



Healthy Operations, Healthy Patients:

Navigating the Intersection of Operations and Cost Control in Dental Practices

Mary Papandreas

DMD Candidate, LDI Summer Fellow

Christian Terwiesch

Wharton Professor, LDI Summer Mentor

OUTLINE



SIGNIFICANCE



PROJECT OVERVIEW



AIMS



METHODS



FINDINGS



FUTURE RESEARCH



LESSONS LEARNED

Thank You!



Christian Terwiesch
PhD

- Wharton Operations & Information Management Professor
- Co-director of Mack Institute for Innovation Management
- Perelman School of Medicine Faculty
- LDI Mentor



Gursher Harika
MBA Candidate

- Director of Analytics & Strategy for Advanced Dental Brands
- Wharton MBA Candidate



Joanne Levy
MBA, MCP

- Founding Director, SUMR; Director, Student Initiatives, LDI
- Associate Director, Health Care Management and Economics PhD Program
- Healthcare Management Concentration Faculty Advisor



Margaret Yang
MS Ed.

- Director of Student Affairs and Engagement at Penn Dental Medicine



Dr. Uri Hangorsky
DDS, MS

- Penn Dental Medicine Clinical Professor of Periodontics
- Penn Dental Medicine Associate Dean for Student Affairs



The cost to both receive and provide dental care is rising, and there is a growing labor shortage in the dental workforce

Labor shortages have led to decreased access to dental care across the country

72M

People in US living in DHPSA

Certain areas of the country have more Dental HPSAs than others, namely rural areas

DHPSA have a population to provider ratio less than 5,000:1

Dental Professionals



12,288 dental professionals needed to alleviate shortage

Key Term
DHPSA: Dental Health Professional Shortage Area



Dental costs have seen historic year over year increases



\$125

Average cost of basic dental cleaning without insurance

This is a base cost assuming no further issues are found



45%

Percent of dentists worry about the financial viability of their practice

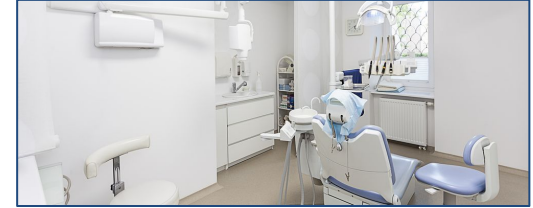
This number has steadily risen since 2021

This case study models the operations of a dental practice and identifies key drivers that impact patient flow and practice finances

Study Design

- Both quantitative and qualitative data was collected from a single dental practice that is part of a broader Dental Services Organization
- Historical CDT codes billed by the practice were used to model static demand by procedure at the dental practice
- Operational capacity was calculated using self-reported productivity metrics regarding both dentist and hygienist time per procedure per patient
- The model determines how many procedures can be done per day based on both demand and resource availability and then translates operational capacity into financial metrics using real P&L data from the practice

A **sensitivity analysis** was performed to demonstrate how **changing various operational metrics** impacted the number of patients able to be treated by the practice and ultimately the financial performance of the practice



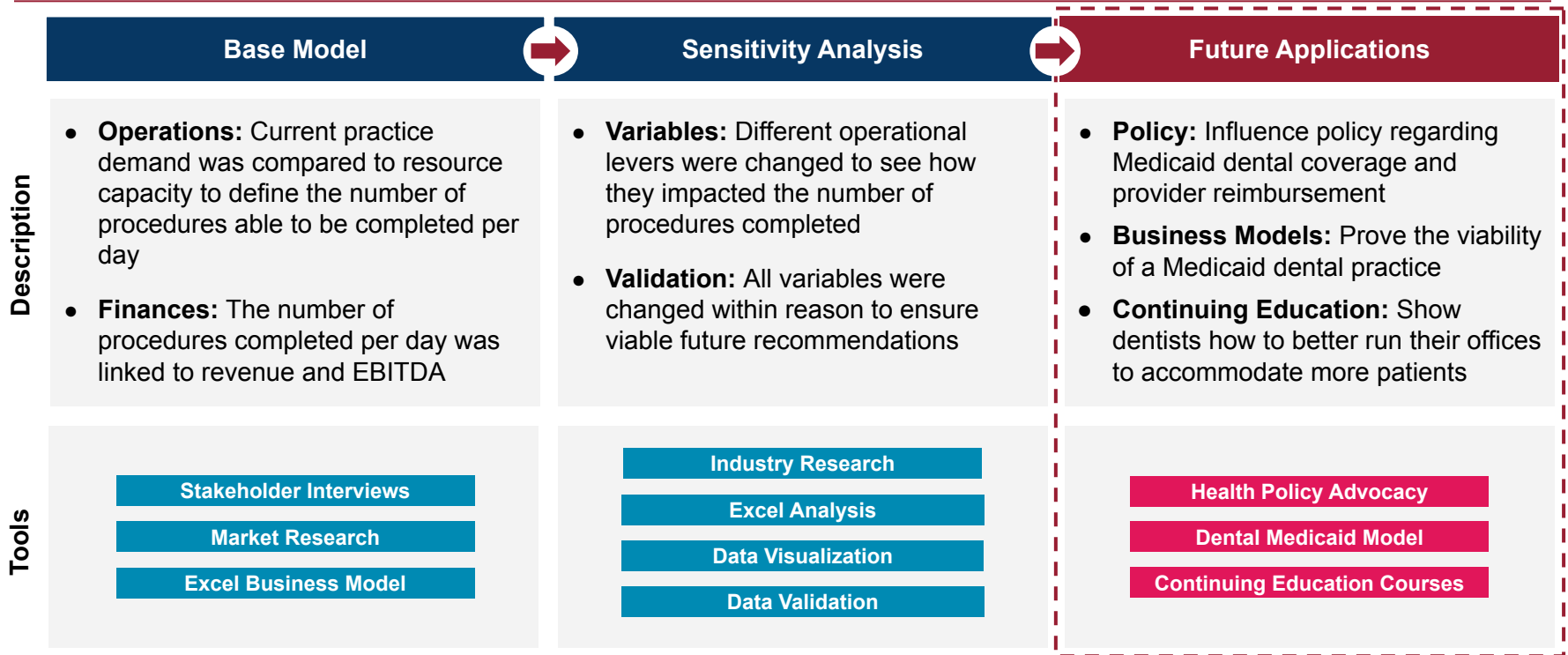
	Metric	
Practice Overview	Location	Boston, MA
	# of Dentists	3
	# of Hygienists	3
	Revenue	\$3.9M
	EBITDA	\$1.5M

Key Term

EBITDA: Earnings Before Interest, Taxes, Depreciation, & Amortization



Identification of operational constraints and their financial impact empowers dental offices to make meaningful workflow changes



An operational model quantifies the current capacity of the dental office and identifies existing constraints to delivering additional care

Model Design

Data sources included historic billing codes, P&L statements, and staff anecdotes

Key Inputs

- Active Patient Panel
- Annual Procedures by Type
- Office Days and Hours
- Reimbursement Rates
- Costs

Key Assumptions

- Hygienist Time per Procedure
- Dentist Time per Procedure
- Productivity vs Downtime Percentage

All procedures were categorized into the following types:

Diagnostics

Preventative

Restorative

Periodontics

Orthodontics

Oral Surgery

Endodontics

Prosthodontics

Adjunct

An operational model quantifies the current capacity of the dental office and identifies existing constraints to delivering additional care

Demand Calculations

Static demand was calculated based on historic CDT codes for completed procedures

1

$$\text{Visits per year} \div \text{Active Patient Panel} = \text{Procedures per patient per year}$$

Procedure Type / Patient / Year

2

$$\text{Visits per year} \div \text{Open Days per Year} = \text{Procedures per day}$$

Procedure Type / Day

Calculating current demand by procedure type allows the model to assess if demand is being met at a more granular level. For example, the practice could be meeting restorative demand but underperforming for oral surgery demand.

Key Term

CDT Code: Code on Dental Procedures and Nomenclature used for standardized billing



An operational model quantifies the current capacity of the dental office and identifies existing constraints to delivering additional care

Operations Calculations

Operational calculations are based off of self-reported productivity metrics from the dental practice being studied

$$1 \quad \text{Working Minutes per Day} \times \text{Daily \% of Procedures} = \text{Available Minutes per Procedure Type}$$

Minutes / Day by Procedure Type

$$2 \quad \text{Available Procedure Minutes per Day} \div \text{Dentist Minutes per Procedure} = \text{Capacity for Procedures per Day}$$

Procedure Type / Day

Example

If a dentist averages *60 minutes* per procedure, they can see 8 patients per day, which is *1,696 patients per year*

If a dentist averages *45 minutes* per procedure, they can see 10-11 patients per day, which is *2,120-2,332 patients per year*

Resource Constraints:

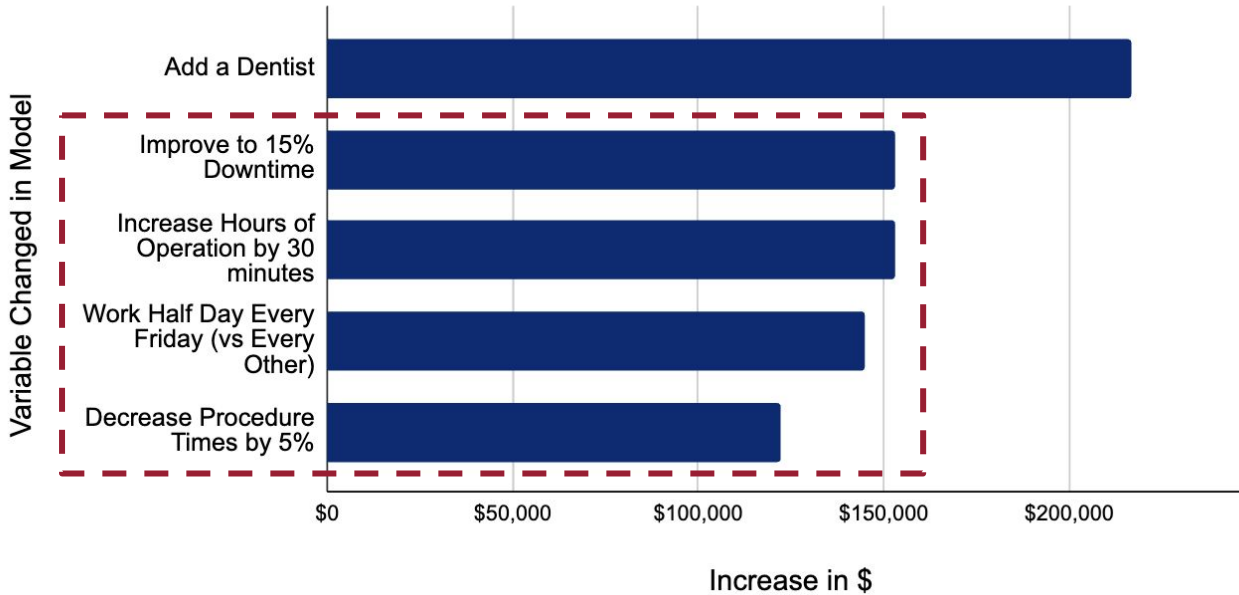
- Number of dentists and hygienists
- Office hours
- Productivity vs downtime

Operational inefficiencies are linked to financial impacts and the impactfulness is further quantified through a sensitivity analysis

The financial viability of a dental practice is measured by EBITDA

Baseline EBITDA:
\$1.52M

Increase in Financial Viability after Making Operational Change



8-10%
increase in financial
viability by improving
one operational
variable

Capacity constraints hinder dental offices from seeing more patients while demand soars

Key Finding:

The model proved that the dental office is **capacity constrained**.
The key resource in every dental office is the **dentist's available time**.

Example Variable: Downtime	Base Case	Better Case
Downtime %	20%	15%
Available Dentist Minutes / Day	384	408
# of Procedures / Day	31	32
# of Procedures / Year	6,572	6,784

“Higher labor productivity in capacity-constrained operations has a direct effect on service level, revenue, and growth.”
- Christian Terwiesch

212
more procedures
annually

Productivity vs downtime*: The practice reported staff is performing clinical work for 80% of the available 8 working hours per day; the other 20% is downtime
*Includes administrative work, EHR time, waiting time, etc

Dentists are highly productive when actively seeing patients, however downtime inefficiencies drive capacity constraints

Operational Variables

1

Percentage Downtime

2

Hours of Operation

3

Friday Hours

4

Procedure Times

“Companies track and record every dollar... that goes through their operation... **The same level of rigor** is often **lacking** when it comes to the **measurement and analysis of labor productivity**, even though one could argue that the **time of our employees** is one of the **most valuable resources** that exist in an organization.”

- *Christian Terwiesch*

Ethical Concerns

- Many of the current ways to improve productivity put both the doctor and patient at potential risk
- Incentivized compensation plans for dentists to complete procedures faster in order to see more patients can lead to decreased quality of care
- Adding new technology often increases the cost of procedures to patients

This study proves that small operational improvements lead to large scale gains in number of patients treated

Future research can explore both how to best achieve increased productivity and the impact of being able to treat more patients from a health policy, health equity, and access to care perspective

Medicaid Dental Practice Viability

This model can influence policy by showing the minimum Medicaid reimbursement required for financial viability of dental practices. Dental offices are also able to compensate for low Medicaid reimbursement rates by increasing the volume of patients they see.

Mid-Level Dental Provider Criticality

Scope of practice for mid-level providers varies by state. The model can show how these differences impact the number of patients able to be treated.

Serving DHP SA in Rural Areas

Increasing the number of patients able to be seen in rural practices can help improve the patient to provider ratio in DHP SA.

Implementation of Productivity Increasing Strategies

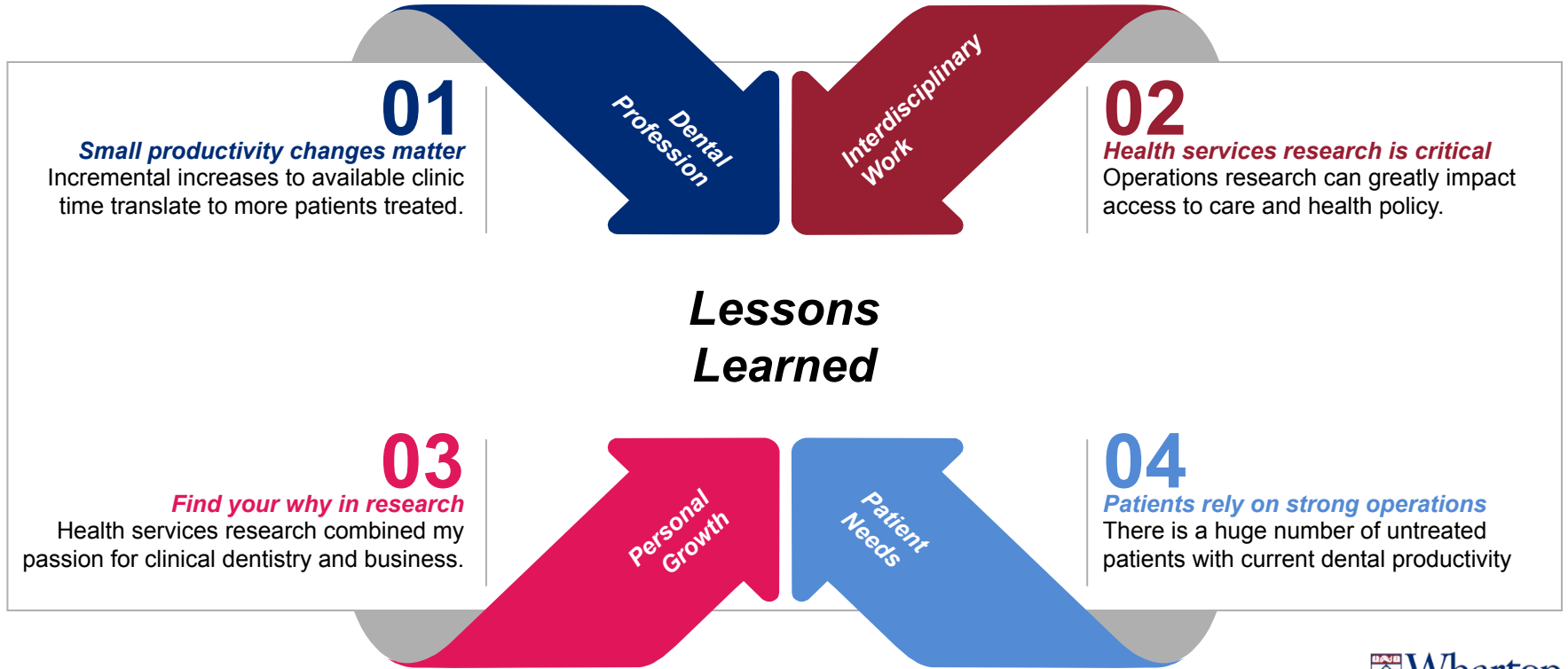
Productivity initiatives can be quantitatively tracked through this model. This empowers dental practice owners to see which strategies improve patient flow the most. To track productivity, practices can time procedures, track outputs, or use visual tracking.

Increased Productivity

Increased Number of
Patients Treated

Increased
Access to Care

The next generation of dentists must recognize the importance of operational efficiency to best treat growing numbers of patients





Thank You



Appendix



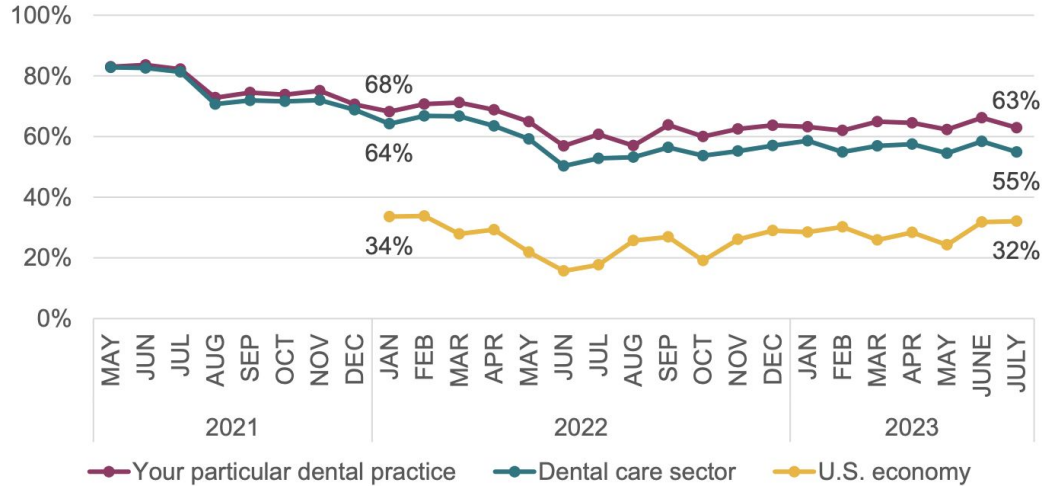
Data Sources

Data Source	Model Use	Associated Tabs
Wharton ACDG Services 20, 21, 22	Procedure Mix, Staffing Ratios, Revenue per Procedure	Demand Pivot & Forecast, Revenue by Procedure, Staffing Summary, Demand, Operations, Capacity Constraints
ACDG P&L	Revenue, Costs	Revenue by Procedure
Stakeholder Interviews	Time per Procedure	Operations

Dentists' Confidence in Economy

Confidence in the Economy

Looking ahead to the next six months, how confident are you in the recovery of the following?
(Percentages indicating “very” or “somewhat” confident.)



Dentists' confidence in their dental practice and the dental care sector declined slightly in July 2023. Confidence levels remain below a high point in 2021.