INTRODUCING TIME-DRIVEN ACTIVITY-BASED COSTING IN CHILE: MEDIUM COSTS ESTIMATION OF BREAST CANCER BIOPSIES IN A PUBLIC ANATOMIC PATHOLOGY LABORATORY

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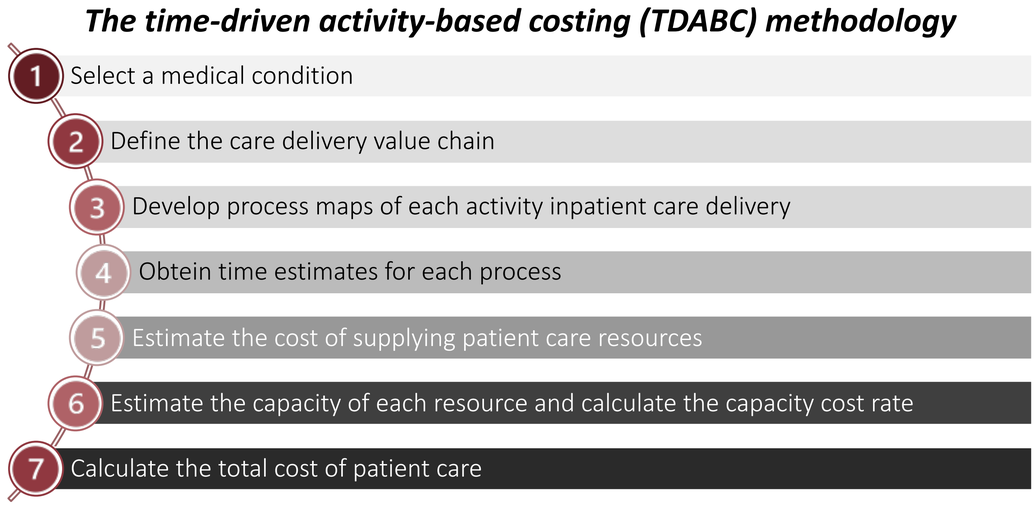
Background & Objectives:

- No local cost studies have been conducted in Chile to estimate medium costs of breast cancer biopsies in the public sector.
- Immunohistochemical studies and Hematoxylin and Eosin staining Histopathological Study experimented an expansion during 2010-2021 period, increased 379.4% and 19.1%, respectively, in relation to in echography and mastectomy rates.
- In a local context demanding increased biopsy rates, it is urgent to elucidate the impact of this activity in public laboratories, considering relevant cost drivers.

Methods:

- We conducted a **Time-Driven Activity-Based Costing (TDABC)**[1,2] in a public laboratory responsible for processing 8.8% of national breast cancer intraoperative biopsies (IB).
- A comprehensive Business Process Management Notation diagram was constructed to represent activities and processing times. Biopsies were broken into pre-analytic, analytic, and post-analytic stages.
- We considered these biopsy types: IB, Hematoxylin and Eosin staining (H&E), and Immunohistochemical study (IS).
- Direct (human resources (HR), equipment, and supplies) and Indirect costs were estimated.
- Turn-Around Time (TAT) indicator was calculated.

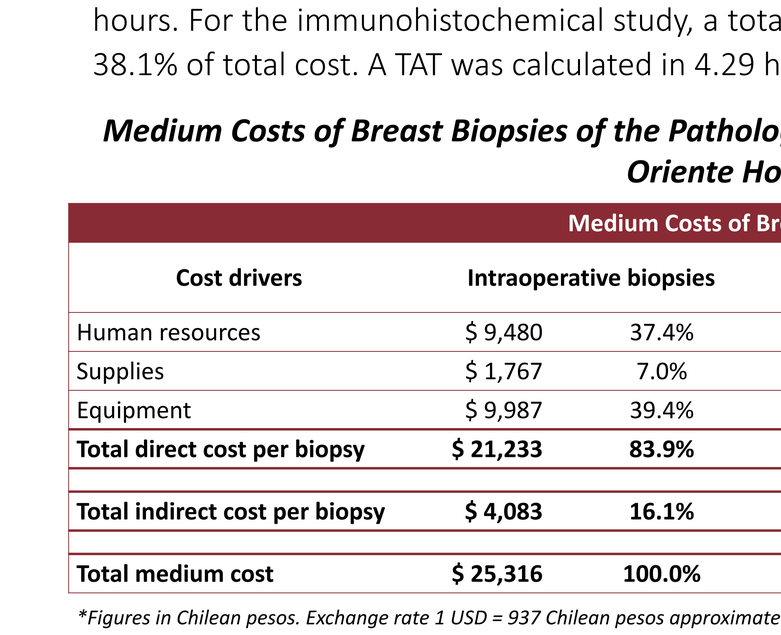
The time-driven activity-based costing (TDABC) methodology



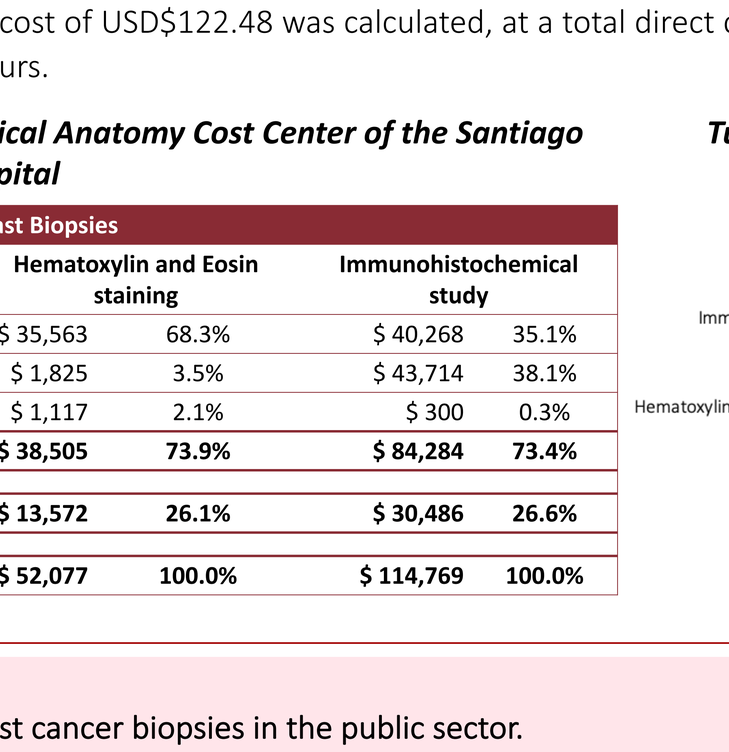
References:
[1] R. Kaplan; S. Shehab. the Time-Driven Activity-Based Costing Project Starter Kit. Harvard Bus Sch 2020;:1–15.
[2] Robert S. Kaplan, Steven R. Anderson. Time-Driven Activity-Based Costing. harvard bussiness Rev 2004.https://hbr.org/2004/11/time-driven-activity-based-costing (accessed 2 Jun 2021).

Results: Firstly, the processing of breast biopsies in the pathology department of the Santiago Oriente Hospital was selected as a case study. A process map was developed from the value chain for the entire process and by type of biopsy. Finally, the resources and their capacity to calculate the total costs associated with the process were estimated, as shown in the attached graphs.

General flowchart of the processing of breast biopsies



Flowchart example: "Analytic Stage of processing Hematoxylin and Eosin staining (H&E) breast biopsies"



Cost table example: "Human resources, supplies and equipment of the analytic stage of processing Hematoxylin and Eosin staining (H&E) breast biopsies"

Human resources / Event	Professional	Use rate	Remuneration per hour	Time (minutes)	Remuneration per minute	Total HR
Reception and control	Pathologist	1	$ 29,506	2	$ 492	$ 984
Rejection of samples (return to macroscopy)	Pathologist	0.01	$ 29,506	1	$ 492	$ 5
Microscopic diagnosis	Pathologist	1	$ 29,506	15	$ 492	$ 7,377
Internal pathologist support	Pathologist	0.025	$ 29,506	15	$ 492	$ 184
External pathologist support	Pathologist	0.025	$ 29,506	15	$ 492	$ 184
				HR	18	$ 182	$ 8,734

Supplies	Event	Use rate	Coverage	Unit of measurement	Unit cost	Purchase unit	Purchase quantity	Purchase price	Conversion unit	Total Supplies
Batch inputs:										
Immersion oil	Microscopic diagnosis	1.05	100%	1 Portaobjetos	$ 49	Botella 500ml	1	$ 23,300	500	$ 142
Procedure gloves	All	1	100%	1 Par	$ 2	Caja 500 pares	500	$ 5,000	0.2	$ 150
									Supplies	$ 292

Equipment	Event	Use rate	Purchase price	Useful life (years)	Equipment annual value	Performance per year	Hours of operation per day	Total Equipment
Microscopio óptico de campo claro BX41	Microscopic diagnosis	1	$ 2,250,000	5	$ 450,000	22,221	9	$ 20
							Equipment	$ 20

**Figures in Chilean pesos. Exchange rate 1 USD = 937 Chilean pesos approximately.*

- **All biopsies ranked in a similar indirect versus direct cost distribution; however, direct costs varied per type**. Intraoperative biopsies resulted in a medium cost of USD$27.01 -per biopsy- at an indirect cost of USD$4.36 (16.1%) and a direct cost of USD$22.66. Out of medium cost per intraoperative biopsies, equipment explains 39.4%, HR 37.4%, and supplies 7.0%. Intraoperative biopsies showed a TAT of 0.6 hours. H&E resulted in a medium cost of USD$58.7, for which indirect cost (26.1% equal to USD$14.48) and human resources in direct costs (68.3% equivalent to USD$37.95) were the most impactful costs drivers. Its TAT was 36.91 hours. For the immunohistochemical study, a total cost of USD$122.48 was calculated, at a total direct cost of USD$89.95 (73.4%), out of which supplies explain 38.1% of total cost. A TAT was calculated in 4.29 hours.

Medium Costs of Breast Biopsies of the Pathological Anatomy Cost Center of the Santiago Oriente Hospital

Medium Costs of Breast Biopsies						
Cost drivers	**Intraoperative biopsies**		**Hematoxylin and Eosin staining**		**Immunohistochemical study**	
Human resources	$ 9,480	37.4%	$ 35,563	68.3%	$ 40,268	35.1%
Supplies	$ 1,767	7.0%	$ 1,825	3.5%	$ 43,714	38.1%
Equipment	$ 9,987	39.4%	$ 1,117	2.1%	$ 300	0.3%
Total direct cost per biopsy	**$ 21,233**	**83.9%**	**$ 38,505**	**73.9%**	**$ 84,284**	**73.4%**
Total indirect cost per biopsy	**$ 4,083**	**16.1%**	**$ 13,572**	**26.1%**	**$ 30,486**	**26.6%**
Total medium cost	**$ 25,316**	**100.0%**	**$ 52,077**	**100.0%**	**$ 114,769**	**100.0%**

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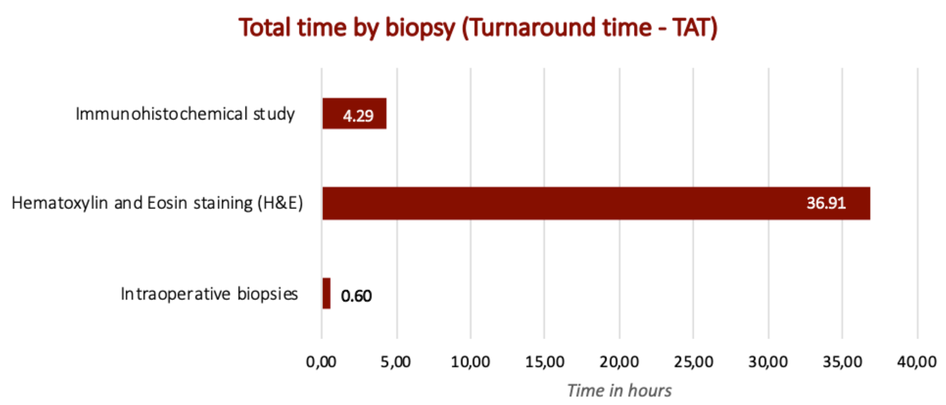
Turnaround time – TAT of breast biopsies at the Santiago Oriente Hospital



Conclusions:

- This became the first TDABC study in Chile in breast cancer biopsies in the public sector.
- **Biopsy costs varied per type and by cost driver.** Higher direct costs were observed in intraoperative biopsies, versus H&E and IS which had a similar proportion of direct and indirect costs. HR are higher in H&E (68.3%, versus 37.4 - 35.1% in IB and IS, respectively). IS has a higher proportion of supplies cost (38.1%, versus 7.0 – 3.5% in IB and H&E, respectively). TAT was 265% greater in H&E than the average of the biopsies studied.
- Particular attention should be paid to innovation in adopting new technologies to accelerate processing times and workflow due to its cost impact.