Assignment #5: Cotter et al. 2004 Hematocrit not validated as a surrogate end point for survival
Cindy Barreto – Ecology and Evolutionary Biology, Ph.D.

For this assignment, Kara Heilemann, Jessica Gutierrez, and I made a search for "The worst 3D figures", and looked at the options available at "The top ten worst graphs". Between the options, we choose the paper of Cotter et al. (2004)"Hematocrit was not validated as a surrogate end point for survival among epoetin-treated hemodialysis patients". The paper is about the evaluation of hematocrit levels and a possible association to end-stage renal disease patients treated with epoetin. At the figure 2 of the paper, they made an association between mortality ratios per quartile of treatment (Fig. 2 A), and between mortality per hazard rate of those quartile (Fig. 2 B), considering the hematocrit rates on both. Quartiles are ranked from 1 to 4, where the epoetin dose was calculated using the total dose of epoetin in the bills for the first 3 months of treatment, making an average per week. Therefore, values, in units per week, consists in Q1 > 0 to 8,738; Q2 > 8,738 to 13,944; Q3 > 13,944 to 21,692; and Q4 > 21,692. The hematocrit levels were calculated as percentages.

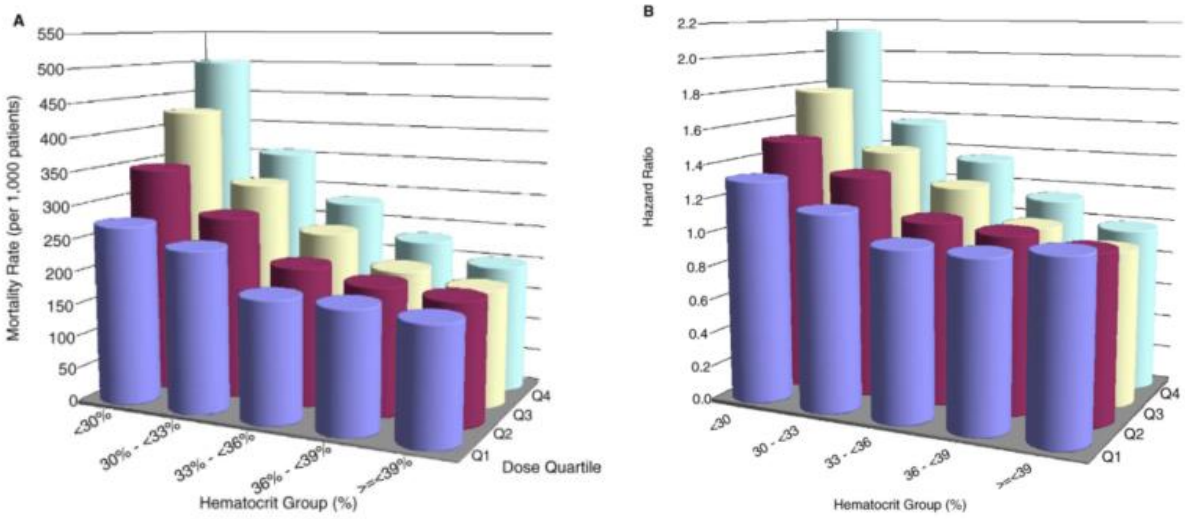

Figure 2. (A) Unadjusted 1-year mortality rates by hematocrit group disaggregated by epoetin dose quartile. Within each epoetin dose quartile, there is a trend toward increasing mortality as the observed study hematocrit decreases, most notably in the fourth quartile (21,692 units/wk). Similarly, there is a trend toward increasing mortality as the epoetin dose increases within each observed study hematocrit range, most notably in the lowest (30%) hematocrit range. (B) Relative risk of death by hematocrit group disaggregated by epoetin dose quartile. For the three lowest observed study hematocrit ranges, compared with the reference group, there is a trend toward higher relative risk of mortality within each hematocrit range as the epoetin dose increases and within each dose quartile as the hematocrit range decreases. For the two highest hematocrit ranges, compared with the reference group, the relative risk of mortality varies, depending on the specific hematocrit range and dose quartile.

The problem with the figure is that they choose a 3D graph unnecessarily. First problem is that they divided the quartiles as a third dimension, which they could simply add colors to designate the quartiles. Secondly, the colors does not have meaning, since the third dimension is already informing about the quartiles. Finally, as the bars are behind each other, a comparison is not only difficult but impossible when the quartile behind have lower values than the one in front. For example, Q3 at the B graph, for ≥ 30% of hematocrit, has lower hazard ratio associated with mortality in patients of that group. Since Q2 has higher mortality, the bar, which has a lighter

color, is hard to see behind the pink bar of Q2. Besides, the figure at the paper is aligned in one column and two rows, occupying one page of the paper, with no caption at the same page.

Following the Claus Wilke's advice in the chapter 26, we avoided the 3D figure and re-made it in a 2D figure. We considered the quartiles as x axis, the mortalities as y axis, and colored the hematocrit groups, as presented below (Figure Option 1). This not only made the figure easier to compare, but also more clear in information, as well as color-blind friendly. The data used for the graph is available on the pdf (Table 3 for A and Table 4 for B).

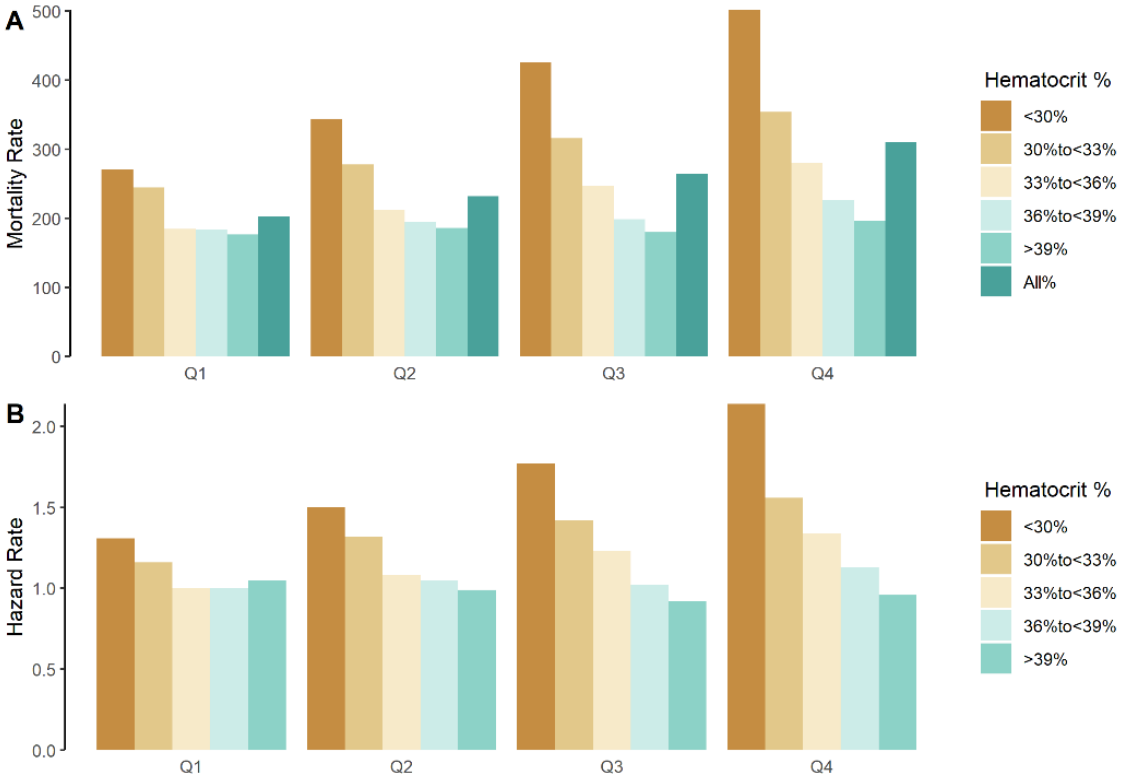

Figure Option 1. (A) Unadjusted 1-year mortality rates by epoetin dose quartile, considering the hematocrit group disaggregated. Within each epoetin dose quartile, there is a trend toward increasing mortality as the observed study hematocrit decreases, most notably in the fourth quartile (21,692 units/wk). Similarly, there is a trend toward increasing mortality as the epoetin dose increases within each observed study hematocrit range, most notably in the lowest (30%) hematocrit range. (B) Relative risk of death by epoetin dose quartile, considering the hematocrit group disaggregated. For the three lowest observed study hematocrit ranges, compared with the reference group, there is a trend toward higher relative risk of mortality within each hematocrit range as the epoetin dose increases and within each dose quartile as the hematocrit range decreases. For the two highest hematocrit ranges, compared with the reference group, the relative risk of mortality varies, depending on the specific hematocrit range and dose quartile.

Paper cited: Cotter DJ, Stefanik K, Zhang Y, Thamer M, Scharfstein D, Kaufman J (2004) Hematocrit Was Not Validated as a Surrogate End Point for Survival among Epoetin-Treated Hemodialysis Patients. *Journal of Clinical Epidemiology* 57 (10): 1086–95

The top ten worst graphs: https://www.biostat.wisc.edu/~kbroman/topten_worstgraphs/