Strengths and Limitations of Different Costing Approaches used for Hospital Budget Impact Models: Application to Imaging Guidance in LAAO Procedures

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Background & Objective

- Clinical guidelines support left atrial appendage occlusion (LAAO) as a safe and effective alternative for non-valvular atrial fibrillation patients at high risk for stroke with contraindications to oral anticoagulants.[1,2]

- Standard of care imaging guidance for LAAO procedures consists of transesophageal echocardiography (TEE) under general anesthesia (GA). However, TEE is not always feasible either due to contraindications to TEE itself or to GA.

- Intracardiac echocardiography (ICE, 2D and 3D) is an emerging technology for imaging guidance for LAAO and addresses these limitations of TEE (**Figure 1**).

Figure 1: Philips VeriSight Pro ICE Catheter

- Routine ICE-guided LAAO has demonstrated similar outcomes and hospital costs compared with TEE-guided LAAO.[3]

- Assessing the budget impact of ICE versus TEE will clearly communicate the economic value and relevant cost-offsets to key hospital decision-makers.

- While hospital budget impact models (BIM) can be simpler to build than cost-effectiveness models, they can be more complicated to inform given challenges with data availability, varying decision-maker perspectives, and complexities around interpretation of costs, charges, and reimbursement.

- **Therefore, the objective of this study is to evaluate the strengths and weaknesses of two costing approaches used for economic evaluation related to image guidance in LAAO procedures.**

Methods

- **Study Design:** We conducted a comparative analysis of two costing approaches: 1) bottom-up and 2) top-down, for estimating the budget impact of two imaging techniques, TEE and ICE, for guiding LAAO procedures. This study compares the strengths and limitations of each approach in terms of their ability to accurately estimate costs.

- **Model:** The data from the two costing approaches were compared using an interactive dashboard BIM built using Microsoft Excel from a United States (U.S.) hospital purchaser perspective. The BIM included a list of relevant model inputs required for TEE and ICE including procedure costs, number of complications, hospital length of stay, procedure time, and professional fees (**Table 1**).

- **Data Sources and Costing Approaches:** The bottom-up approach used published literature, including meta-analyses and observational studies. The top-down approach used the U.S. Premier Healthcare Claims Database, which houses data on inpatient and outpatient hospital visits for various procedures.[4-5]

- **Outcomes:** Strengths and limitations of each costing approach were assessed using the two data sources.

Table 1: Procedure resources included in BIM

Resource	Model Input Example
Imaging Devices	Cost and type
Room time	Procedure time
Supplies	Procedure supplies (e.g., guidewire, LAAO implant)
Pharmacy	Clinical pharmacy costs
Hospital stay	Overnight versus same-day discharge costs
Complications	GA-related adverse effects
Professional fees	Anesthesiologist fees

Results

- When using published data, key strengths included ease of accessibility and the ability to ensure data are relevant to the comparators; limitations included the inability to disaggregate some cost data and challenges with combining the data sources across different studies.

- Using claims data ensured one overall costing source for TEE and ICE and that all relevant hospital costs could be included; challenges included the need to adjust for potential confounders and ensuring data were specific to the comparators and procedures of interest.

- Additional examples of strengths and limitations of bottom-up (left) and top-down (right) costing approaches are presented in **Table 2**.

Table 2: Strengths and Limitations of Bottom-Up and Top-Down Costing Approaches

Bottom-Up Approach (Published Literature)	
Strengths	**Limitations**
Ease of accessibility as many articles are open-access and easily available online.[4]	Inability to disaggregate some cost data.[6]
Ability to ensure data are specific to the procedure of interest and relevant for each comparator included in the analysis.[6]	Time-consuming and challenging to combine data sources across studies due to different patient populations and the high variability of values.[4]
May be more accurate and useful for several decision problems as specific data can be sourced.[4]	Costs may be unavailable for certain procedure resources of interest (e.g., GA-related complication costs per event).[7]
Granular costing process allows for more accurate cost estimations and more resources to be included.	May not be reflective of the patient's journey or patient population.[8]

Top-Down Approach (Premier Database)	
Strengths	**Limitations**
Data is readily available from one overall costing source, making the approach more accessible.[4]	There is a need to adjust for potential confounders to ensure study results and conclusions are not biased.[9]
Data can be disaggregated to facilitate subgroup analysis across a wide range of therapeutic areas and products/devices (e.g., age, sex).[5,10]	Specific data may not be available for all comparators and the procedure of interest (e.g., LAAO with conscious sedation versus GA, 2D versus 3D ICE catheter).[7]
Additional costs at the hospital encounter level are available that may not be accounted for in the literature, facilitating comprehensive cost estimations.[5]	Costs can vary substantially between individual patients; therefore, cost estimates may not be reflective of a patient's journey and/or the patient population.[11-12]
Ability to determine the exact line items billed from the hospital encounter, allowing for transparency and minimizing double counting of costs.	Rigorous programming and statistical analysis is required to design and execute this costing approach.

Discussion & Conclusions

Using more than one costing approach (e.g., literature versus claims data) can help validate predictions for a hospital BIM as each approach can have its own strengths and weaknesses.

When presenting a BIM to a hospital decision-maker, it is essential to have well-informed default values to facilitate understanding and local adaptation.

References   **1.** January 2019 *J Am Coll Cardiol.* 74(4):599. **2.** Kirchhof 2016 *Europace.* 18(11): 1609-1678. **3.** Alkhouli 2020 *JACC: Clin Electrophys.* 6(4): 393-400. **4.** Mogyorosy 2005 *HealthBasket.* **5.** Premier Applied Sciences 2020. *PremierInc.com.* **6.** Hemam 2019 *Heart Rhythm.* 16(3): 334-342. **7.** Freitas-Ferraz 2020 *JACC.* 75(25): 3164-73. **8.** Villablanca 2018 *Catheter Cardiovasc Interv.* 91(2): 330-342. **9.** Skelly 2012 *Evid Based Spine Care J.* 3(1): 9-12. **10.** Pan 2015 *J Thromb Thrombolysis.* 39(4): 508-515. **11.** Edbrooke 1997 *Intensive Care Med.* 23(6): 645-650. **12.** Edbrooke 1999 *Anaesthesia.* 54(2): 110-120.

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