



The Color Vision Testing Suite

Clinical Studies and Validation  
of Waggoner HRR

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## Clinical Research & Studies: Waggoner HRR

### Waggoner HRR Description

The purpose of the Waggoner HRR is to determine if an individual has a color vision deficiency; if color vision deficient, the test determines the type and degree of the deficiency. The Waggoner HRR can be used on both adults and children, literate or illiterate, since it uses symbols to identify the deficiencies. Due to using symbols, this test can be used to test individuals who speak any language. The Waggoner HRR is a step above the PIP24 in identifying the type and severity of a color vision deficiency. The Waggoner HRR uses both pseudoisochromatic and desaturated test plates to increase its sensitivity and specificity.

### Waggoner HRR Validation & Research Use

Chidester, T., Milburn, N., Peterson, S., Gildea, K., Roberts, C., & Perry, D. (2013, September). Development, Validation, and Deployment of a Revised Air Traffic Color Vision Test: Incorporating Advanced Technologies and Oceanic Procedures and En Route Automation Modernization Systems. Office of Aerospace Medicine: Federal Aviation Medicine.

#### Summary:

The Aerospace Human Factors Research Division (AAM-500) of the Civil Aerospace Medical Institute developed the Air Traffic Color Vision Test (ATCOV) to determine whether individuals with color vision deficiencies (CVDs) have adequate color vision to perform critical color-related tasks involved in air traffic control. New research was required to integrate Advanced Technologies and Oceanic Procedures (ATOP, or Ocean21) and En Route Automation Modernization (ERAM) display systems into the ATCOV. The research team conducted a study to validate the addition of Ocean21 and ERAM items into ATCOV subtests. Several validated Waggoner color vision tests were used in this study to help detect color vision deficiencies, including the Waggoner PIP24, Waggoner HRR, and Waggoner CCVT.

Cotter, S., & Jenewein, E. (2014, June). *Pediatric Eye Exams: Tricks of the Trade*. Presented at the American Optometric Association, Philadelphia, PA.

#### Summary:

A simple and efficient approach for conducting eye examination for infants, toddlers, and preschool children was presented. Age-appropriate techniques for the assessment of visual acuity, eye alignment, refractive error, and ocular health were discussed. Part of ocular health testing included color vision testing using the "Color Vision Test Made Easy" test as well as the Waggoner HRR. Both tests are recommended for continued use in this population of children as a result of the conducted assessments and studies.

Formankiewicz, M. (2009, October). *Assessment of Colour Vision*. Continuing Education presented at the Association of Health Professions in Ophthalmology. Retrieved from <http://www.ahpo.net/assets/CET%20C-11998.pdf>

#### Summary:



The aim of this article is to give an overview of a selection of color vision tests. The design of these tests, as well as their advantages and limitations were discussed. Specifically, the article compares a range of color vision tests including the Waggoner HRR, Anomaloscope, Ishihara pseudoisochromatic plates, Lantern tests, Cambridge color test among several others. A colorimetric analysis of the Richmond and Waggoner HRR plates indicated that the colors are well aligned with the dichromatic confusion lines.

Lester, H. (2010). Color Vision Testing. *Federal Air Surgeon's Medical Bulletin*, p. 4.

**Summary:**

Dr. Lester, on behalf of the FAA, provides a list of all color vision tests that FAA aviation medical examiners can use when performing the annual medical examination on licensed pilots. Both the Waggoner PIP24 and Waggoner HRR are both accepted by the FAA for testing licenses pilots.

Makunyane, P. (2016). An update on diagnostic tests for colour vision defects in individuals working in the aviation industry : Back to basics. *Back to Basics. Occupational Health Southern*, 22(3), 12–16.

**Summary:**

To provide an update on colour-vision tests approved by the International Civil Aviation Organization and to highlight the importance of choosing appropriate colour-vision tests that can be used with confidence to detect colour-vision deficiency, to classify the type of deficiency involved, and to quantify the severity of loss. The authors recommend using either the Waggoner HRR or Waggoner PIP24 as a screening tool and the Waggoner CCVT as a secondary precision test.

Milburn, N., Chidester, T., Peterson, S., Roberts, C., Perry, D., & Gildea, K. (2013, May). *Pilot Color Vision Research and Recommendations*. Presented at the Aerospace Medical Association.

**Summary:**

This presentation explains the color vision test process, exceptions, procedures, and color vision tests that can be used by aviation medical examiners according to the FAA.

Miyazaki, K., Kashiwada, T., Hayashi, T., Kitakawa, T., Kubo, A., Nishino, Y., Kitahara, K. Tsuneoka, H. (2008). Evaluation of the Waggoner Hardy-Rand-Rittler Pseudoisochromatic Test in Anomalous Trichromats. *Japanese Orthoptic Journal*, 37, 207–213.

**Summary:**

The authors evaluated the Waggoner HRR by comparing it to the Richmond HRR in 16 protan deficient and 38 deutan deficient individuals. The Waggoner HRR and Richmond HRR percent agreement in severity was 87.5% for individuals with a protan deficiency and 73.7% for individuals with a deutan deficiency. The disparity between the two tests often was demonstrated by individuals receiving milder severity results from the Waggoner HRR than the Richmond HRR. In conclusion, the Waggoner HRR may be equivalent to the Richmond HRR for the evaluation of severity grading in anomalous trichromats.

**If interested in more articles that included Waggoner HRR in their research or writings, please find the following articles for you to peruse:**



Dain, S. J. (2004). Clinical colour vision tests. *Clinical & Experimental Optometry*, 87(4–5), 276–293.

Xie, J. Z., Tarczy-Hornoch, K., Lin, J., Cotter, S. A., Torres, M., Varma, R., & Multi-Ethnic Pediatric Eye Disease Study Group. (2014). Color vision deficiency in preschool children: the multi-ethnic pediatric eye disease study. *Ophthalmology*, 121(7), 1469–1474.