# Appendix A

**Auditory processing tests**

The AP-tests in IMAP provide measures of spectral and temporal resolution, and frequency discrimination. These features are thought to be associated with language and literacy skills[3, 7]. The tests, and have been chosen on the basis of good test-retest reliability and a wide distribution of thresholds amongst children. Moreover, resolution tests provide a means for separating out sensory from non-sensory components, by subtracting the tone threshold from the two test conditions[5].

*Temporal resolution* is measured using a backward masking task, which involves identifying a target tone preceding a bandpass noise. There are two conditions, one with no gap between the stimulus and noise (BM0), and the second with a 50 ms gap (BM50), as shown in Figure 2. Subtraction of thresholds obtained with the two conditions (i.e., BM0 – BM50) provides a measure of temporal resolution.
*Spectral resolution* is measured using a simultaneous masking task, whereby the tone is presented within a bandpass noise. There are two masker conditions, one with a spectral notch (SMN), and the other, without (SM). Spectral resolution (also called 'frequency selectivity') is derived from the thresholds obtained from the two tasks (SM – SMN).
*Frequency discrimination* is measured by detecting the smallest, just detectable difference between the two tones which differ in frequency.
*Speech-in-noise* involved presentation of a simple vowel-consonant-vowel (VCV) syllables (e.g., 'a-G-a') presented in a three band, single male weighted noise speech modulated noise (ICRA-5) which varies in intensity relative to the VCV. The listener is required to repeat the syllable and obtains a score based on number of syllable correctly repeated.

**Attention test (IHR Cued Attention Task, IHR-CAT)**

This test was developed at the MRC IHR and measures phasic alertness based on the difference in reaction times (RT) in response to a target in a cued and a non-cued condition i.e., $RT_{non\text{-}cued} - RT_{cued}$. The task is performed within both auditory and visual domains. Smaller cueing effects indicate higher alertness, and thus, better attention. Unlike all the other tests within the IMAP battery whose orders are pseudo-randomized, this test is always situated two-thirds along the test sequence to avoid order effects.

**Cognitive tests**

These are all standardized psychometric tasks[8]. The digit span forwards and backwards tasks[9] assess short-term and working memory respectively. The nonword repetition task, from the NEPSY test battery[10], is a test of verbal short-term memory. It provides an indirect measure of language abilities[11,12]. Both tests are presented via the IHR-STAR software platform, and are incorporated into the IMAP battery, with stimuli presented via headphones at 70 dBA. Nonverbal reasoning skills (NVIQ) is assessed using the Matrices task from the WASI test battery[13], and reading is assessed using the Test of Word Reading Efficiency (TOWRE)[14]. Both these tests sit outside the IHR-STAR platform. IHR-STAR presents a screen to indicate to the tester when these tasks should be performed with the child.

**Supplementary tests / questionnaires**

Pure-tone audiometry is used to assess hearing sensitivity and establish normal hearing. Parental report of the child's language skills (Children's communication Checklist-2; CCC-2)[15] and every day processing of auditory stimuli (Children's auditory processing performance scale; CHAPPS)[16] are assessed using currently available questionnaires.