Analytical issues for pandemic disruptions

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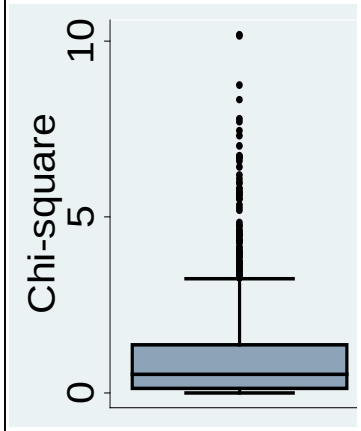
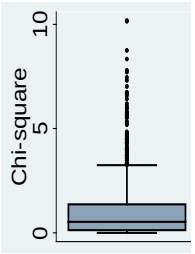


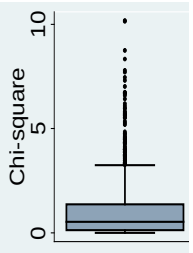
Sometime in 2020

Outline



- Example: Group prenatal care
- Pandemic effects
- Interrupted time series design
- Should I pool information?
- If pooling, how to accommodate pandemic effects
- Caveats
- Summary

Example: EMBRACE study

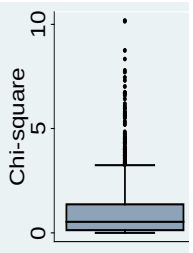


We had recruited 101 participants into a randomized comparison of usual versus group pre-natal care when the pandemic hit.

Primary outcome: premature birth
Secondary outcomes: depression/anxiety

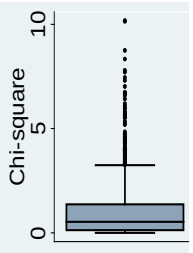
Pausing to retool the “group” prenatal care group. But what will the analysis eventually be?

Pandemic effects



- Pandemic could increase the rates of premature birth and increase depression and anxiety in both arms equally or unequally.
- The change in the intervention (from in-person to remote) could reduce the effectiveness of the intervention during the pandemic.
- Data collection methods might change during the pandemic, affecting measured values.

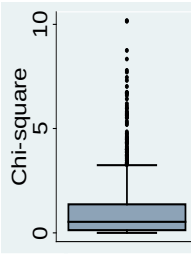
Pandemic effects



- The characteristics of those willing to participate may change.
- In Duo PACT – target population changed.

Bottomline: At the time of the pandemic onset, a multitude of things could change the average values, which is what the typical statistical analysis is modeling.

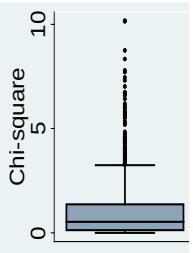
Interrupted time series

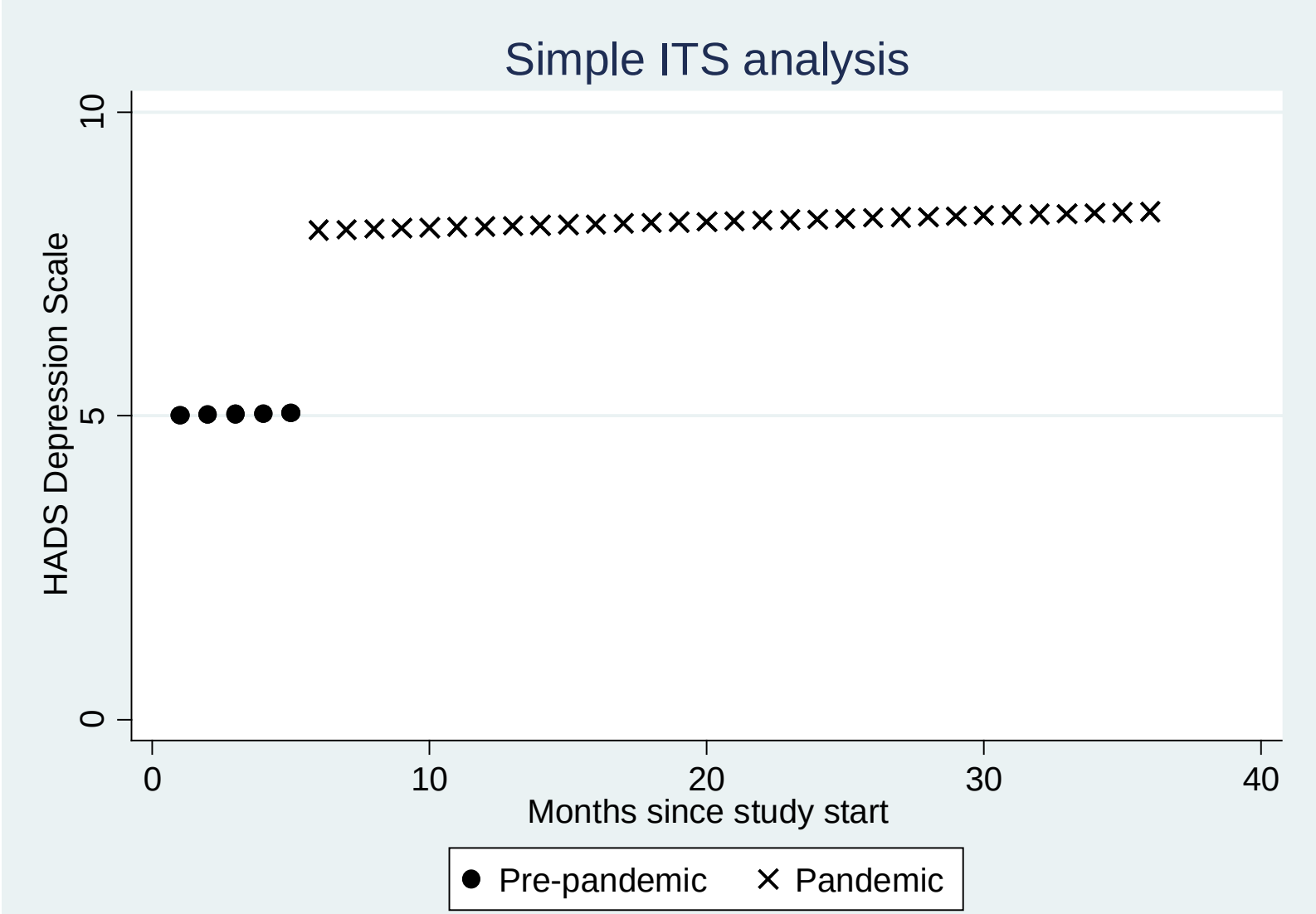


There are plenty of ongoing studies checking the impact of the pandemic. Usually using a interrupted time series design.

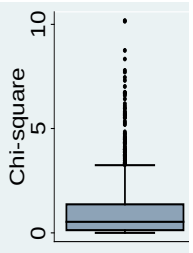
- Is the pandemic increasing premature birth rates?
- Is the pandemic reducing the number of prenatal care visits in usual care?

Interrupted time series





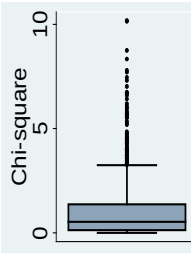
Interrupted time series



The analysis of an interrupted time series design is conceptually simple:

- Include a secular trend (time).
- Include a sharp change at the time of the interruption (pre/post interruption).
- Test significance of the sharp change.

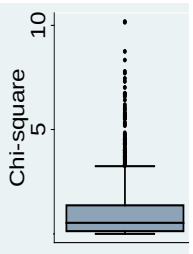
Pandemic effects

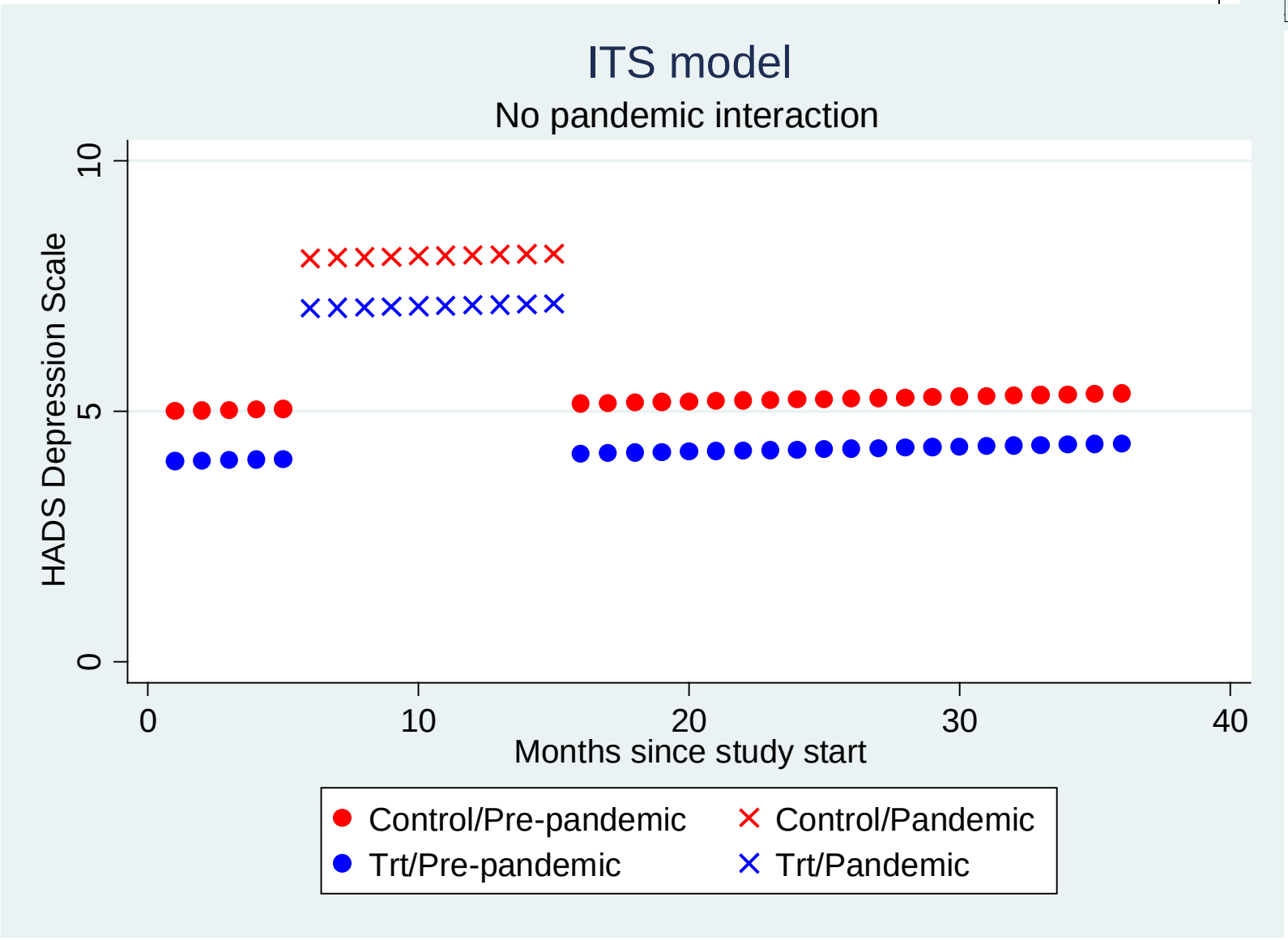


The same strategy may work to *remove* pandemic effects:

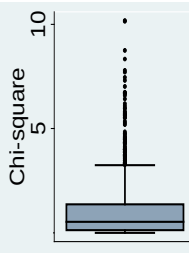
- Include a secular trend if you have a sufficiently long period of study.
- Include a sharp change at the time of the interruption (pre/post interruption).
- BUT - focus on the effects of the intervention, not the pandemic.

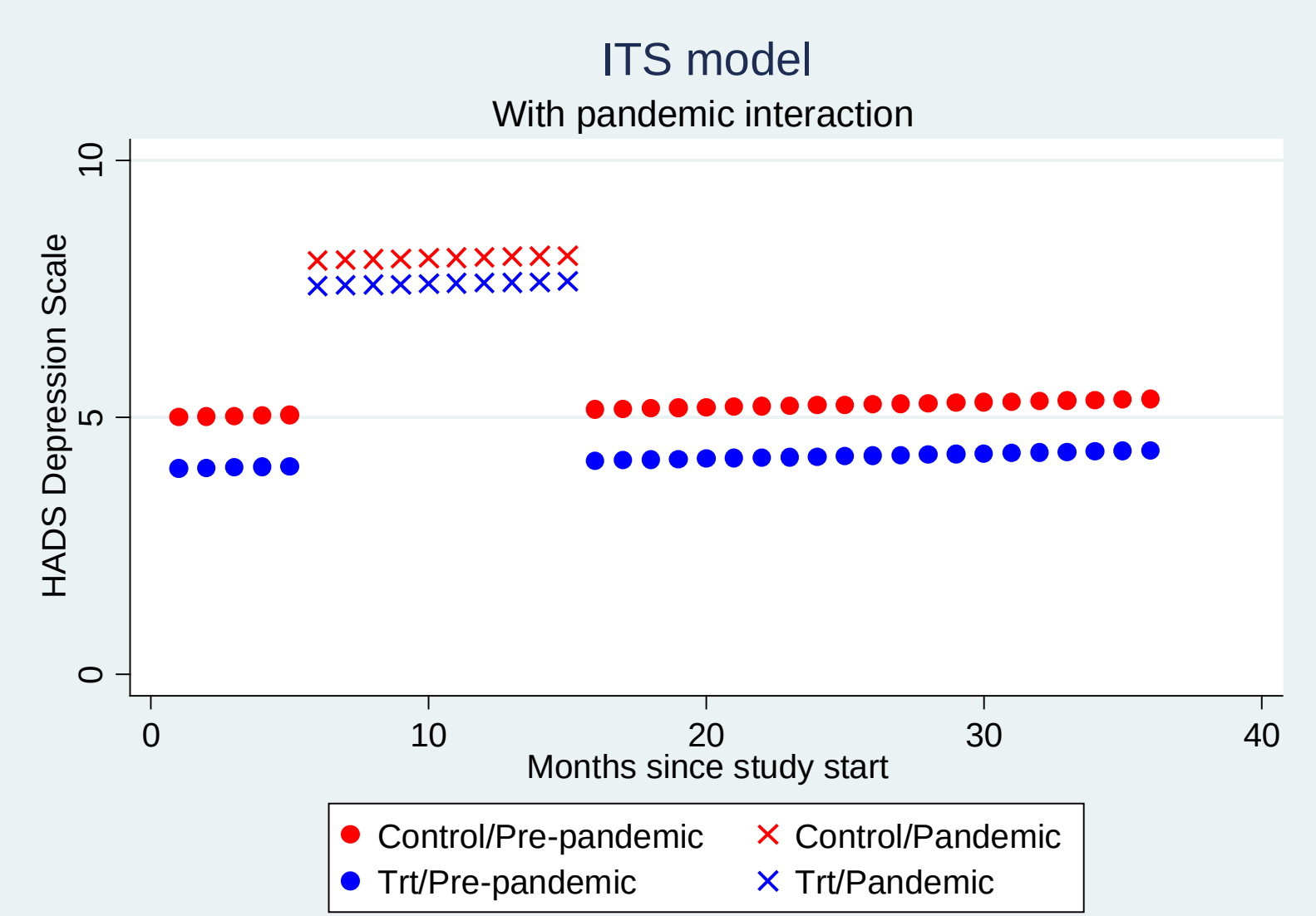
Pandemic effects



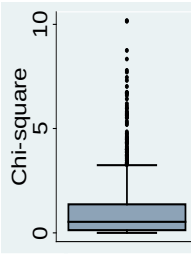


Pandemic effects





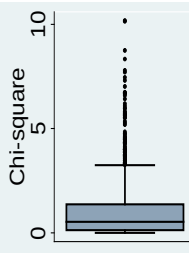
To pool or not to pool



Wise to check to see if the size of the intervention effect is stable during as compared to not during the pandemic:

- Allow the effects to be modified during the pandemic by including an interaction of the pandemic effect and the intervention.
- Can test for effect modification.
- Because interaction tests often have low power, be liberal and consider effect sizes.

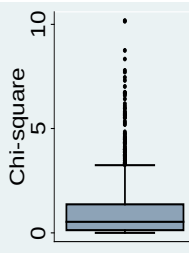
Pooling

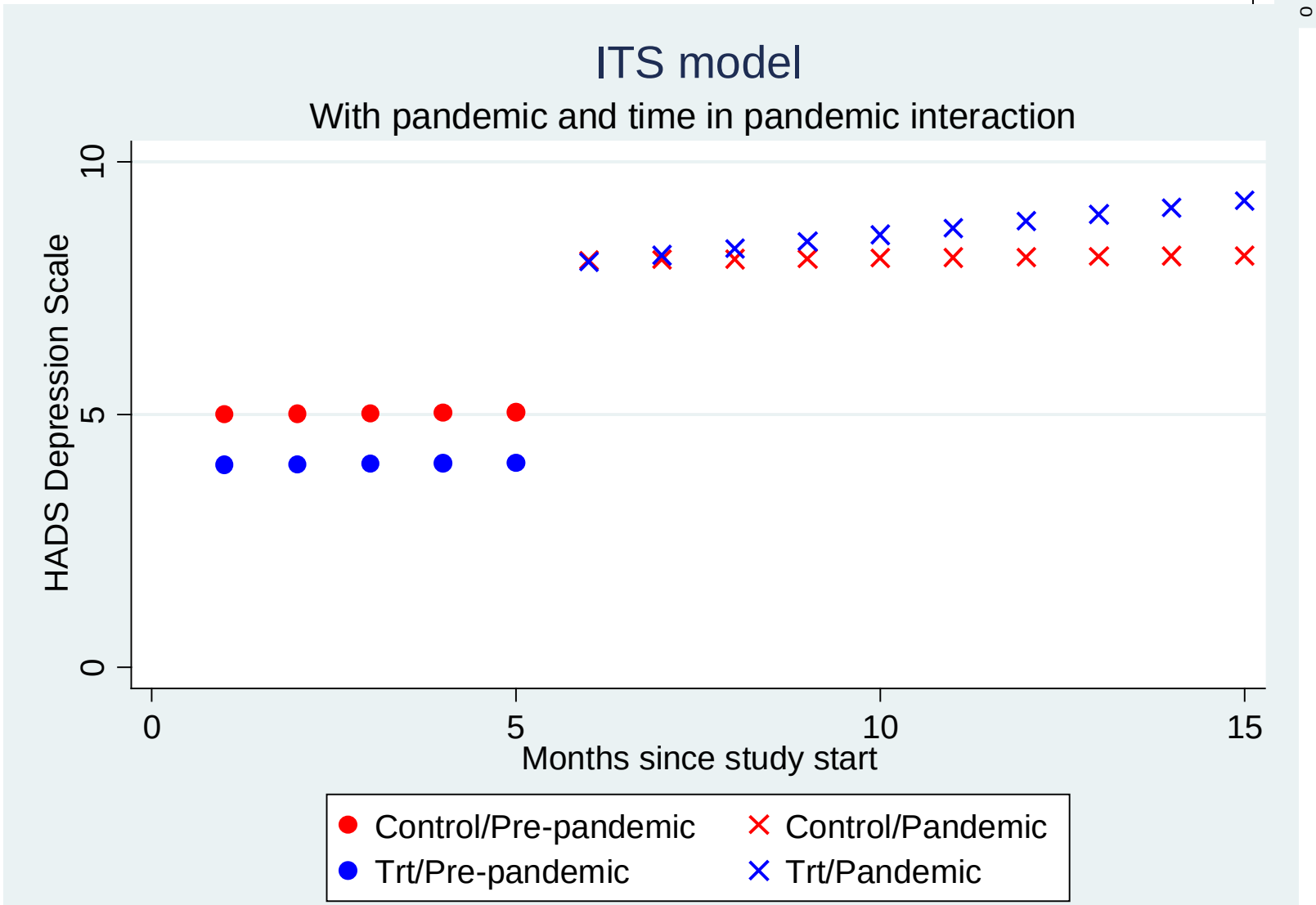


Start with the highest order interaction terms and remove them one by one (where appropriate) as Tor plans in Duo PACT.

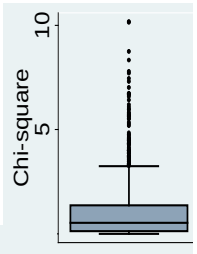
If there does not appear to be effect modification: By dropping interaction terms between pandemic terms and the intervention, the model will estimate pooled effects.

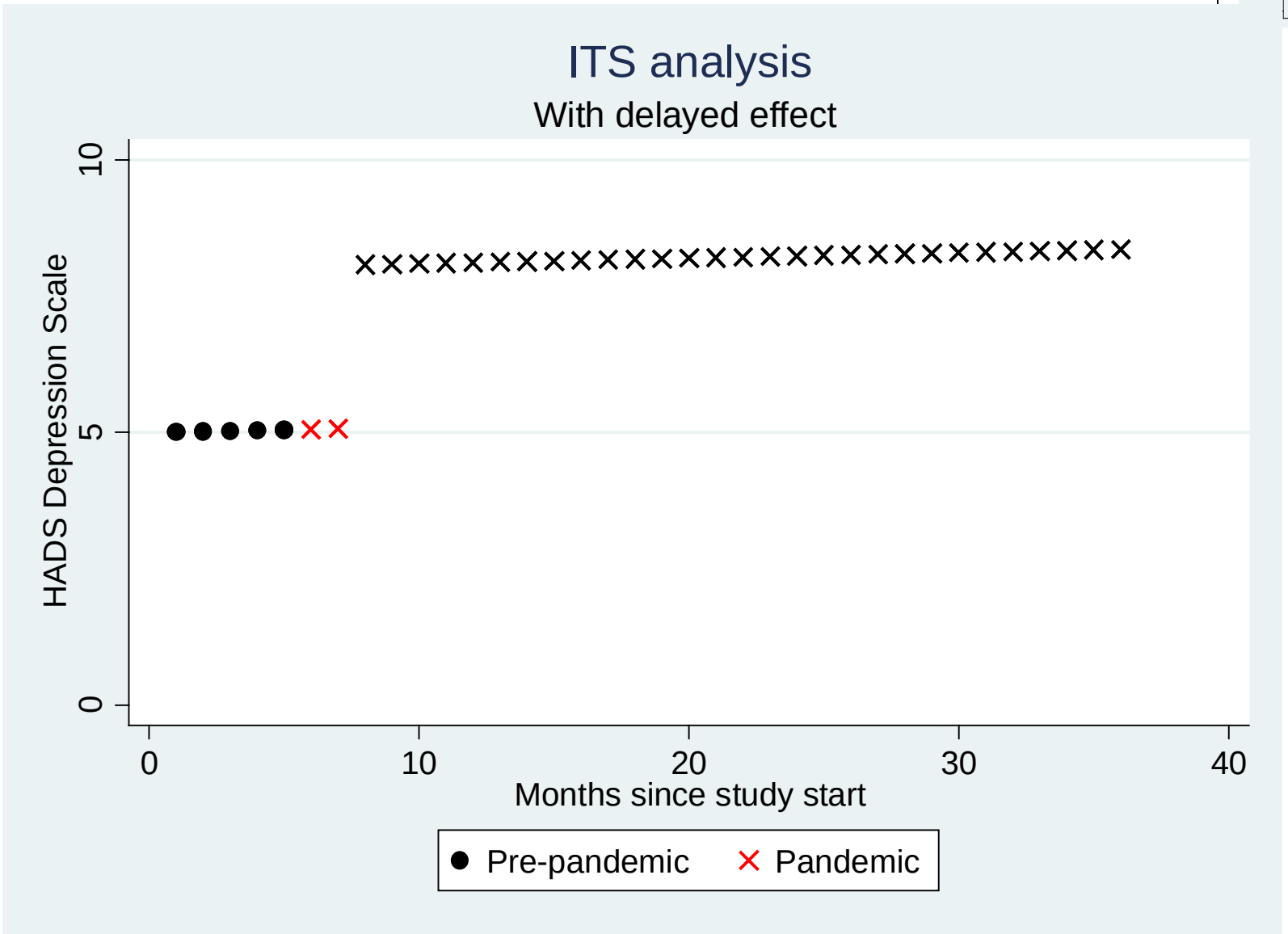
Some caveats – higher order interaction



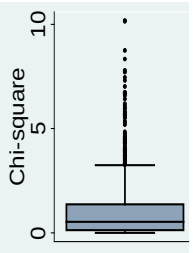


Some caveats – delayed effect



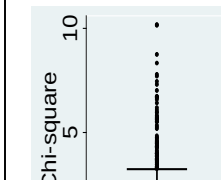


This will not always work



- Extreme situation: all pre-intervention are pre-pandemic and all post-intervention are pandemic.

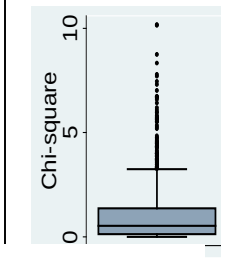
This will not always work



How will I know in more complicated situations?

- Try fitting higher order interactions, look for “non-estimable” [SAS/Stata] or “(empty)” [Stata]
- This indicates the design will not support full assessment of pandemic effect and interactions.
- Look for drastic increases in standard errors and wide confidence intervals (barely support) with inclusion of interaction terms.
- CYFNS
- (Consult your friendly neighborhood statistician)

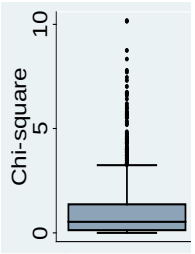
This will not always work



Another alternative when there are a small number of rigidly scheduled visits (e.g., baseline, 6 months, 12 months).

- Define all possible follow-up patterns by pandemic/not. For example: baseline/pre-pandemic, 6m/pandemic, 12m/pandemic. (There may be as many as 2^T patterns with T visits, e.g., $2^6 = 64$ with 6 visits).
- Assess interactions with pattern instead of ITS pandemic terms.

Summary



- Interrupted time series concepts can be used to model pandemic effects.
- That can be used to remove pandemic effects from ongoing studies.
- This will work best when you have sufficient data pre and during pandemic to allow comparisons so you can check for effect modification. Otherwise the results hinge crucially on model assumptions.
- In the absence of effect modification you can pool data to get a combined estimate.
- Be prepared to do sensitivity analyses for both pandemic effects and (Tor) missing data.