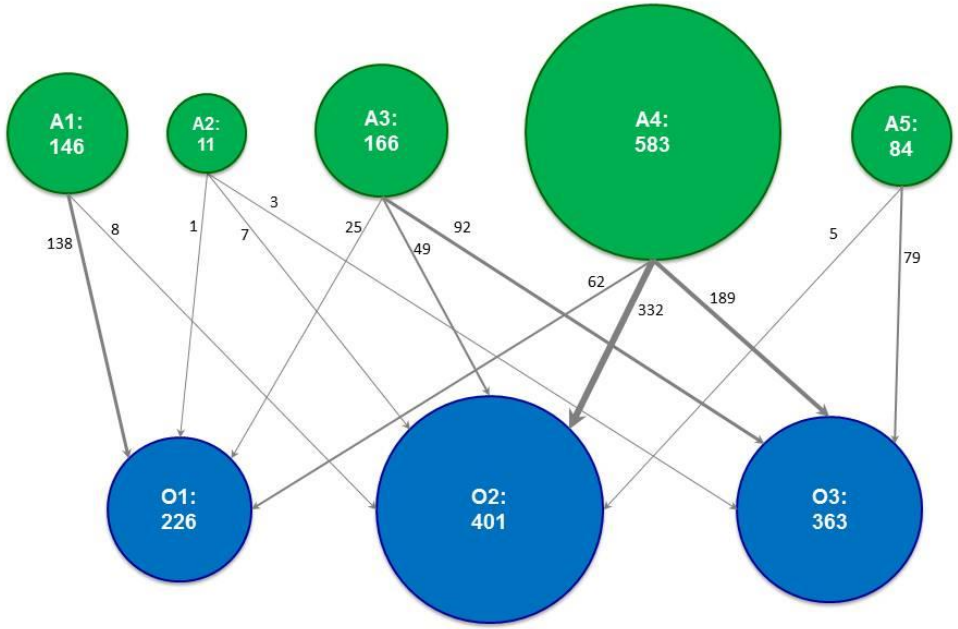
[1]Diagnosis of highest order in any ear, so normal means both ears had no middle ear pathology. Aud; audiologist, Oto; otolaryngologist.

Table 6. Accuracy of diagnoses made by audiologists (using otolaryngologist as reference)

All ears - abnormal[1] vs. normal									
	Otolaryngologist diagnosis			**Prevalence[2]** % (95% CI)	**Sensitivity[2]** % (95% CI)	**Specificity[2]** % (95% CI)	**PPV[2]** % (95% CI)	**NPV[2]** % (95% CI)	**LR+** % (95% CI)	**LR-** % (95% CI)
Audiologist diagnosis	Abnormal[1]	Normal	Total							
Abnormal	330	64	394	22.3 (19.8 to 24.9)	83.3 (78.9 to 87.8)	95.4 (94.1 to 96.6)	83.8 (79.5 to 88.0)	95.2 (93.8 to 96.6)	18.0 (12.6 to 23.3)	0.2 (0.1 to 0.2)
Normal	66	1315	1381							
Total	396	1379	1775							
Child - abnormal[1] in either ear vs. normal in both ears										
	Otolaryngologist diagnosis			**Prevalence[2]** % (95% CI)	**Sensitivity[2]** % (95% CI)	**Specificity[2]** % (95% CI)	**PPV[2]** % (95% CI)	**NPV[2]** % (95% CI)	**LR+** % (95% CI)	**LR-** % (95% CI)
Audiologist diagnosis	Abnormal	Normal	Total							
Abnormal	225	39	264	29.1 (26.1 to 32.1)	89.6 (85.8 to 93.5)	93.6 (91.7 to 95.5)	85.2 (80.9 to 89.5)	95.7 (94.0 to 97.3)	14.1 (9.5 to 18.6)	0.1 (0.1 to 0.2)
Normal	26	573	599							
Total	251	612	863							

[1]Abnormal: Acute OM without perforation, Recurrent acute OM, OM with effusion, Chronic OM with effusion, OM (undifferentiated), Acute OM with perforation, Dry perforation, or Chronic suppurative OM. [2]Bootstrap methods were used to estimate standard errors taking into account ears within children and children within families. PPV = positive predictive value, NPV = negative predictive value, LR+ = positive likelihood ratio, LR- = negative likelihood ratio.

Figure 1. The number of assessments/reviews conducted by each audiologist (A1 to A5) and each otolaryngologist (O1 to O3), and the numbers completed by each audiologist/otolaryngologist pair.



A1 completed 146 (15%), A2 completed 11 (1%), A3 completed 166 (17%), A4 completed 583 (59%), & A5 completed 84 (8%) of the assessments. O1 reviewed 226 (23%), O2 reviewed 401 (41%), & O3 reviewed 363 (37%) of audiology assessments. The size of the circles and lines reflect numbers of assessments, but are not to scale.