4. Study Design Challenges and Data Sources for Economic Analysis

Measuring value using an economic framework that considers the societal perspective is critical to the long-term success of innovative technology-enabled care models and patient-centric, value-based care. Value has two components: 1) quality, which includes health outcomes; and 2) cost of care. Most investigators are comfortable measuring changes in health outcomes but are less familiar with how best to capture a change in cost of care. There are three important considerations when measuring the economic cost of care for children:

1) the cost of care delivered by your hospital or clinic may be only the "tip of the iceberg"; there may be other costs to patients, payers, transport organizations, other health systems, etc.
2) measuring the reimbursement or charges for the care is less important that measuring the major resources used to deliver care (the cost drivers); and
3) pediatric patients tend to have very large variation around their mean cost of care, so a large sample size may be needed to identify statistically significant cost differences.

<u>Potential Data Issues to Consider If Using Single-Source Billing Data to Measure Economic Cost of Care:</u>

- Program-specific billing records will have bias due to missed events (i.e., children often get care from many providers that may not be recorded in your program's databases).
- Pre-intervention billing data may be biased for multiple reasons: patients/subjects were younger with different physiology/pathophysiology in the pre-intervention period, their diseases had not yet progressed, their access to care (or insurance coverage) was different causing them to look "cheaper" or "more expensive" in the pre-intervention period, or the intervention started at or near birth with no pre-birth cost data.
- High health care utilization (i.e., high cost) for medically complex patients is subject to "regression towards the mean" (Welch, 1985; Finkelstein et al, 2020), and this must be accounted for in all observational economic studies. In a randomized, controlled trial this factor is mitigated by having a comparison group of patients who did not get the treatment. When a RCT is not feasible or appropriate, the choice of comparison group or comparison time period can affect the validity of the results.
- Anecdotal evidence indicates that children, particularly those with medical complexity and/or those who have been experiencing poor access to comprehensive care, can have a cost "bump" before cost saving are seen when they receive a new intervention. This is associated with better access to care rather than the intervention in isolation. Thus, the time period needed to measure a telehealth intervention's effect on cost is likely greater than that needed to measure a health benefit.

These issues can derail economic analysis unless we explicitly plan to overcome them. Fortunately, modern study design and available archival data on cost drivers can help. For example, a quasi-experimental design, such as a propensity-score matched pre-post cohort study with a well-matched control population will help control for biasing factors. Further, if costs are estimated using a source such as all-payer state billing data or a combination of data sources that contain all events for major cost drivers (e.g., ED visits, hospital admissions and outpatient surgeries), we improve our ability to control the biases associated with measuring cost for children with complex chronic conditions. If these potential biases cannot be mitigated through study design or data sources, it is essential to acknowledge them as limitations and estimate their impact on results.

4. Study Design Challenges and Data Sources for Economic Analysis

Recommendations:

1) Identify all cost drivers of interest in the study design phase and ensure that cost data is obtained from sources that adequately reflect them.
2) If using a pre/post study design, exclude patients for whom you cannot get cost data in a 12-month pre-intervention period (these subjects require a different approach not discussed here).
3) If using archival data from other sources such as a state all-payer database, construct a "Finder File" which contains patient characteristics at baseline (e.g. data of birth, sex, race, first and last name, address, date range for which you want cost data) which you can send to the archival data organization. This will ensure that your data query yields accurate data for the correct patient cohort.
4) When requesting claims data, realize that these data may not be finalized and completely available until 6-12 months after the date of service so please be patient).
5) When pulling data from billing or claims databased, also ask for an age-sex-race-matched control group of children not in your program/intervention cohort. This group should ideally be five times larger than your intervention group size to be sure that you can achieve adequate propensity score matches.
6) Secure the assistance of an experienced billing data user/analyzer – biostatisticians who primarily do research on health outcomes do not necessarily have this skill set, although some may. This person will be responsible for the construction of the baseline matching variables, propensity-score matching of the intervention and control populations, construction of your resource use and cost variables, and performance of the multivariable modeling required for analysis of the data. They should be able to lead or support the writing up of your Methods and Results sections in the final program report.

If you follow these recommendations, then it is highly likely that you will be able to find cost differences, as long as you 1) have adequate power (sample size) to detect a cost difference (Dooley et al, 2021), and 2) your cohort has been exposed to the program benefits for a sufficiently long time period to get beyond the "bump" in increased costs usually associated with providing care to underserved patients.

To find contact information for your state's archival data organization, a good source is the AHRQ website for State Inpatient and ED data bases. Many states share their de-identified data with AHRQ as part of the Healthcare Cost and Utilization Project (HCUP). The HCUP data sets are incredibly valuable for all types of cost analyses. Their Data Use Agreements do not allow (and their identifiers do not enable) you to link your patients to their data, but they do provide a list of contacts to the data organizations that deliver their raw data sets. These are the contacts in your state that can assist you in accessing the data that can be linked to your patient records. On the AHRQ website, look for the State Inpatient Data (SID) at https://www.hcup-us.ahrq.gov/db/state/siddbdocumentation.jsp (accessed 5/4/2022), and then search for the **Data Organizations Participating in the SID**. The current link for state-specific contact information is: https://www.hcup-us.ahrq.gov/partners.jsp?SID#AK (accessed 5/4/2022) however, the website is updated regularly, so you may have to search for the latest link.

In summary, using standardized measures and methods for economic evaluation of individual telehealth programs enable us to generate impactful, evidence-based economic studies. This synopsis describes the basic issues and steps need for good economic studies. This type of research is truly "team science" so make sure that your team includes input from clinicians, program staff, parents, and other stakeholders, as well as analytical experts with the skills to manage the required programming and data analysis.

References:

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