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# Micro-Costing: A Deceptively Simple Method for Estimating the Costs of Deploying Implementation Strategies and Evidence- Based Interventions

**ACCORDS Sustainability, Value, and Cost Seminar Series**

January 25<sup>th</sup>, 2021

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# My Background

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- PhD Economics – Corporate Finance & Industrial Organization
- University of Auckland, New Zealand – Public Health System Economics
- Palo Alto Medical Foundation Research Institute – Primary Care
- Fred Hutchinson Cancer Research Center – Cancer Care, Community Pharmacy

# Learning Objectives

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- Understand what is micro-costing, why is micro-costing data important, and what type of studies include micro-costing.
- Understand common types of micro-costing data collection tools.
- Learn about the strengths and limitations of three approaches to implementation strategy cost assessment based on micro-costing.
- Recognize the limitations of micro-costing and directions for future methodological development.

# Micro-Costing to Assess Healthcare Intervention Costs

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- “Direct enumeration and costing out of every input consumed in the treatment of a particular patient.” *(Neuman, 2016, Second Panel of CE)*
- Enumerating each input used in the process of developing, implementing, operating, and delivering the EBI, assigning a cost to each input, and adding the costs. *(Wang, 2019)*
- “In micro-costing, a cost is derived for each element of an intervention: staff time, supplies and medications, out-of-pocket expenses, and so on.” *(VA, 2010)*

# Micro-Costing - Most Granular, Precise Costing Method

## Spectrum of Costing Methods

### Least Precise

#### Average/Gross Costing

‘Top Down’ Approach

Based on RVUs, DRGs

- *Lump sum of funding & divide by # patients*
- *Assumes every encounter with the same code costs the same*

### Most Precise

#### Micro-Costing

‘Bottom-up’ Approach

Based on each input of the intervention

- *Account for cost variations across patient subgroups, providers, sites, contexts.*
- *Account for costing differences in scale & efficiency*
- *Preferred for costing new interventions*

# Example of a Micro-Costing Study: (Mirambeau et al., 2013)

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- **Setting:** 25-bed hospital in rural Vermont
- **Intervention:** 3-person Community Health Worker (CHW) Program
- **Study Objective:** Estimate the “fixed and variable costs of implementing the (CHW) program for one year.”
- **Costing Perspective:** hospital

# Study Results: (Mirambeau et al., 2013)

**Table 3** One-year program cost (in dollars) of CoCo team, St. Johnsbury, Vermont (October 2010–September 2011)

Personnel	Wages	Benefits	Total
Community health workers (n = 3)	106,995	40,658	147,653
Chronic integration coordinator (n = 1, 70 %)	53,475	20,320	73,795
Management leadership (n = 1, 20 %)	19,600	7,447	27,047
Volunteers (n = 2)	5,085	1,932	7,017
Subtotal	185,155	70,357	255,512
10 % overhead			25,551
Total personnel cost			281,063
Operational	Description		Cost
Start-up	CHW recruitment, furniture, computer, etc.		5,089
Direct program cost			
Office space (1,500 sf)	Rental fee		113,625
Program operation activities	Mileage, promotional material, participant transportation, education/marketing material, office supplies, utilities, IT support, etc.		16,801
Training (n = 4)	Registration fee and travel/lodging costs for attending training, conferences, networking, etc.		4,062
Total operational cost			139,577
Total program cost			420,640

# Micro-Costing Data Collection: (Mirambeau et al., 2013)

		<i>Data Collection Tools</i>	
<i>Data Collection Characteristics</i>	<i>Standardized Comprehensive Template</i>	<i>Activity Logs</i>	
<b>Tool Development</b>	1) Scanned literature to identify cost categories from previous studies of CHW 2) 2-day site visits & interviewed program staff 3) Reviewed CHW program documentation	<i>Not Reported</i>	
<b>Participants</b>	Hospital Administrator	All Program Personnel	
<b>Mode</b>	<i>Not Reported</i>	<i>Not Reported</i>	
<b>Frequency</b>	Once	Personnel recorded their time for 2 weeks in 30-min increments	
<b>Timing</b>	<i>Not Reported</i>	<i>Not Reported</i>	
<b>Data Completeness</b>	<i>Not Reported</i>	<i>Not Reported</i>	
<b>Published Tool</b>	<i>Not Reported</i>	<i>Not Reported</i>	

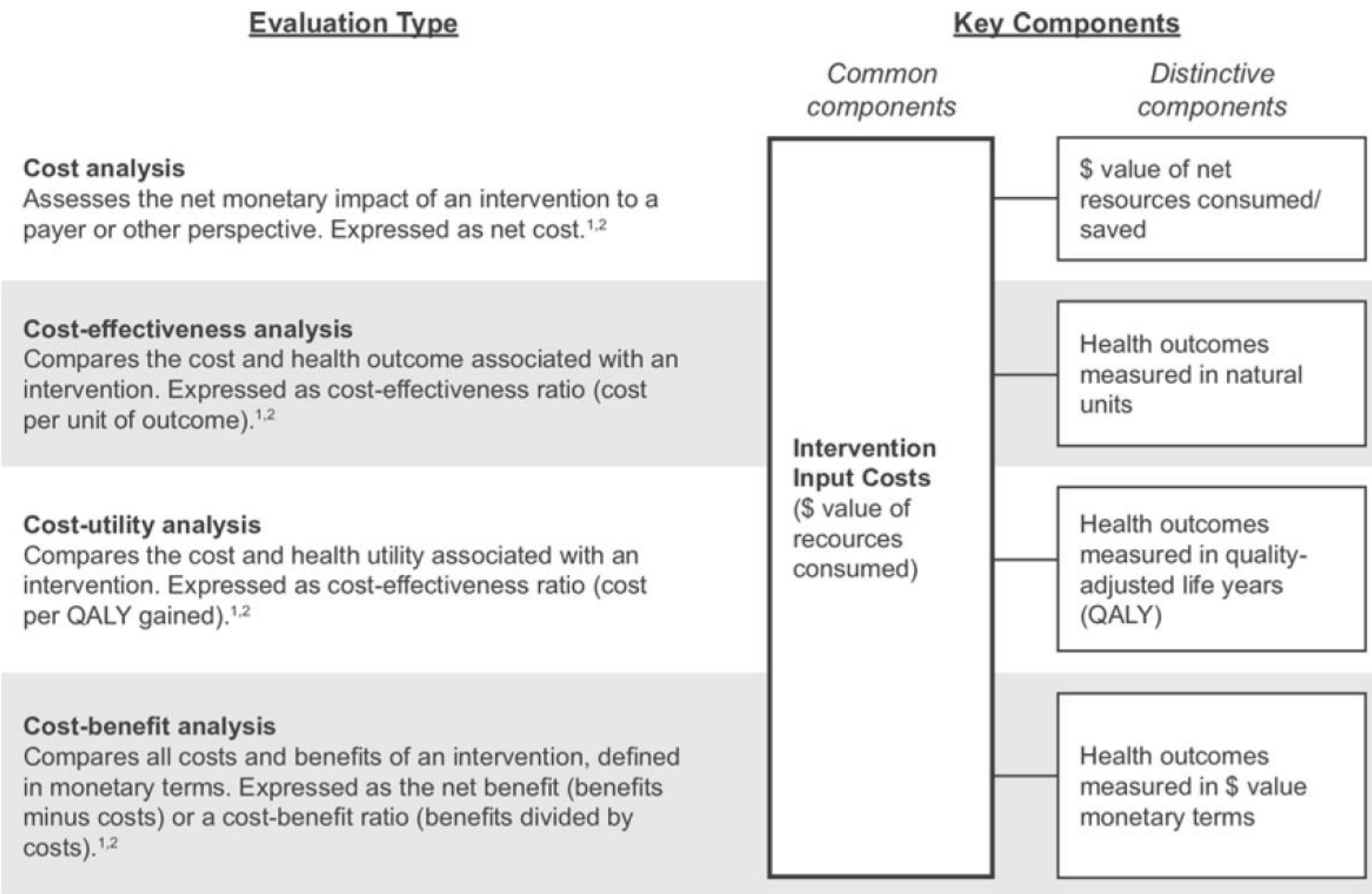


# Micro-Costing Data Sources: (Mirambeau et al., 2013)

Cost Categories*	Quantity (Data Source)	Price (Data Source)
<b>PERSONNEL</b>		
Paid personnel	Time (Activity Logs)	Wage + Benefits (Database)
Volunteers	Time (Activity Logs)	Wage + Benefits (BLS)
Administrative Overhead	% Total Personnel Costs	(Database)
<b>START UP</b>		
CHW recruitment, telephones, computers	# (Database)	Actual Prices (Database)
<b>DIRECT PROGRAM COSTS</b>		
Office space	Sq Ft (Hospital Floor Plan)	Rental Rates (Local Commercial Real Estate)
Promotional Material, Participant Transportation, Educational Material, Office Supplies, Utilities, IT Support,	# (Database)	Actual Prices (Database)
Professional Development	# Conferences (Program Records)	Conference Registration Receipts

\*From development of the Standardized Comprehensive Template

# Micro-Costs are Used in Economic Evaluations of Interventions



Reliable cost information provides the foundation of all economic evaluations – societal or healthcare sector perspective

# Micro-Costs Guide Financing Decisions of Interventions

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- **Payer Perspective** – “How much should we reimburse for a new intervention?” “How can we develop new payment models?”

## Case Study: CMS’s Oncology Care Model

- Measured the costs the additional staff to perform “between office visit” care
- Established a new **Care Management payment** of \$160 per month
- Conducted a simulation **budget impact** analysis including the **Care Management payments**

# Micro-Costs Impact Stakeholder Decisions to Adopt Interventions

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- **Healthcare Organization** – “How much will the intervention cost to implement and deliver *in our setting?*”

“Do the current payment models cover these costs?”

- **Budget impact analyses** / (ROI)

- **Providers** – “Do we have the time and resources to deliver the intervention?”

- Opportunity costs

- **Patients** – “Can my family afford this intervention?”

- Family-level **Budget impact analyses**

# Most Commonly Reported Costing Perspective: Healthcare Organization

Micro-Costing Perspective	Frequency of use (n=195 studies)*
Hospital/clinic/provider	57%
Societal	21%
Healthcare program	11%
Healthcare system	9%
Insurer	5%
Employer	1%
Other	8%

\*Critical appraisal of healthcare intervention micro-costing studies – July, 2015 (Xu, 2021)

Future micro-costing studies should consider different multi-level stakeholder perspectives

# Methodological Challenge:

## No Standardized Guideline for Micro-Costing Studies

- Current micro-costing guidelines do NOT provide sufficient detail for conducting, appraising or reporting micro-costing studies.
  - Second Panel of Cost-Effectiveness in Health & Medicine (2016, p. 218)
  - Good study protocol of a micro-costing study (Rugar, 2016)
- In our case study, what would you have changed?
  - Data Collection – Tool Development, Participants, Mode, Frequency, Timing, Data Completeness, Accuracy & Precision of Estimates
  - Sensitivity Analysis
  - Measurement of Implementation & Development Costs

# Methodological Challenge: Unstandardized Terms for “Development” & “Implementation” Costs

## Health Economics Approach – CDC

### Intervention Costs

Fixed Costs: Do not vary with the quantity of output in the short run (1 year)

#### Development Costs

- Intervention Development Planning
- Intervention Material Development

#### Start-up Costs

- Facilities & Infrastructure set-up (technology)
- Hiring costs
- Training

#### Operation costs

- Labor (benefits, administrative support, operations management, supervision, program monitoring)

Variable Costs: Vary with the quantity of output

- Labor (intervention delivery staff)
- Materials, Supplies

(Wang, 2018)

## Implementation Science Approach – NCI

### Implementation Phases for Cost Assignment based the Exploration, Preparation, Implementation, & Sustainment Framework

Exploration	Stakeholders identify a health need and the best EBP to address the health need
Preparation	Identify barriers & facilitators of implementation and develop a detailed plan
Implementation	EBP use is initiated & instantiated in the organization
Sustainment	EBP continues to be delivered & realizes a public health impact

(Moulin, 2019)

# Methodological Challenge: Unstandardized & Poorly Defined Cost Categories

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- Majority of micro-costing studies develop their own instruments & cost-categories
- Breadth, granularity, and terminology of costs varies by study
  - Should labor costs include benefits & administrative support?
  - Should management of labor or wider program support be included?
  - Should office space be included?
- What does it mean when a cost category is not included in a study?



# Methodological Challenge:

## Data Collection Can Be Costly & Burdensome

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- Data collection (direct measurement of time use) involves trade-offs between accuracy & precision vs. high research burden

### **More accurate & precision cost estimates require more research burden:**

- Stakeholder engagement
- Participant burden from self-report & direct measurement studies (e.g. more frequent measurement, longer surveys)
- Increased research timeframe & costs

# Micro-Costing Data Collection Tools: 5 Common Types

Micro-Costing Data Collection Tools	Description	Frequency of use (n=93 studies)*
1) Standardized Comprehensive Template	Collects costs for most or all aspects of an intervention. Can be generalized to be made publicly available or used for multiple studies.	31%
2) Targeted Questionnaires	Similar to Templates 1) but more limited in scope, are study specific or less formal/standardized.	34%
3) Activity Logs (Cost Diaries)	Intervention staff (study participants) prospectively to track time or materials used for intervention activities.	38%
4) Direct Observation	Trained person observes intervention processes and records time or materials used during intervention activities	10%
5) Onsite Databases or Records	Data systems housed on-site to collect resource use information specific to the site.	41%

\*Systematic review of public health & prevention intervention studies 2008-2019 (Wang, 2019)

51 (55%) studies used only 1 type of tool; 42 (45%) used  $\geq 2$  types of tools

# Micro-Costing Data Collection Tools: Strengths & Concerns

Micro-Costing Data Collection Tools	Strengths	Concerns
1) Standardized Comprehensive Template	<ul style="list-style-type: none"> <li>• Comprehensive</li> </ul>	<ul style="list-style-type: none"> <li>• Quality depends on their development process</li> <li>• Burden on stakeholders to gather the data to fill them out</li> </ul>
2) Targeted Questionnaires	<ul style="list-style-type: none"> <li>• Can learn more about implementation process</li> </ul>	<ul style="list-style-type: none"> <li>• Less generalizable across studies</li> </ul>
3) Activity Logs (Cost Diaries)	<ul style="list-style-type: none"> <li>• Can attribute self-report time to specific activities</li> </ul>	<ul style="list-style-type: none"> <li>• Burdensome to fill out resulting in missing data</li> <li>• Expanding the data collection time frame to ease burden can lower accuracy (increase recall bias)</li> <li>• Can change behavior (Hawthorne Effect)</li> </ul>
4) Direct Observation	<ul style="list-style-type: none"> <li>• 'Gold standard' of time use data</li> </ul>	<ul style="list-style-type: none"> <li>• High burden on researchers</li> <li>• Can change behavior (Hawthorne Effect)</li> </ul>
5) Onsite Databases or Records	<ul style="list-style-type: none"> <li>• Facilitates a lower burden data collection on a larger scale</li> </ul>	<ul style="list-style-type: none"> <li>• May not include useful data, particularly for new interventions</li> </ul>

\*Systematic review of public health & prevention intervention studies 2008-2019 (Wang, 2019)

# Implementation Strategy Cost Assessment based on Micro-Costing

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Three case studies to highlight state of the art & emerging methods

- **Costing perspective:** Organization
- **Micro-costing Method:** Activity Based & *Time-Driven* Activity Based
- **Implementation Strategy:** a set of *activities* that are accomplished to achieve changes in evidenced-based practice

# Two Approaches to Micro-Costing: General vs Activity-Based

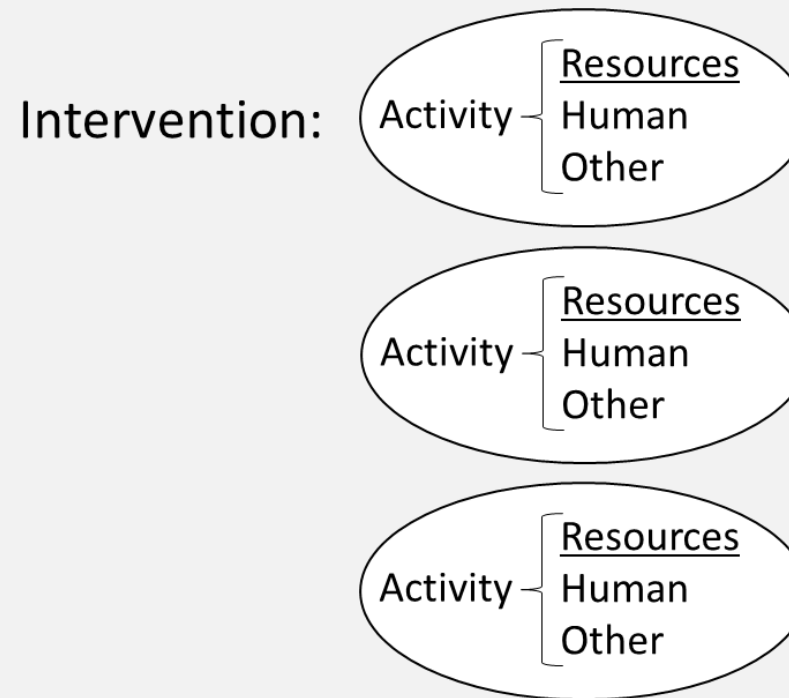
## General

1. List cost categories

Intervention  
Resources  
Human  
Other  
Other  
Other

## Activity-Based

1. Identify activities or processes of implementing & delivering the intervention
2. List the resources & costs each activity



Adds visibility to organizational processes and their costs

# Activity-Based vs. *Time-Driven* Activity-Based Micro-Costing

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**Activity-Based Micro-Costing** – relies on personnel self-report data to determine % of time spent on each activity ('activity logs')

***Time-Driven* Activity-Based Costing**-developed for machine-based production processes that record the time of each discrete, repeated activity.

WARNING: Think carefully about the accuracy & precision of *Time-Driven* Activity-Based Costing when applied to healthcare interventions & implementation strategies.

# Case Study 1: (Saldana, 2014)

	1. (Saldana, 2014)	2. (Cidav, 2020)	3. (Panattoni, 2017)
<b>Setting</b>	Counties in California & Ohio		
<b>EBP</b>	Multidimensional Treatment Foster Care		
<b>Implementation Strategy</b>	Community Development Teams vs. Implementation as Usual		
<b>Study Description</b>	Prospective, investigator led trial		
<b>Micro-costing method</b>	ABC		
<b>Innovation</b>	Developed a standardized framework of 8 'activity categories' across 3 phases of implementation		

# Cost of Implementing New Strategies (COINS) Framework

Stage of Implementation	Activity Categories*	Implementation Strategy (costs)
Pre-Implementation	1. Engagement	\$
	2. Consideration of Fidelity	\$
	3. Readiness Planning	\$
Implementation	4. Staff Hired & Trained	\$
	5. Fidelity Monitoring Process in Place	\$
	6. Services & Consultation Begins	\$
Sustainability	7. Ongoing Services, Consultation, Fidelity Monitoring, and Feedback	\$
	8. Competency	\$

\*Note: Referred to as 'Stages' in original tool



# Case-Study 1 (Saldana, 2014): Strengths & Limitations

	(Saldana, 2014)	(CIDAV, 2020)	(Panattoni, 2017)
<b>Strengths</b>	<ul style="list-style-type: none"><li>• Standardized activity categories</li><li>• Disentangle implementation from intervention costs</li><li>• Framework allows prospective planning for resource requirements</li></ul>		
<b>Limitations</b>	<ul style="list-style-type: none"><li>• Difficult to apply to strategies that do not follow a protocol– e.g. observational or retrospective studies</li><li>• Self-reported methods have unknown accuracy &amp; precision, with potentially high respondent burden</li></ul>		

## Case Study 2: (Cidav, 2020)

	1. (Saldana, 2014)	2. (CIDAV, 2020)	3. (Panattoni, 2017)
<b>Setting</b>	Counties in California & Ohio	Primary Care Practices	
<b>EBP</b>	Multidimensional Treatment Foster Care	Two psychotherapy EBPs	
<b>Implementation Strategy</b>	Community Development Teams vs. Implementation as Usual	Multi-component practice facilitation	
<b>Study Description</b>	Prospective, investigator led trial	Prospective, investigator led trial	
<b>Micro-costing method</b>	ABC	TDABC	
<b>Innovation</b>	Developed a standardized framework of 8 'activity categories' across 3 phases of implementation	Activities are sourced from a process map & specified according to (Proctor, 2013) strategy reporting requirements	

# Case-Study 2 (Cidav, 2020): *Time-Driven Activity Based Costing*

	Actions / Activities	Actors	Action Frequency*	Time Spent per Unit Action*	Total Time Spent on Action	Wage Rate	Total Activity Cost	
Strategy Name	Action 1	A	#	hours	hours	\$/hour	\$	
		B		hours	hours	\$/hour	\$	
	Phone Calls	B	30 / day	2 min / call	1 hour / day	\$40 /hour	\$40 / day	
	Action 3	A	#	hours	hours	\$/hour	\$	
		B		hours	hours	\$/hour	\$	
	<b>Total Strategy Cost</b>							<b>\$</b>

\*\*Aligned with (Proctor, 2014) strategy reporting requirements

## Key Steps:

1. Actions / Activities sourced from a process map
2. Measure Frequency & *Average* Time Spent Per Unit
3. Report non-personnel, fixed resources separately

# Case-Study 2 (Cidav, 2020): Strengths & Limitations

	(Saldana, 2014)	(CIDAV, 2020)	(Panattoni, 2017)
<b>Strengths</b>	<ul style="list-style-type: none"> <li>Standardized activity categories</li> <li>Disentangle implementation from intervention costs</li> <li>Framework allows prospective planning for resource requirements</li> </ul>	<ul style="list-style-type: none"> <li>Works well for activities that are discrete countable events</li> <li>Can reduce research burden</li> </ul>	
<b>Limitations</b>	<ul style="list-style-type: none"> <li>Difficult to apply to strategies that do not follow a protocol– e.g. observational or retrospective studies</li> <li>Self-reported methods have unknown accuracy &amp; precision, with potentially high respondent burden</li> </ul>	<ul style="list-style-type: none"> <li>Same</li> <li>Difficult to know how accurate the Average Time Spent per Unit is</li> </ul>	

## Case Study 3: (Panattoni, 2017)

	1. (Saldana, 2014)	2. (CIDAV, 2020)	3. (Panattoni, 2017)
<b>Setting</b>	Counties in California & Ohio	Primary Care Practices	Primary Care Clinic
<b>EBP</b>	Multidimensional Treatment Foster Care	Two psychotherapy EBPs	Chronic Care Management
<b>Implementation Strategy</b>	Community Development Teams vs. Implementation as Usual	Multi-component practice facilitation	Standardized Workflow – ‘Champion Chronic Care Model’
<b>Study Description</b>	Prospective, investigator led trial	Prospective, investigator led trial	Retrospective, evaluation of a health system led QI project
<b>Micro-costing method</b>	ABC	TDABC	ABC
<b>Innovation</b>	Developed a standardized framework of 8 ‘activity categories’ across 3 phases of implementation	Activities are sourced from a process map & specified according to (Proctor, 2013) strategy reporting requirements	Activities sourced from Lean management principles; Outlook Calendar metadata for personnel time estimates

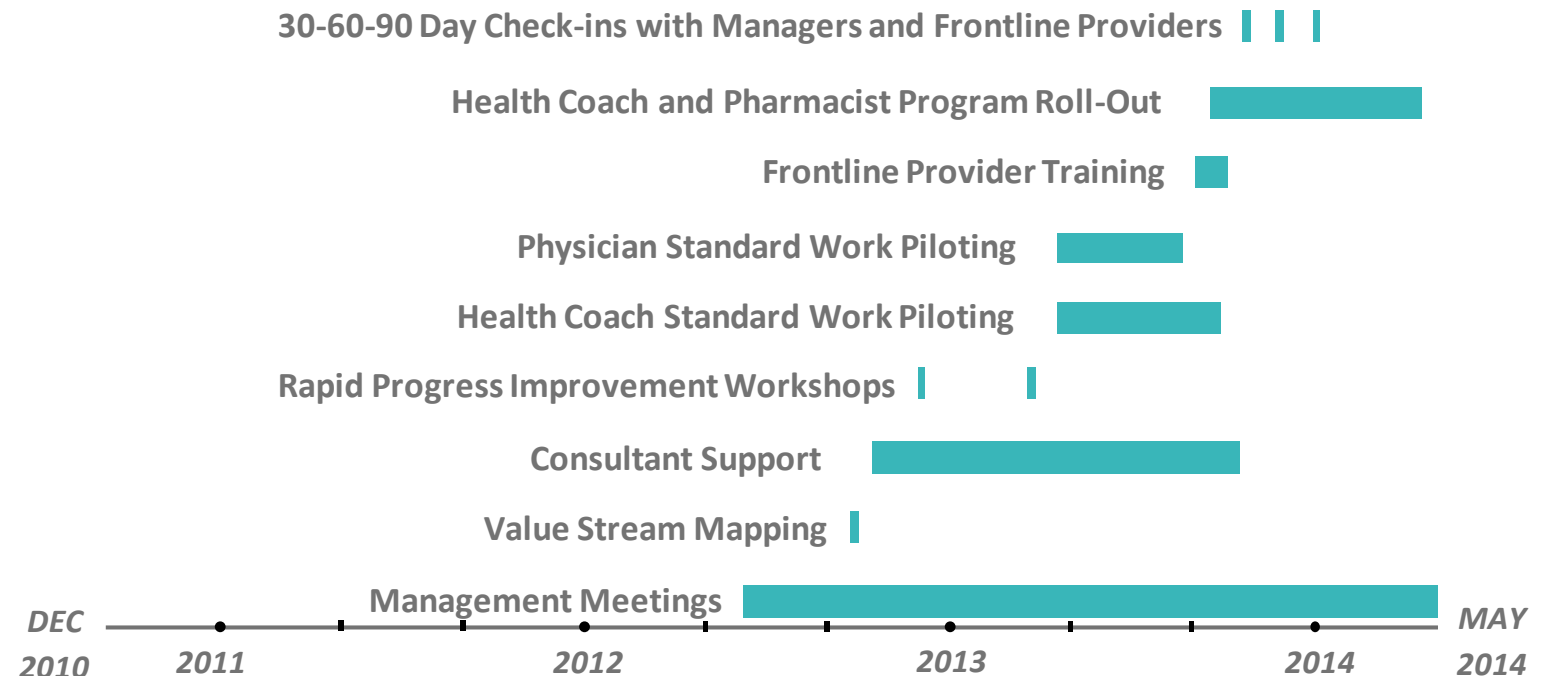
# Case-Study 3 (Panattoni, 2017): Outlook Metadata + Lean Activities

The implementation of the Champion Chronic Care Model in a single clinic cost over \$1.3 million, took over two years, & involved 169 personnel.

## Data Sources

- Microsoft Outlook® calendar data
- Budget data for employees with full time assignments (FTEs) to implementation
- Program documentation

## Lean Management Activities



# Case-Study 3 (Panattoni, 2017): Strengths & Limitations

	(Saldana, 2014)	(CIDAV, 2020)	(Panattoni, 2017)
<b>Strengths</b>	<ul style="list-style-type: none"> <li>Standardized activity categories</li> <li>Disentangle implementation from intervention costs</li> <li>Framework allows prospective planning for resource requirements</li> </ul>	<ul style="list-style-type: none"> <li>Works well for activities that are discrete countable events</li> <li>Can reduce research burden</li> </ul>	<ul style="list-style-type: none"> <li>Microsoft Outlook Metadata is routinely collected with low research burden</li> <li>Cost large health system led implementation efforts</li> </ul>
<b>Limitations</b>	<ul style="list-style-type: none"> <li>Difficult to apply to strategies that do not follow a protocol– e.g. observational or retrospective studies</li> <li>Self-reported methods have unknown accuracy &amp; precision, with potentially high respondent burden</li> </ul>	<ul style="list-style-type: none"> <li>Same</li> <li>Difficult to know how accurate the Average Time Spent per Unit is</li> </ul>	<ul style="list-style-type: none"> <li>Outlook Metadata has unknown accuracy &amp; precision</li> </ul>

# Future Directions: Standardize Guidelines for Micro-Costing Studies

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- Cost Categories – Breadth & Granularity of Costs
  - “A standardized taxonomy of costs for micro-costing data collection tools and methods used in public health and prevention science could improve the transparency of, and confidence in, intervention cost estimates.” (Wang - CDC, 2019)
- Measurement of Development & Implementation Costs
- Data Collection – Tool Development, Participants, Mode, Frequency, Timing, Data Completeness, Accuracy & Precision of Estimates
- Sensitivity Analysis



# Strengthen the Relevance of Micro-Costing Data to Stakeholders

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- Identify the cost-related barriers & facilitators relevant to health decision leaders
  - Formative analysis: “What cost-related information would you like to know?”
- Explore how micro-costs vary by multi-level stakeholder perspective & implementation phase
  - What are the costs to funders, organizations, management, providers, patients of participating in your intervention?
- Micro-costing studies (cost categories, data collection tools, & output) should be understandable by the multiple communities that use this information (researchers, funders, practices)

# Explore New Technology Driven Methods to Track Time Use

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- EHR Telemetry / Log Data – “Click Data”
- Outlook Calendar Metadata
- Smartphone/watch
  - Activity logs
  - Location data / geo-fencing

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# Thank-you

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