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BRIEF COMMUNICATION

Programming a LOGMAR calculator into a REDCap database

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LOGMAR (logarithm of the minimum angle of resolution) is a common modality for reporting visual acuities academically [1]. However, Snellen charts are the predominant tool of visual acuity measurement clinically. Online calculators convert individual Snellen acuities to LOGMAR, but this is labour intensive and invites error from manual data transcription. Furthermore, these tools rarely allocate for missed or additional letters read, diminishing the precision of reported findings.

Tiew et al. published a Microsoft Excel® formula for calculating LOGMAR acuity from Snellen measurements en masse [2]. While useful during data analyses, this method possesses some potential caveats. Firstly, it only applies for analysis of pre-collected data and requires the generation of datasheets without LOGMAR measurements. Furthermore, given Microsoft Excel's® limited utility for statistical analyses, it necessitates loading data into other packages, requiring the generation of multiple files and

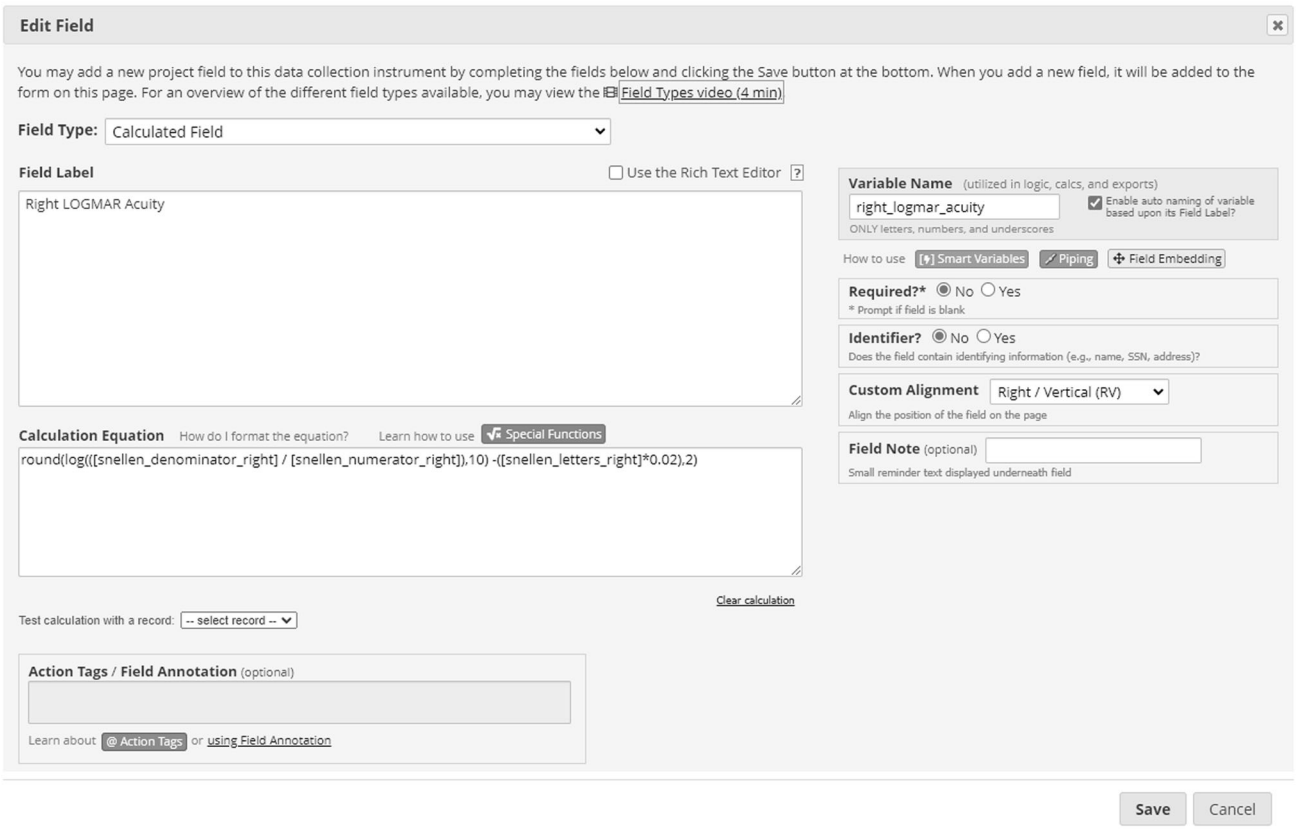

Fig. 1 Design of the equation for the right LOGMAR acuity in a calculated field.

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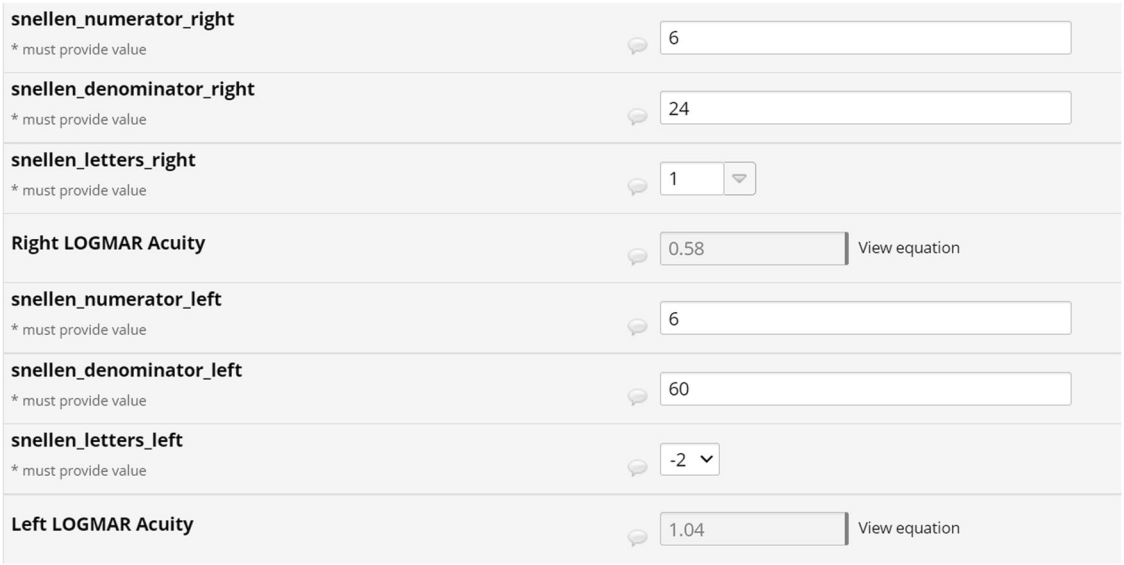

Fig. 2 Example of manually entered data (Snellen denominator, numerator, and letters) with the calculated acuity for a right and left eye.

increasing data corruption and transcriptional error risks. Finally, it limits opportunities for data checking at time of entry during prospective collection, a quandary accentuated by visual acuity's importance. Consequently, our group developed an algorithm for calculating this prospectively and automatically during data entry. By cross-checking calculated LOGMAR with conversion tables, it reduces random error during data entry and ultimately conserves time while using REDCap.

REDCap (Research Electronic Data Capture) is a secure, web-based platform supporting data capture, storage, and exportation for research studies [3, 4]. This ubiquitous database software is commonly utilised in ophthalmic research and forms the basis of data entry and storage for the Queensland Inherited Retinal Dystrophy Registry. To our knowledge, this is the first published example of such an algorithm using this platform.

Our dataset utilises clinical data from the Queensland Eye Institute. We compiled records for over 440 patients with IRD's from 2014 onwards and are currently expanding to incorporate older data and patients from multiple centres. The clinical nature of our registry necessitates the conversion of clinically acquired Snellen acuities to LOGMAR for reporting purposes.

The LOGMAR visual acuity of right and left eyes for 200 randomly selected patients was calculated using our REDCap algorithm, including a minimum 30 patients with missed or additional Snellen letters documented. Each additional letter read or missed was assigned a value of 0.02 [1]. Validation was performed by LG comparing calculated values to manually precalculated LOGMAR acuities [2]. All algorithm-calculated and precalculated LOGMAR values correlated.

Figure 1 demonstrates the algorithm with variable names. It requires a "calculated field" and reads as follows where 10 corresponds with the logarithm base and 2 corresponds to the decimal places:

```
round(log(([snellen_denominator_left] / [snellen_numerator_left]),10) -([snellen_letters_left]*0.02),2)
```

Figure 2 demonstrates manually entered data and the function's output. Without variable names, it reads as:

```
round(log(([A] / [B]),10) -([C]*0.02),2)
```

A = Snellen denominator | B = Snellen numerator | C = Extra letters read or missed.

We successfully programmed and tested a LOGMAR calculator into REDCap for our registry and encourage other ophthalmic researchers utilising the software to implement this tool. This will reduce steps during analysis, enable prospective "checking" of data for validity, and reduce errors generated from exporting spreadsheets to numerous statistical packages.

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AUTHOR CONTRIBUTIONS

JC: Manuscript writing and editing. LG: Validation of algorithm through testing. JW: Manuscript writing and editing. AS: Algorithm and database design. SD: Algorithm and database design.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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