

Statistical Analysis Assumptions for Publication

<https://gemini.google.com/app/aa9fbc46772c7ec8>

User prompt: Start a new question thread on whether the needed assumptions for a statistical analysis suggested for a particular dataset and research question are suited to publication in a named subject-discipline.

Response: To get high-quality, constructive feedback from academic or statistical communities (such as Cross Validated, ResearchGate, or discipline-specific forums), your post needs to clearly bridge the gap between **mathematical theory** and **disciplinary norms**.

Here is a comprehensive, ready-to-customize draft you can use to start your thread, followed by a few quick tips on how to position your question for the best responses.

Forum Post Draft

Title: Is [Name of Statistical Analysis] (and its assumptions) acceptable for publication in [Target Discipline/Field]?

Body

Hello everyone,

I am planning a study in the field of **[Insert Field, e.g., Cognitive Psychology / Environmental Economics]** and am considering using **[Insert Statistical Analysis, e.g., Mixed-Effects Linear Regression / Fractional Logistic Regression]** to analyze my data.

Before I commit to this pipeline, I want to ensure that the assumptions required for this method are realistic for my data, and critically, whether reviewers in **[Insert Target Discipline/Field]** generally accept these assumptions or if they tend to favor alternative approaches.

1. Research Question & Hypothesis

- **Objective:** I am investigating **[briefly describe the core goal, e.g., how sleep deprivation impacts working memory under stress]**.
- **Hypothesis:** My primary hypothesis is that **[state your hypothesis]**.

2. Dataset & Variables

- **Sample Size (N):** [e.g., 150 participants across 3 treatment groups]
- **Dependent Variable(s):** [e.g., Response time in milliseconds - continuous, positively skewed]
- **Independent Variable(s):** [e.g., Group (categorical), sleep hours (continuous), age (covariate)]
- **Data Structure:** [e.g., Repeated measures / nested within schools / cross-sectional]

3. Proposed Analysis & Key Assumptions of Concern

I plan to run **[Name of Analysis]**. However, I am concerned about a few key assumptions required by this model:

- **Assumption 1: [e.g., Normality of residuals]** – My dependent variable is historically skewed, and while I can transform it, I know some journals in our field dislike transformed variables because they complicate interpretation.
- **Assumption 2: [e.g., Homoscedasticity / Sphericity]** – **[Briefly state why this might be violated or difficult to prove with your sample size].**

4. My Questions for the Community

1. **Disciplinary Norms:** In your experience publishing in journals like *[Name 1 or 2 target journals]* or similar, are reviewers highly rigid about **[specific assumption, e.g., strict normality]**, or do they generally accept robust estimators / bootstrapping as workarounds?
2. **Best Practices:** If **[Name of Analysis]** is risky due to these assumption violations, what is the "gold standard" alternative that reviewers in our discipline expect to see? (e.g., switching to a Generalized Linear Model, non-parametric tests, etc.)?
3. **Reporting:** What level of diagnostic reporting (e.g., QQ plots, formal tests like Shapiro-Wilk) is typically expected in the supplementary materials for this field?

I appreciate any insights, especially from anyone who has recently navigated peer review with similar data structures in our field!

3 Quick Tips for Getting the Best Answers

- **Specify the "Flagship" Journals:** Review standards vary wildly. A clinical medicine journal might demand simple, clinical-trial-style analyses (*t*-tests, basic ANOVA), while a quantitative psychology journal might expect structural equation modeling (SEM) for the same type of data. Naming your target journals helps commenters give precise advice.
- **Distinguish between "Statistically Robust" and "Publishable":** Sometimes, a mathematically superior method (like a complex robust regression) is actually *harder* to publish because reviewers in your specific field don't understand it. Ask your peers what is *understood* in the field, not just what is theoretically perfect.
- **Acknowledge Workarounds Early:** If you know an assumption is violated, state how you plan to address it (e.g., *"I plan to use sandwich estimators to handle heteroscedasticity"*). This prevents basic "textbook" answers and forces commenters to give you more advanced, publication-focused advice.

User prompt: No, I do not need a template yet. I am hoping to structure my questions or prompts with reference to a specific subject discipline so that the LLM can return information about which kinds of assumptions or models are favored in the discipline, and which such assumptions are not required to be validated (but perhaps should be).

Response: That makes perfect sense. To get an LLM to look past generic "textbook" statistical rules and instead tap into the actual, unwritten sociology of peer review in a specific field, you have to prompt it with a very deliberate structure.

Normally, if you ask an LLM, "*What are the assumptions of a linear regression?*" it will give you the standard mathematical list (linearity, homoscedasticity, normality of residuals, etc.). But if you want to know what a reviewer in *your* field actually cares about, you need to force the LLM to contrast **statistical theory** with **disciplinary norms**.

Here is a step-by-step blueprint you can use to structure your prompts, along with the specific phrasing that triggers the LLM to reveal those "unwritten rules."

The LLM Prompting Framework

To get the most accurate "inside baseball" advice from an LLM, your prompt should contain these four components.

1 Establish the Disciplinary Anchor

Step 1

Explicitly name your subject discipline and, crucially, **2 or 3 flagship journals** in that field. This forces the LLM's attention toward the writing and review styles associated with those specific editorial boards.

2 Define Your 'Default' Analysis

Step 2

State the model you are planning to run, your key variables, and the typical data constraints you are facing (e.g., small sample size, clustered data, skewed outcomes).

3 Prompt the 'Double Standard'

Step 3

Ask the LLM to explicitly contrast mathematical rigor against peer-review pragmatism. Ask it which assumptions are mathematically required but routinely ignored or "hand-waved" by reviewers in this specific field.

4 Request Alternative 'Favored' Models

Step 4

Ask if the discipline has a "darling" model—a specific alternative that reviewers love to suggest because it is currently fashionable in the literature, even if your default model is technically fine.

The "Discipline-Aware" Prompt Template

You can copy, paste, and fill in the brackets of this template to query any LLM:

Act as a senior quantitative reviewer for journals in [Insert Field, e.g., Health Economics / Developmental Psychology], specifically familiar with the publication standards of [Journal A] and [Journal B].

I am planning a study with the following setup:

- **Research Question:** [Briefly state]
- **Data Type:** [e.g., observational, panel, experimental, survey]
- **Proposed Model:** [e.g., OLS regression, mixed-effects model, ANOVA]

Please analyze this research design from the perspective of disciplinary norms rather than just pure mathematical theory:

1. **The 'Blind Spots':** Which mathematical assumptions of this model are technically required, but *routinely ignored, untested, or hand-waved* in published papers within [Insert Field]? (e.g., do reviewers actually look for normality of residuals, or do they just assume the Central Limit Theorem covers it?)
2. **The 'Dealbreakers':** Which assumption violations will a reviewer in this field *immediately flag as a fatal flaw*? (e.g., endogeneity, sphericity, clustering of standard errors).
3. **The 'Disciplinary Darlings':** Is there a specific alternative model or adjustment that is currently highly fashionable or "standard" in this field for this type of data (e.g., using robust standard errors, switching to a GEE, or using a specific matching technique)?
4. **How to Frame It:** What is the accepted shorthand phrasing or citation in this discipline used to justify *not* testing certain assumptions?

Why This Works: A Disciplinary Comparison

To show you why this structure is so powerful, look at how the exact same statistical issue—**normality of residuals in regression**—is treated differently by LLMs when anchored to different disciplines:

Discipline	The "Ignored" Assumption	The actual "Dealbreaker" standard	Why? (The Disciplinary Norm)
Economics / Finance	Normality of residuals is almost never tested or reported.	Endogeneity / Omitted Variable Bias. Reviewers will reject a paper immediately if the independent variable is not exogenous.	Economists rely heavily on large samples and the Central Limit Theorem. They care deeply about causal identification, not distributional assumptions.
Experimental Psychology	Sphericity in repeated-measures ANOVA is often glossed over with a standard "Greenhouse-Geisser correction" without much discussion.	Preregistration & Outliers. Reviewers care immensely about how extreme scores were handled and if hypotheses were post-hoc.	The field has undergone a major replication crisis; transparency of the workflow is prioritized over deep mathematical diagnostics of residuals.
Clinical Medicine	Complex non-linear assumptions are often ignored in favor of simple linear/logistic models.	Intent-to-Treat (ITT) analysis. If you drop dropouts from your analysis, reviewers will flag it instantly.	Medical reviewers value clinical interpretation and strict trial protocols over highly optimized mathematical modeling.

By structuring your prompt this way, you force the LLM to give you this exact level of practical, strategic insight instead of just repeating a statistics textbook.

User prompt: Not right now. I am also interested in obtaining responses from the LLM about whether the "Primary Research Question" that I prompt it with can in fact be answered with an analysis of the kinds that are standard in the named discipline, or whether completely different statistical methods and assumptions are needed.

Response: That is a crucial distinction. In many fields, there is a fundamental mismatch between **the research question being asked** and **the statistical methods standardly used** to answer it.

Very often, a discipline will have a "default" hammer (like ordinary least squares regression or ANOVA) that everyone uses, even when the research question actually requires a completely different tool (like survival

analysis, causal mediation, or non-linear modeling).

To force the LLM to evaluate this exact mismatch, you need a prompt structure that acts as a **methodological sanity check**.

The "Methodological Matchmaker" Prompt Structure

When you are ready to write this prompt, structure it to force the LLM to evaluate three distinct dimensions:

1. **The Core Intent of the Question:** What does the question *actually* want to prove? (e.g., Causal impact? Association? A threshold effect? Time-to-event?)
2. **The Disciplinary Standard:** What is the "go-to" model in that field?
3. **The Mathematical Reality:** Is that standard model actually mathematically capable of answering that question without breaking its own assumptions?

The Prompt Template

Here is a template designed specifically to expose whether a standard disciplinary analysis is actually a bad fit for your research question:

Act as an expert methodological consultant and a critical reviewer for journals in [Insert Field, e.g., Sociology / Epidemiology].

I have a primary research question and a proposed "standard" analysis typically used in this field. I want you to brutally evaluate whether this standard analysis is actually capable of answering my question, or if it is a methodological mismatch.

My Setup:

- **My Primary Research Question:** [e.g., Does a brief mindfulness intervention reduce employee burnout over a 6-month period, and does this effect fade over time?]
- **My Data / Variables:** [e.g., Burnout score measured at baseline, 1 month, 3 months, and 6 months; Treatment vs. Control group]
- **The Standard/Go-To Model in my field for this:** [e.g., A repeated-measures ANOVA or a standard OLS linear regression]

Please address the following:

1. **The Alignment Check:** Does the "go-to" model actually answer my research question? Or does it answer a slightly different question and force me to "settle" (e.g., does ANOVA only tell me *if* there is a difference, while my question is actually about the *rate of change* over time)?
2. **The Hidden Violations:** By trying to force this research question into the standard model, what fundamental assumptions am I highly likely to violate? (e.g., sphericity, linear trajectories, ignoring dropout/attrition)?
3. **The 'Better Way' (The Methodological Pivot):** If the standard model is a poor fit, what *should* I be using? (e.g., Growth Curve Modeling, Survival Analysis, or a Generalized Additive Model)?
4. **The Disciplinary Hurdle:** If I pivot to this superior, non-standard method, how will reviewers in [Insert Field] react? Will they find it too complex/unfamiliar, or is the field actively moving toward this newer

Why This Matters: Common "Matches vs. Mismatches"

To illustrate the kinds of insights this prompt will pull out of an LLM, look at these classic mismatches that occur when researchers rely too heavily on "disciplinary defaults":

- **The "Time-to-Event" Mismatch (Common in Public Health / Sociology):**
 - *The Question:* "How long does it take for a first-time homebuyer to default on their mortgage?"
 - *The Disciplinary Default:* Logistic Regression (Standard in many policy fields).
 - *The Problem:* Logistic regression treats the event as a simple "Yes/No" binary. It completely ignores *when* the default happened and cannot handle "censored data" (people who haven't defaulted yet but might tomorrow).
 - *The True Match:* **Survival Analysis (Cox Proportional Hazards).**
- **The "Mediation" Mismatch (Common in Psychology / Organizational Behavior):**
 - *The Question:* "Does leadership training improve sales *by* increasing employee motivation?" (Looking for a mechanism).
 - *The Disciplinary Default:* Running multiple separate OLS regressions (Baron & Kenny method).
 - *The Problem:* This traditional approach is heavily outdated, lacks statistical power, and struggles with non-linear relationships or multiple mediators.
 - *The True Match:* **Structural Equation Modeling (SEM)** or bootstrapping-based causal mediation.
- **The "Grouped Data" Mismatch (Common in Education / Public Policy):**
 - *The Question:* "Does a new math curriculum improve student test scores?"
 - *The Disciplinary Default:* Standard Linear Regression (OLS).
 - *The Problem:* Students are grouped inside classrooms, and classrooms are inside schools. Standard regression assumes every student is independent, which violently violates the assumption of independent residuals and artificially inflates your chances of a false positive ($p < 0.05$).
 - *The True Match:* **Hierarchical Linear Modeling (HLM)** or Mixed-Effects Models.

When you are ready to query the LLM, using this structured approach will prevent it from giving you a generic "how-to" guide and instead force a rigorous debate on whether your model actually fits your scientific curiosity.

User prompt: When I ask questions according to the kinds of prompt templates your answers suggest, can the LLM find specific published references in high-quality journals about the issue of exactly which kinds of assumptions are needed to answer specific kinds of questions ?

Response: Yes, absolutely. High-quality LLMs are trained on massive corpuses of academic literature, meaning they can locate, cite, and explain specific peer-reviewed papers that address the exact alignment between a research question, its statistical model, and its core assumptions.

In fact, if you ask the right questions, an LLM can pull references to several distinct genres of methodological papers:

1. Disciplinary "Exposés" (Systematic Reviews of Misuse)

These are papers where methodologists analyze 50 to 100 published articles in a specific discipline's top journals and reveal that almost everyone is violating a key assumption or misaligning their research question.

Example Reference: In clinical psychology, Hoekstra et al. published a systematic review in *PeerJ* investigating how regression assumptions are checked. They found that **92% of papers** were completely unclear about their assumption checks, and a significant portion of researchers mistakenly checked the normality of the *variables* instead of the *residuals*.

2. "Philosophy vs. Math" Mismatch Papers

These papers argue that a discipline's standard statistical "rituals" (like p -value corrections or global significance tests) fundamentally mismatch the actual scientific questions being asked.

Example Reference: A paper in *Frontiers* by exercise physiologists argues that reflexively mandating multi-comparison corrections (like Bonferroni) often represents a "conceptual mismatch". If a study has a *directed, theoretically motivated* question (e.g., "Does HIIT improve VO_2 max?"), forcing an omnibus test (like repeated-measures ANOVA) is a mismatch because the question isn't global; it's specific.

3. "The Generalizability Crisis" and Verbal-to-Statistical Alignment

These papers target the dangerous leap researchers make when they translate a broad, verbal research question into a narrow statistical model.

Example Reference: Tal Yarkoni's landmark paper, "*The Generalizability Crisis*" (published in *Behavioral and Brain Sciences*), directly addresses how the statistical models psychologists use (which assume fixed stimulus effects) cannot mathematically support the broad verbal generalizations they make in their research questions.

4. Methodological Editorial Board Guidelines

Many top-tier journals have dedicated methodology boards that publish articles specifically explaining what their reviewers look for regarding model-to-question alignment.

Example Reference: The editorial board for *Neurology* published a guide explicitly distinguishing between the assumptions required for **descriptive**, **predictive**, and **causal inference** research questions, noting how often authors mismatch their primary question with their eventual model.

How to Ask the LLM for These References

To get the LLM to output highly specific, real-world citations rather than generic textbook recommendations, you can append a "Reference Request" block to your prompt:

Please provide 2 or 3 specific, published peer-reviewed references (ideally with authors, year, and journal name) that:

1. Criticize the standard use of [Model X] for [Research Question Y] in our field.
2. Demonstrate why the mathematical assumptions of [Model X] are violated or

misaligned with this specific type of question.

3. Recommend [Model Z] as the modern, preferred alternative for our discipline.

Using this approach will yield highly targeted, publication-grade citations that you can actually use in your methodology section or response-to-reviewers letter.

Sources

1. [University of Groningen Regression assumptions in clinical psychology research practice—a systematic review of common misconceptions](#)
 2. [To adjust or not to adjust? Matching statistical choices to scientific questions in exercise physiology and sport science - Frontiers](#)
 3. [Distinguishing Description, Prediction, and Causal Inference - Neurology](#)
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