How effectively do drought indices capture health outcomes in rural Australia?
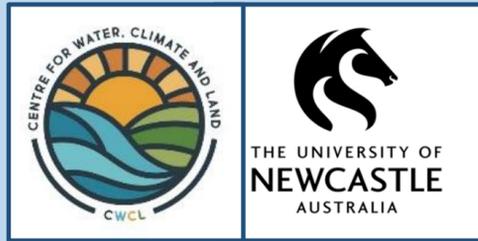
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Introduction

There is a lack of studies that quantitatively investigate wellbeing as a direct outcome of drought. Our study investigated the relationship between drought and wellbeing to determine which drought index/indices and time window/s most effectively capture wellbeing outcomes. We used a variety of drought types, time windows and indices to identify the thresholds for wet and dry epochs that exacerbate and buffer impacts to wellbeing.

Methods

The study population is a subset of the Australian Rural Mental Health Study (ARMHS) cohort. Drought indices were calculated at five time windows (6, 12, 24, 36 and 60 months to cover short, seasonal and multiyear droughts). Two wellbeing outcomes were tested; the K10 and the ARMHS Wellbeing index (WI).

Box plots were generated using Python to assess the relationship between each drought index and the two outcome measures at each of the four postcodes for the five time windows. One-way ANOVA was used to test the statistical significance between the drought indices and the two outcome measures for each of the five time windows at the four postcodes.

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Results

Box plots depicting the relationships between K10 and the number of months below decile 1 (Figure 1) demonstrate both the spatial variability between postcodes and the temporal variability between time windows. High distress is not always associated with the highest number of months in drought, although the low distress group most often experienced the lowest median number of months in drought. The variation in the length of the interquartile demonstrates that the dispersion of data varies for the four postcodes and the five time windows. The largest median drought scores across all distress groups tended to sit higher in the quartile range (negatively skewed), indicating more participants in the sample had less months in drought.
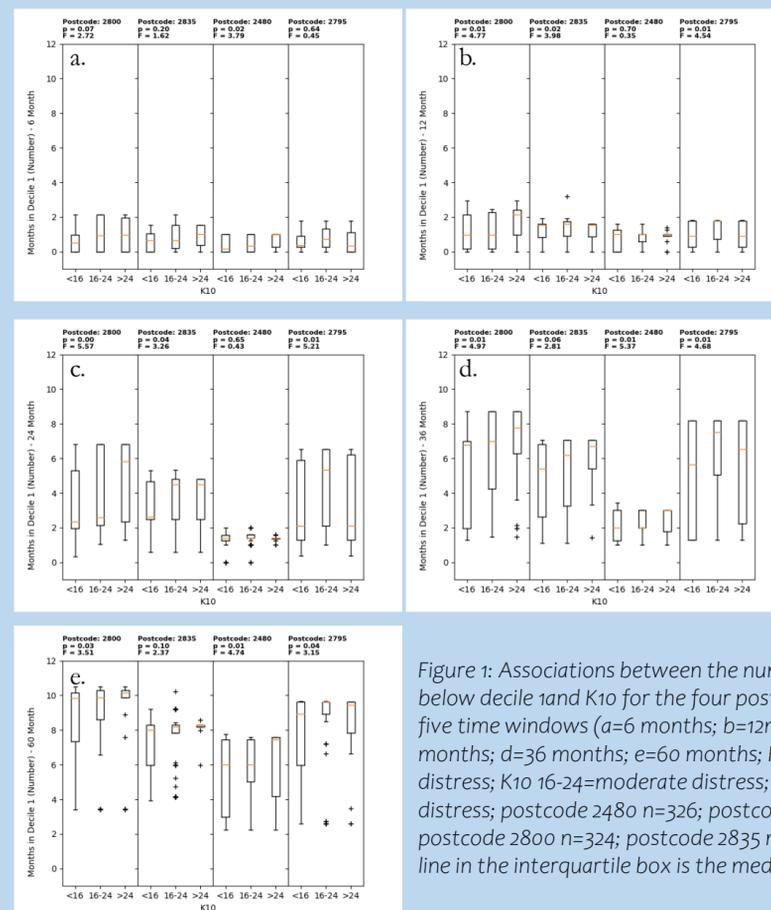
Figure 1: Associations between the number of months below decile 1and K10 for the four postcodes at the five time windows (a=6 months; b=12months; c=24 months; d=36 months; e=60 months; K10<16=low distress; K10 16-24=moderate distress; K10>24=high distress; postcode 2480 n=326; postcode 2795 n=269; postcode 2800 n=324; postcode 2835 n=276; orange line in the interquartile box is the median).

Discussion

The relationship between drought indices and wellbeing outcomes differs temporally, spatially and according to drought type. This variation highlights that in any empirical drought study it is essential to consider the sensitivities and uncertainties associated with the relationship between drought and wellbeing. Critically, the choice of drought index, time window and wellbeing outcome must be objectively selected, and it must be recognised that the results will differ based on these choices.

In addition, investigations into the relationship between drought and wellbeing must (i) incorporate the three aspects of drought (duration, frequency and magnitude) both individually and in combination, while (ii) considering different types of drought (e.g. meteorological, agricultural), and (iii) importantly, capture the context of specific locations, communities and sectors.

Findings indicate that several commonly used drought indices are not correlated to wellbeing outcomes

Conclusions

Our findings demonstrate that when conducting empirical drought studies the use of wellbeing outcome measures and drought indices should not be chosen arbitrarily. Findings indicate that it is necessary to determine if the wellbeing outcome and drought index are associated and preliminary testing is needed to ensure the drought index is effectively capturing the health outcome. These results also highlight the complexity of the relationship between drought and wellbeing