Types of Variables in Statistical Modeling

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Review: Types of Variables when Summarizing Data

Categorical variables: take on small number of discrete values

Examples: gender, race/ethnicity, political party preference, region, binary indicators of events

Asked: Are the categories ordered in any way, or are they simply discrete values?

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Continuous variables:
take on many possible values

Examples: height, age, income, blood pressure.

Asked: What does the distribution look like (shape, center, spread)? Is the variable normally distributed?

Classifying Variables for Model Fitting

Dependent Variables (DVs)

Other names: outcome, response, or endogenous variables, or variables of interest

Model distributional features of these <u>variables of interest</u> as a function of **independent variables**
(i.e., their distributions **depend on** the values of these other variables)

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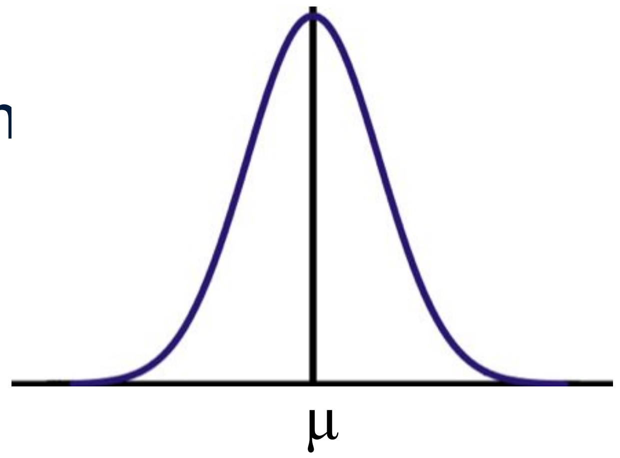
Independent Variables (IVs)

Other names: predictor variables, covariates, regressors, or exogenous variables

When fitting models, we examine the distributions of dependent variables **conditional** on the values of these independent variables

Dependent Variables (DVs)

- "Model" the DV, **which is a variable of primary interest,** as a function of other theoretically relevant IVs
  → **our research question defines all of these variables!**
- Involves selecting reasonable distribution for DV (e.g., norm
  and defining parameters of that distribution (e.g., the mean)
  as a function of (or conditional on) the IVs



- DVs could be continuous, categorical, binary, etc.

Example: Assume blood pressure is normally distributed, where mean **depends on** a person's age, BMI, and gender.

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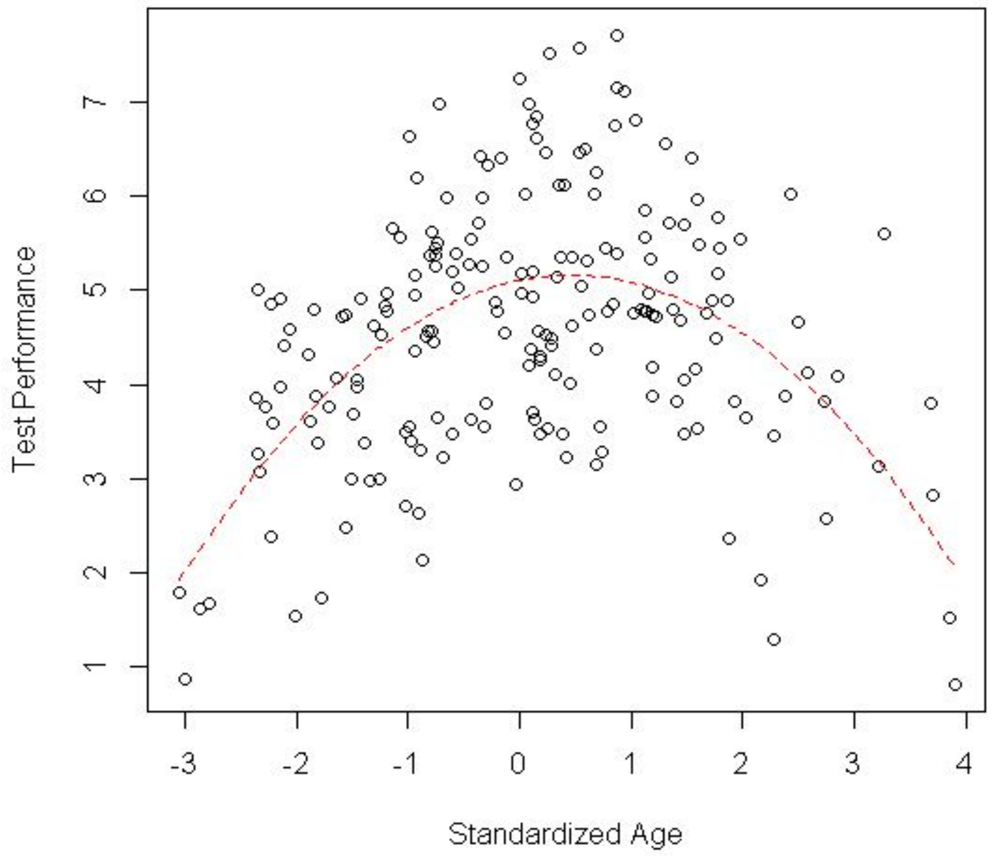
  Interested in estimating relationships of IVs with DVs
- Might be **manipulated by an investigator**
  Randomized experiment: cases randomly assigned to an intervention or a control group ("group" is the predictor)
- Could simply be **observed**
  Observational studies: hard to make causal inference about relationships

Independent Variables (IVs)

- If IVs **continuous**: estimate functional relationships of those IVs with distributional features of the DVs
- If IVs **categorical**, compare groups defined by the categories in terms of distributions on the DV



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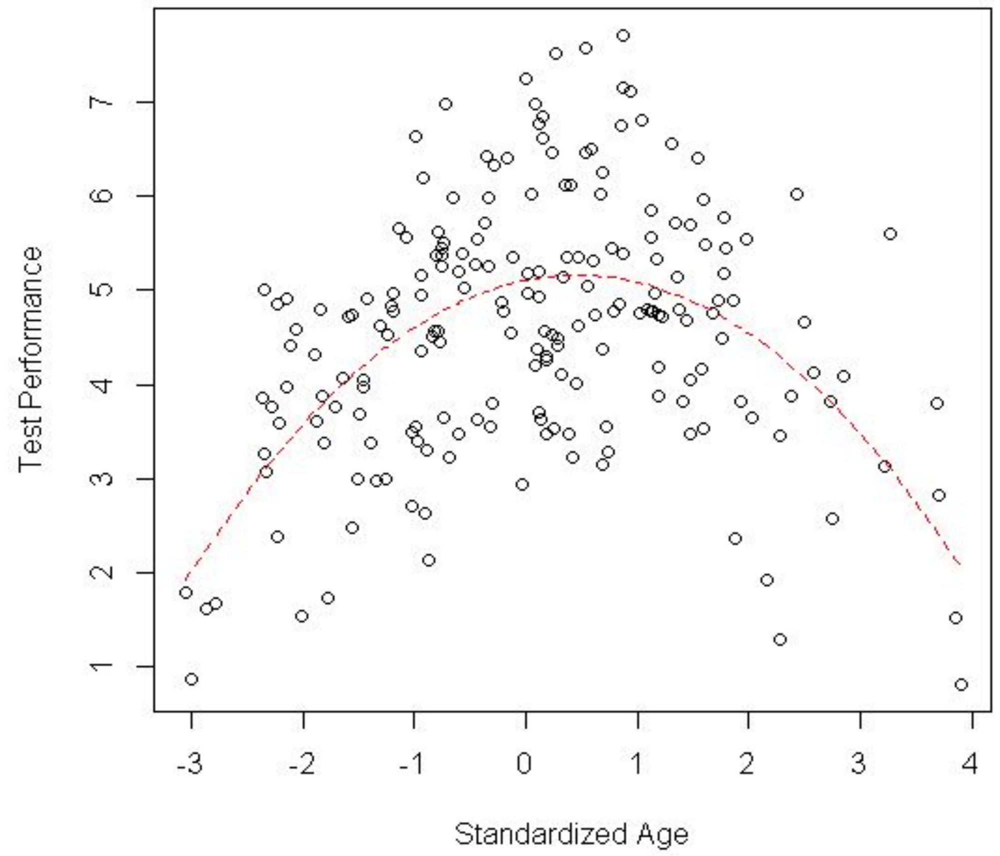

Best Practice

Avoid estimating *functional* relationships of categorical IVs (e.g., race) with DVs, since actual values of categorical IVs may not have any numerical meaning!

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“Control” Variables

Goal: Estimating parameters describing **relationships** of IVs with DVs

- **Randomized study designs:** attempt to ensure randomized groups are **balanced** with respect to other **“confounding” variables** that may have negative impact on estimation of relationship of group with DV

- **Non-randomized (observational) designs:** groups that define IV **may not be balanced**. *Example:* males generally may weigh more than females, and an analysis looking at relationship of gender with DV related to weight may not yield clear estimate of the gender – DV relationship.

“Control” Variables, cont’d

When fitting models, include several IVs
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"Control" Variables, cont'd

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Example: Interested in comparing distribution of blood pressure (DV) between males and females, and weight is related to blood pressure.

→ Include weight as a **control variable**, and make inference about the gender – blood pressure relationship **given a value for weight**

Missing Data

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Listwise Deletion =units of analysis with **any missing data** on **any of IVs or DVs** dropped from analysis!

If **cases dropped are systematically different** from cases analyzed
→ introduce **bias in estimated IV- DV relationships!**

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  Are there differences?

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- If evidence of differences → other techniques can be used (e.g. **imputation**) to address missing data issue

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- Recognize that study designs affect properties of collected data, and **models need to reflect these properties**!

Example: Repeated measures of DV from the same person over time will be correlated!