QMEE Winter 2024 Week 6 Assignment
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1. **Measurement**

   (a) Replication of figure 1 from *Voje et al. 2023*

Figure 1 (Voje et al. 2023) for CDC data on weekly COVID-19 hospitalization rates			
Theoretical context	**Empirical relational structure**	**Numerical relational structure**	**Meaningful inferences**
Weekly COVID hospitalization rates in the U.S. categorized by age group (0-4, 5-17, 18-49, 50-65, 65+ years)	Weekly hospital rates (absolute scale)	Weekly hospitalization rates are on the absolute scale and are a valid, reasonable, and relevant measure	Mean of weekly hospitalization rates
Context is public health related – focusing on age differences in COVID hospitalizations, so a relevant measure would be these rates	Weekly rates are separated by age group (ordinal scale)	Weekly rates categorized by age group	Distribution of rates for each age group
	Time of rates is given by the week of the year (interval scale)		

Weekly hospitalization rates are defined by the number of hospital residents in a surveillance area with laboratory confirmed tests per the estimated population size of the surveillance area. $*$

   (b) The continuous response variable is the weekly hospitalization rates in a given surveillance area, which would be on the absolute scale, so any inferences will be meaningful. The predictors being used are age group, which is on an ordinal scale, and the week of the season, which is on an interval scale. Median and percentile would be valid inferences for age group, and mean, standard deviation, or linear models with time would be valid inferences for an interval scale predictor.

2. **Effect sizes and meaningful magnitudes**

   (a) With weekly hospitalization rates as the continuous response variable, the difference of means, between the pooled mean of weekly hospitalization rates for age groups younger than 65 years and the mean of weekly hospitalization rates for the age group 65+ years, would be a reasonable measure of effect. Starting simple by comparing the oldest group (65+ years) with all younger age groups (0-65 years) using a difference of means is intuitive and reasonable to get at the biological question of does older age result in higher COVID-19 hospitalization rates. Furthermore, the context of this question is geared towards public health rather than dynamical systems modeling, and using a measure of effect that is the difference of means of an intuitive measure and contextually important and relevant for public health seems reasonable. As far as historical precedent in the field of disease modeling goes, I am only familiar with parameter estimation for mechanistic models, so I am not familiar with the literature on purely statistical methods for answering such a biological question and am unaware of the 'statistical norm.'

   (b) Since the continuous response variable is on an absolute scale and the units are intuitive, it's not necessary to standardize the measure of effect. The way the weekly hospitalization rates are defined is intuitive, but standardizing could be useful for scaling purposes.

   (c) The measure of effect chosen is simple and intuitive and doesn't involve unit changes, and again, the measure being used is relevant for public health (difference of means of hospitalization rates).

   (d) Backdrop of meaning in magnitude

Scale of magnitude			
Measure of effect	$1 <$	$[1, 3.4]$	$3.4 >$
a priori	Judged to not be of practical/meaningful biological relevance	Grey area	Judged to be of practical/meaningful biological relevance

   50% of the data are hospitalization rates of 3.4% or less, and 25% of the data are hospitalization rates of 1% or less. So taking a difference of means to be larger than 3.4% can be judged as biologically relevant (i.e., relevant for public health).

   (e) i. While this measure is statistically significant with very little uncertainty, the scale of magnitude being used implies this result is not practically relevant.

   ii. According to standard statistical norms, this measure is not statistically significant with lots uncertainty, while breaching into territory of practical relevance.

   iii. This measure is statistically significant with a little uncertainty, and the scale of magnitude being used implies this result is also practically relevant.

   iv. This measure is statistically significant with some uncertainty, and the scale of magnitude being used implies this result not practically relevant.

v. This measure is statistically significant with some uncertainty, and the scale of magnitude being used implies this result has variability in its practical relevance.

vi. This measure is statistically significant with little uncertainty, but the scale of magnitude being used implies this result has variability in its practical relevance.

vii. This measure is statistically significant with little uncertainty, and according to the scale of magnitude being used in not practically relevant.