Power Analysis & Sample Size Calculation

What is power?
The likelihood that your test will detect an effect if there is one.
Power, or sample size calculations, are based on three inputs. Power percentage, sample size, and effect size. You calculate the third given based on providing observed or estimated values of the other two.

When do you need a power analysis and what it can tell us?

- Minimum sample size needed to detect an effect size
- Want a large enough sample to be able to observe the effect, also see if obtaining a larger sample is unnecessary
- Should be done before the study begins as part of protocol development
    - Often needed for IRB, grant proposals and may be required in future manuscripts

Information we need to conduct a power analysis

- Primary outcome and measurement scale (continuous, categorical/binary, time-to-event, etc)
- Number of groups
- Cross sectional or longitudinal
- Estimated effect size, which can be computed by
    - Means and standard deviations
    - Difference between proportions
    - Odds ratio or hazard ratio
- If effect sizes cannot be estimated, use rules of thumb for standardized variable like
    - Small = 0.2
    - Medium = 0.5
    - Large = 0.8

Limitations of power analysis in pilot studies

- Pilot studies are usually meant to inform future power analysis and not for themselves to be adequately powered
- Help to assess how many patients could eventually be recruited or feasibility of outcome measurement and protocols

FAQs
What if I don't know the effect size?/There is no other prior research or pilot data available.
Reference the literature:
The literature may not have the exact same study design as your study but guide what would be reasonable to expect.
Also, clinical experience or a chart review can be done to inform estimates; a perfect prediction is not needed.

General estimates based on effect size can be used, but this is often less preferrable to specific numbers that can be referenced.
Calculations could be done for a range of effect sizes that represent best case to worst case scenarios

My study has multiple outcomes/endpoints. Do I need a power analysis for each one?
We advise selecting one primary outcome and conducting your power analysis based on that. Only one sample size can ultimately be used, so the power analysis should address the most important outcome. If you want adequate power across multiple outcomes, the sample size will need to be based on the largest required sample size.

Do I need a power analysis after the study is complete (post-hoc)?
We advise against doing so. Mainly for the reasons outline in the following article: https://pubmed.ncbi.nlm.nih.gov/32814615/