

# THE RED FLAG MATRIX

Using the  
QuickSIN and  
the ANL Tests

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A matrix is a simple tool, commonly used by managers to analyze their business. Typically, a matrix consists of two dimensions and four quadrants. One dimension is mapped on the horizontal axis and the second dimension is mapped on the vertical axis. A matrix is an effective way to isolate a problem or prioritize resources. By charting information along two dimensions, powerful insights about business challenges can be uncovered.

A common term used by medical professionals is “red flag.” Although the term sounds pretty ominous, it’s a descriptive way to warn people about something. The term “red flag” is actually quite common in many professions, including meteorology, telecommunications, and the military. Since it’s such a descriptive term, we thought the term “red flag” can be applied to the hearing aid selection process as a way to provide both patients and audiologists with some advanced warning of a challenging situation involving the selection and use of hearing aids. By plotting the scores of two speech-in-noise tests on a matrix, important “real world” information about a patient’s communication ability can be quickly obtained and used in the hearing aid decision making process.

## WHY USE SPEECH-IN-NOISE TESTS

Difficulty in background noise is the primary complaint of many hearing impaired patients and hearing aid users. Among the difficulties these patients experience are poor speech intelligibility in noise and annoyance from sound. Over the past several decades audiologists have relied on the standard battery of pre-fitting tests (i.e., word recognition in quiet and the pure tone audiogram) to make a determination about hearing aid candidacy and to help establish expectations with amplification. Although the standard pre-fitting battery of audiological tests are useful for quantifying the degree and type of hearing loss, their relatively poor face validity suggests these tests have substantial limitations in the counseling process. Specifically, the results of both pure tone and speech in quiet audiometry have been shown to have a weak relationship at best to real world hearing aid outcome. (See Taylor, 2007 for a literature review).

According to Margolis (2004) up to 80% of the information a clinician shares with a patient is forgotten immediately. An important ingredient of effective communication is the clinician’s ability to convey technical information in a clear and concise manner. By combining two test scores as a single

point on a matrix, clinicians have the ability to communicate test results more effectively, which may lead to improved patient retention of the test results and clinical recommendations.

An inability on the part of the audiologist to measure these “real world” problems with the traditional battery of pre-fitting tests, combined with poor patient retention of these results may contribute to non-use, returns for credit and lower than expected real world hearing aid benefit.

The purpose of this article is show how a four quadrant matrix can be used to plot the results of two commercially available tests, the Quick Speech in Noise (QuickSIN) and Acceptable Noise Level (ANL) tests. Our working hypothesis is that measuring speech intelligibility in noise with the QuickSIN and annoyance from sound with the ANL during the pre-fitting appointment, before patients begin using amplification, helps establish precise realistic expectations with each patient prior to their initial trial with hearing aids. Taken a step further, providing the patient with insight on their ability to understand speech in noisy listening conditions and annoyance from various environmental sounds, may actually contribute to a more successful hearing aid outcome. This concept is similar to how a surgeon would discuss a prognosis with a patient using pre-operation test results. Audiologists could use the results of the QuickSIN and ANL plotted as a single point of the Red Flag matrix to set the stage for those patients “at-risk” for non-use and poor benefit in noise.

## THE QUICKSIN AND ACCEPTABLE NOISE LEVEL TESTS

Although various speech-in-noise tests have been commercially available for several years, survey data indicates they are seldom used by clinicians. Several reports have suggested that incorporating speech-in-noise tests into a routine battery of pre-fitting tests has both clinical value. Wilson and McArdle (2005) and Wilson (2004) have reported that speech in noise scores cannot be predicted from speech in quiet scores for many patients; and concluded that speech in noise testing should be part of a clinician’s routine battery of audiological tests. Wilson and McArdle’s thread of research in this area would suggest that the scores on speech-in-noise tests provide valuable insight into speech understanding ability in everyday listening situations.

In addition to speech-in-noise tests being used to objectively measure speech understanding ability, these tests can also be employed to measure other facets of communication, such as annoyance

from noise and subjective ability to understand speech. The Acceptable Noise Level test has been studied extensively. (See Freyaldenhoven et al 2007 for a review). Nabelek et al (2006) have reported that annoyance is a predictor of hearing aid non-use.

Expert opinion suggests the routine use of speech-in-noise tests. The Hearing Instrument Associations Top 10 Reasons for Hearing Aid Delight study (Rogin, 2009) reveals a relationship between computer-based testing and patient satisfaction. In addition, Sweetow et al (2010) has proposed the use of a “functional communication assessment”, in which two objective and two subjective measures of the residual auditory system are used. For these reasons, routine testing of speech intelligibility in noise and annoyance from sound would be warranted prior to prescribing amplification.

## THE RED FLAG MATRIX

An earlier publication (Taylor and Bernstein, 2011) reviewed results of 47 patients on the QuickSIN and ANL tests, collected during the pre-fitting evaluation. Using the published normative results of QuickSIN and ANL tests in the unaided condition, the Red Flag Matrix was developed in order to more precisely identify patients who might be “at-risk” for struggling with speech intelligibility in noise or annoyance from sound prior to receiving hearing aids. The point of intersection of the four quadrants is 7 dB. (See Figure 1) This intersection point is based on QuickSIN and ANL research. According to Killion & Niquette (2000) QuickSIN scores 7 dB or less indicate a near-normal or mild SNR loss and well fitted directional microphones is thought to bring their aided speech intelligibility scores back to into the normal or near-normal range. ANL scores 7 dB or less is considered a predictor for full time hearing aid use Nabelak et al (2006).

After the results of the two tests are obtained, the clinician can plot a single dot on the matrix, which represents the QuickSIN and ANL score as a single point. The lower left hand column of Figure 1 (Q1) is labeled the “in the clear” zone because both the unaided Quick SIN and ANL scores are in the “near normal” or mild SNR loss range. When results fall into this quadrant patient would expect minimal problems with intelligibility and annoyance in background noise when amplification is used.

The upper left hand quadrant of Figure 1 (Q2) are patients with “near normal” or mild SNR loss QuickSIN scores and an elevated ANL score (<7 dB ANL). Hearing aid users falling into this quadrant are “at-risk” for experiencing difficulties with annoyance from sounds, which correlates with non-use.

Although research indicates that a score of greater than 13 dB on the ANL equates with non-use of hearing aids, we decided to use 7 dB as the cut off, as score below 7 dB on the ANL correlate with full time hearing aid use.

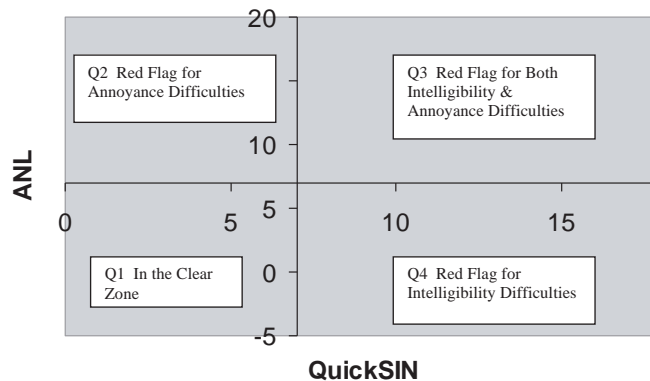


Figure 1. The Four Quadrants of the Red Flag Matrix

The upper right corner (Q3) of the Red Flag Matrix denotes patients with significant SNR loss on the QuickSIN (>7 dB) and a significant ANL scores (>7 dB). Based on some published research hearing aid users falling into Q3 might be “at-risk” for difficulties with annoyance and speech intelligibility in noise. Finally, the lower right hand corner (Q4) are patients with no measurable annoyance problems, but a significant SNR loss. Q4 patients would be “at-risk” for having difficulties with speech intelligibility in noise, but no indication of a problem with sound annoyance.

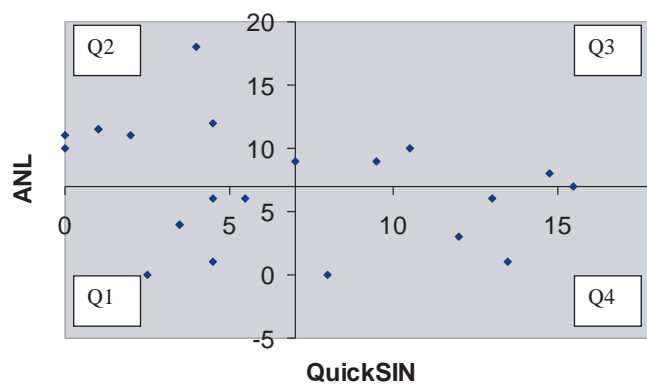


Figure 2. Current Hearing Aid Users

Figure 2 shows the results for 22 current hearing aid users on the Red Flag Matrix. Although hearing aid benefit and satisfaction was not measured, considering all 22 patients are full time hearing aid users, we can presume some level of satisfaction and/or benefit is being achieved. Results plotted on the

red flag matrix for each of the 22 hearing aid users would suggest that a poor score (red flag) on either test is not necessarily equated with poor outcomes.

## POTENTIAL USES OF RED FLAG MATRIX

The purpose of this study was to evaluate the feasibility of conducting the QuickSIN and ANL during the pre-fitting appointment and plotting the results as a single point on a four quadrant matrix. Based on our preliminary experience with the Red Flag Matrix it is a tool that provides specific insights into common communication problems not readily quantified by the traditional battery of pre-fitting tests. Additionally, the two tests take less than 10 minutes of clinical time to conduct. We believe it has the potential to be an essential tool for dispensing audiologists.

Plotting the scores from the QuickSIN and ANL as a single point on a matrix can lead to more precise patient counseling. By plotting the score as a single point and placing that single point in one of four points on the matrix, patients have an easy-to-understand visual of their results in relation to other patients.

Using this approach, patients can be informed of being “at-risk” for non-use or less than expected benefit in noise with amplification *prior* to using hearing aids. Because the results of the individual patient can be compared to the normative data collected on the QuickSIN and ANL tests, patients are informed of their results using an evidence-based approach. If a red flag is present for problems with sound annoyance or speech intelligibility in noise, implications can be discussed in a straightforward manner with patients.

More precise or systematic decisions about hearing aid technology and special features can be made during the selection process. In theory, patients who fall into Q4 are challenged by both annoyance and intelligibility issues. Currently, to our knowledge there are no hearing aids with automatic switching algorithms, which have the ability to simultaneously optimize performance for both comfort and clarity. Therefore, patients who fall into Q4 might be strongly advised to use manual or remote control of their instruments. Patients with scores in Q4 would be encouraged to utilize manual control allowing for manipulation of multiple features that optimize for both comfort and clarity in background noise.

*Note: The Quick SIN can be obtained from Etymotic Research, Elk Grove Village, IL ([www.etymotic.com](http://www.etymotic.com)) and the ANL test can be obtained from Frye Electronics, Tigard, OR ([www.frye.com](http://www.frye.com)).*

## HOW TO USE SPEECH IN NOISE TESTING IN YOUR CLINIC

### *An interview with Clinical Audiologist Dr. Jill Bernstein*

***Why is it important to routinely conduct speech in noise testing?***

**Dr. Bernstein:** The primary complaint for many patients, especially younger ones in their 40's, 50's, and 60's, is difficulty hearing in background noise and not one-on-one communication situations. It comes as no surprise that their pure tone audiogram often shows a mild high frequency hearing loss and word recognition in quiet is in the normal range. This kind of testing doesn't have a lot of face validity to the patient because we aren't actually testing them under the conditions that they are complaining about. In our practice we test both a patient's performance in and annoyance of background noise using the QuickSIN test and Acceptable Noise Level test, respectively. We have found that these tests provide different kinds of insight into how the patient is affected by noise, which helps us in the counseling process and in recommending the right hearing aid technology.

My own personal experience has shown that you can't predict how much noise someone will tolerate based on just traditional audiometric test results. There are patients who tolerate high levels of noise even though their performance is poor and vice versa. Understanding all these pieces of the puzzle are essential is developing an aural rehabilitation package for the patient.

***How do the test results help you make better clinical decisions?***

**Dr. Bernstein:** We don't follow a “one size fits all” approach in our practice and so we use the individual patient history, audiogram, speech-in-noise test results, and COSI to help formulate a plan to help them achieve their hearing goals. Based on their lifestyle and test results, we can determine if basic or more advanced technology is most appropriate to meet the patient's listening needs. If they are in very diverse and challenging noisy environments, we can also use the speech-in-noise test results to counsel the patient about realistic expectations and compensatory strategies. In general, having speech-in-noise test results helps us counsel the patient more effectively because we have objective test results that speak directly to their complaint of difficulty hearing in noise.

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The Loyalty Loop

Figure 1

many alternatives prior to making a purchase. And, once they do make a purchase, customers often enter into an extended open-ended phase with a business. The Loyalty Loop is shown above in Figure 1.

According to Edelman, businesses often overemphasize the “consider” and “buy” stages, allocating more resources than necessary to build awareness and encourage purchase. With the advent of Facebook, Web 2.0 and other new media, the “evaluate” and “advocate” stages become more relevant. Marketing investments that help consumers navigate the evaluation process and spread positive word-of-mouth about your practice can be as important to the productivity of a business as building awareness and driving purchases. The end result, of course, is to create an emotional bond with your patient. Using the Loyalty Loop as a roadmap ensures you are accounting for all the stages of the patient’s interaction with your practice. Your website, Facebook page, clinical protocol and office management system are simply tools designed to assist you in creating that engaging patient experience. It all begins and ends with the timeless art of connecting with people – the natural “sweet spot” for many audiologists. ■

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news breaks. These member alerts will keep you up to date on legal, event and advocacy issues.

#### 5. Off the Shelf, Customizable Marketing Materials for Your Practice

ADA’s *Hear for You* program is designed to help you market at a grass roots level, where it matters most. *Hear for You* materials include Power Point slide templates, press release templates, a brochure template and an F.A.Q. sheet along with recommended ideas for community outreach activities. *Hear for You* is ideal for communicating with multiple audiences including physicians and prospective patients. ■

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##### *How has the use of these tests made a difference in your practice?*

**Dr. Bernstein:** We recently added the Acceptable Noise Level test to our audiometric test battery and realized immediate benefits from both business and patient care standpoints. The first patient that we performed the test on was a working physician who was an experienced hearing aid user and established patient in our practice. He commented after the evaluation that it was the most thorough evaluation they have ever had. The next day we had a call from another physician that this patient referred to us after their positive experience. I’m happy to say that both of the patients are extremely satisfied with their new hearing aids. We have also seen a greater acceptance by patients to try more advanced hearing aids after we help them understand how their test results reflect their everyday listening needs and how the right technology can really help them improve their hearing. I truly believe that they enter their hearing aid trial period more knowledgeable about their hearing loss, how noise impacts them, and how their hearing aids can and cannot help them. Being educated about their hearing health helps them have a greater sense of control over how they are addressing their hearing loss and this increased empowerment translates to higher overall satisfaction. ■

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