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Clock Drawing: Critical Errors for Detecting Cognitive Impairment

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**Background:** Clock drawing tests are popular components of cognitive assessments and one of only two screens recommended in the AMA’s older driver program. This study sought to identify the optimal subset of clock errors for cognitive screening.

**Methods:** The clock drawings of an educationally and ethnolinguistically diverse sample (N = 536) were analyzed for the association of 24 errors with the presence and severity of cognitive impairment defined by independent research criteria.

**Results:** Among participants with ≥ 5 years of education, 11 of 24 errors were associated with dementia, and 6 identified dementia with 72% sensitivity and 88% specificity in this group: inaccurate time setting, no hands, missing numbers, number of substitutions or repetitions, or refusal to attempt clock drawing. In this sample, error patterns did not effectively discriminate subjects with subsyndromal cognitive impairment, or with dementia but < 5 years of education. In subjects with ≥ 5 years of education, time setting was the most prevalent error at all stages of cognitive impairment, refusal occurred only in moderate and severe dementia, and ethnicity had no effect. All critical errors increased in frequency with stage.

**Conclusions:** Only 6 errors need be assessed to capture most of the power of clock drawing to discriminate cognitively impaired from unimpaired subjects, provided subjects have at least 5 years of education. These errors require minimal conceptual classification, making them easily detected and scored by non-specialists.

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Figure 1: Percent of subjects exhibiting errors

+ Whole clock scoring algorithm; ◇ Incorrect time setting; □ Missing numbers; ▲ Substitution; × Repetition; ★ No hands; ○ Refusal. Errors were ranked according to frequency and plotted in terms of the percentage of individuals at each CDR stage identified by the error made. The error algorithm was then plotted against the composite errors individually.