



# The reliability of visual acuity measurements from inpatient referrals to ophthalmology

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## To the Editor:

Inpatient referrals to ophthalmology are common and varied, with a significant proportion associated with visual acuity (VA) loss [1–4]. Therefore, reliable bedside VA testing is necessary for the safe assessment and triage of inpatients [2]. Bedside VA testing is challenging due to limited Snellen chart availability, lack of expertise and patient cooperation [2]. Smartphone-based VA testing apps offer an accurate, reliable and portable alternative [5]. This study assesses the characteristics of inpatient ophthalmology referrals and VA reliability using PEEK Acuity or portable Snellen charts compared to ophthalmology clinic VAs.

This study respected the tenants of the declaration of Helsinki. Electronic inpatient referrals from August 2019 to February 2020 at Princess Royal University Hospital (London, UK) were eligible. Anonymised data on inpatient age, gender, VA, referrer level, referring specialty and VA tool (portable Snellen chart, PEEK Acuity or other) were extracted. Ophthalmology clinic electronic records (Medisoft™) were then searched for corresponding clinic VAs and ophthalmic diagnoses; VAs >1.0 logMAR were excluded due to the optotype size limit for portable Snellen charts.

Referral demographics are presented as counts and percentages per patient. Mean differences between inpatient and clinic VAs are analysed per eye, with paired *T* test and one-way ANOVA used to evaluate statistical significance. Intraclass correlation coefficient (ICC) and Bland–Altman plots were used to assess the reliability of inpatient vs clinic

VAs and stratified by PEEK Acuity or portable Snellen charts (Fig. 1). Analyses were performed using SPSS v.24, Chicago, IL.

During the study period, 129 referrals were received with a mean time-to-review of 3 days ( $\pm 5$ ). Mean inpatient age was 57.6 years ( $\pm 26.2$ ) and 66% were female. Most referrals were from medical (48%), stroke (14%) and surgery (9.3%) wards and were performed by FY2s (43.4%), FY1s (24.8%) and registrars (27.1%). An ophthalmological diagnosis was present in 86.8% of referrals, of which 27.7%, 20.5%, 10.7% were of neuro-ophthalmological, retinal/uveitic and paediatric aetiology, respectively; 13.4% had no abnormality detected.

From 122 eligible eyes, VA were measured using PEEK Acuity (25.4%), portable Snellen charts (12.3%) and other methods (62.3%). The mean difference between inpatient and clinic VAs was significant (logMAR  $-0.075$ , [95% CI:  $-0.14$  to  $-0.012$ ],  $p = 0.02$ ) but not significantly associated with referrer level or referring speciality.

Inpatient PEEK Acuity VA showed better correlation (ICC 0.309,  $n = 31$ ) to clinic VA than inpatient portable Snellen chart VA (0.224,  $n = 15$ ). Inpatient vs clinic VA agreement was better for PEEK Acuity ( $-0.05$ ) than portable Snellen charts ( $-0.13$ ) (Fig. 2).

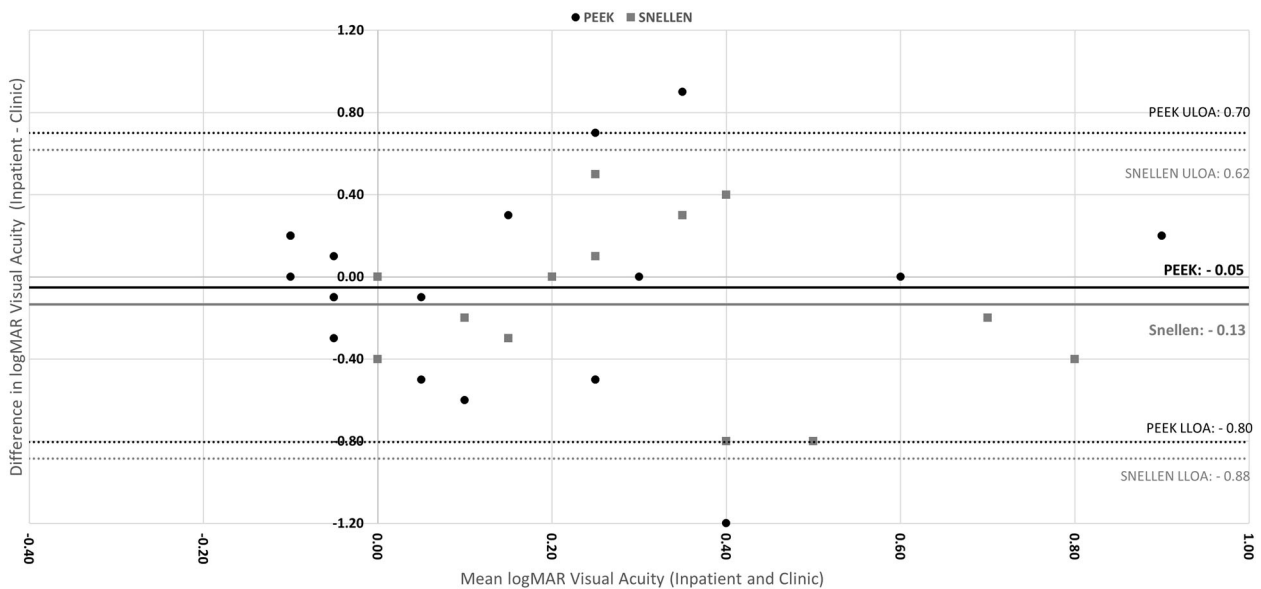
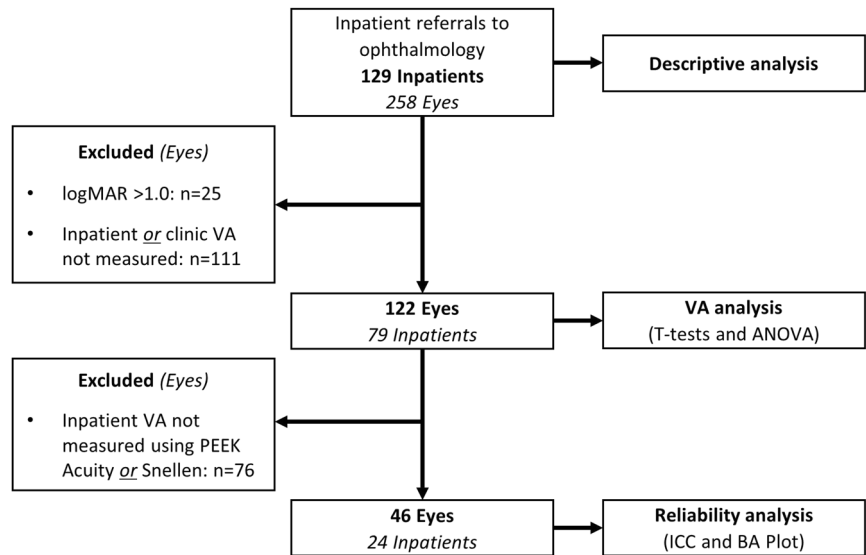
This study confirms the diversity of ophthalmic presentations amongst referred inpatients [1–4]. With the majority of VA testing being done by foundation year doctors, robust VA testing tools and training are essential. Inpatient VAs were somewhat overestimated when compared to clinic VAs but this was independent of the referrer

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**Fig. 1 Study participant and analyses flow chart.** VA visual acuity, LogMAR logarithm of the minimum angle of resolution, ANOVA analysis of variance, ICC intraclass correlation, BA: Bland–Altman.



**Fig. 2 Bland–Altman plot of visual acuity reliability for PEEK Acuity and portable Snellen charts.** Bias: ( $\pm$ SD) for Snellen:  $-0.13 (\pm 0.38)$  and PEEK:  $-0.05 (\pm 0.38)$ . ULOA: upper limit of agreement. LLOA: lower limit of agreement.

level. Overall, reliability results showed agreement between inpatient VA were poor compared to clinic VA. However, smartphone-app-based VA measurements using PEEK Acuity were more reliable than portable Snellen charts, suggesting app-based bedside VA testing is a viable, portable alternative.

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**Compliance with ethical standards**

**Conflict of interest** The authors declare no competing interests.

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