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Healthcare Innovation Absenteeism:
The Rise of Physician Entrepreneurs & Medical Startups

By

Charleata Battle, MBA

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Executive Doctorate in Business

In the Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY

ROBINSON COLLEGE OF BUSINESS

2022

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ACCEPTANCE

This dissertation was prepared under the direction of CHARLEATA BATTLE Dissertation Committee. It has been approved and accepted by all members of the committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctorate in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ACKNOWLEDGMENTS

There are many people who have helped me along my dissertation journey, I would like to thank them. First, I would like to thank my dissertation committee for your collective guidance and belief in my research project. Thank you, J.J. Hsieh, Ph.D. for your resourcefulness and leadership. Thank you, Likoebe M. Maruping, Ph.D. for helping me maintain the fortitude necessary to achieve my goals. Thank you, Aaron M. Baird, Ph.D. for lending your healthcare expertise to this project.

To my children, how I love you so much. Thank you, Eryn Chandler Payton, and Jordan Scott Payton, for the gifts of your unwavering love, encouragement, and understanding. I never imagined that all three of us would be attending college at the same time. Thank you for following in my first-generation college graduate footsteps. I am deeply proud of you.

To my parents, sisters, brother, family, and friends: you put up with me missing so many events and trips home. I hope for the time to reconnect with each of you.

To my professors who mentored and motivated me: Lars Mathiassen, Ph.D., Arun Rai, M.B.A., Ph.D., Satish Nargundkar, Ph.D., Mark Keil, D.B.A., and Louis Grabowski, D.B.A., thank you for helping me get to this day.

To each of the 21 brilliant founding physician entrepreneurs, thank you for your belief in this project and for the sacrifice of your time to honor an interview with me during the height of the global COVID-19 pandemic. Thank you for following your incredible ideas and for creating medical startups to deliver healthcare innovations.

To the memory of my loving grandmother, Pattie Richardson Arrington. Thank you for your wisdom, prayers, and actions.

I have finally become my ancestors' wildest dreams.

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ABSTRACT

For years, warning signs have illuminated imminent days of reckoning for stalled healthcare innovation across the dynamic American healthcare landscape. An evolving epic battle for healthcare innovation delivery has silently raged and set arena stages throughout the healthcare industry. Urgent innovative healthcare delivery is needed to ameliorate longstanding points of failures in providing healthcare delivery to society. Historically, the science of medicine has fostered cultural practices of innovation absenteeism and resistance to change. Mired by archaic processes, legacy systems, and fractionally useful equipment, our current healthcare ecosystems are unsustainable. Recently, some unhindered frontline physicians opted to take on a portion of critical healthcare challenges and followed their ideas to leverage clinical expertise and drive the agenda for changing healthcare innovation delivery.

Our qualitative multi-case study design centered around empirical evidence that answered the research question: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services? We examined 21 cases of physician founded medical startups to understand particularizations around physician entrepreneurship. Findings suggest three contributions towards knowledge accumulation about physician entrepreneurs and medical startups: exclusive decision-making processes, industry-specific insights, and illuminations of physician voices that might not otherwise be heard.

Keywords: Entrepreneur; health; innovation; physician; startup

I CHAPTER I. INTRODUCTION

The U.S. healthcare sector has been peppered with unintended consequences of stalled healthcare innovations for many years. Recently, the global coronavirus pandemic exposed subcutaneous layers of ill-preparedness of healthcare systems to meet routine and surge demands for innovative healthcare products and services. Like bared pustules, widespread healthcare challenges accentuated the sense of urgency and pleas for escalated innovations in healthcare to satiate increased surges of medically complex patient populations. Over the years, unmet and unprecedented public health needs have beckoned the healthcare industry for more comprehensive and sustainable healthcare innovations.

The primary purpose of this paper is theory application. Through this document, we report the record of our experience of applying effectuation theory of entrepreneurship in the context of physician entrepreneurship through a qualitative micro-targeted multi-case study, against the backdrop of data-rich insights collected from a sample of 21 medical startup cases through in-depth semi-structured interviews of the 21 founding and leading physician entrepreneurs for each case. There are two key assumptions in our study: 1) In the practice and business of medicine, physicians trust in the voices of other physicians. 2) Physicians who found and lead medical startups are armed with exceptionally high levels of developed clinical expertise as means from which they can draw from, unlike any other entrepreneur. Accordingly, our research approach centered on understanding physician entrepreneurship from the perspectives of physician entrepreneurs to democratize learning from actively engaged physician entrepreneurs who founded & led medical startups, and experienced decision-making processes to commercialize a new medical product or service. See Table 1 for a preview of this study's novel contributions.

Table 1: Preview of Study Contributions

<i>Contribution</i>	<i>State of Extant Literature</i>
1. Advancement of knowledge accumulation and theoretical understandings of effectuation theory of entrepreneurship and the five principles.	<ul style="list-style-type: none"> • Entrepreneurial theorists have traditional approached explorations of entrepreneurship from theoretically diverse lenses of econometrics: <ul style="list-style-type: none"> ○ Private equity ○ High profit realization models. ○ These are less representative of ordinary entrepreneurs
2. Provided novel insights about specific processes germane to medical startups: <ul style="list-style-type: none"> • High levels of clinical expertise, unlike any other entrepreneur • Physicians trust in other physicians • Peer stakeholders engaged in commercialization as <ul style="list-style-type: none"> ○ Testers, validators, investors & customers 	<ul style="list-style-type: none"> • Opaque and wide-ranging generalizations that blurred perspectives on physician entrepreneurial experiences and medical startups • Misunderstood experiences of hurdles: <ul style="list-style-type: none"> ○ Personal, professional, and economic apart from mass groups of other entrepreneurs.
3. Provided novel industry insights that have not otherwise been heard: <ul style="list-style-type: none"> • acumen development • challenges and mistakes • commercialization • decision-making • medical education experiences • physician & entrepreneur roles • stakeholder relationships 	<ul style="list-style-type: none"> • Overlooks explicit revelations of interesting data insights that: <ul style="list-style-type: none"> ○ Identify and amplify physician voices ○ Pinpoint emergent themes and data patterns
4. We advance knowledge that distinguishes physician entrepreneurs from all other entrepreneur categories. Their medical expertise transcends and transforms into multifaceted healthcare innovations delivered by medical startups: new medical products and services.	<ul style="list-style-type: none"> • Knowledge gaps exist in understanding the transcendence of medical expertise utilized as means in medical startup ventures apart from the mass groups of other small business startups across industries. • Knowledge about physician entrepreneurship, medical startups, and the decision-making processes required for medical startups have not be made within influence and reach of prospective or current physician entrepreneurs.

I.1 Background

The origin of this research project was a developed response to an identified and contemporary business problem in the U.S. healthcare industry. Our background problem setting for this study was entrepreneurship among physicians in the U.S. healthcare sector where historically, healthcare innovations have been gravely stalled. In our research inquiry, we explored physician entrepreneurship and medical startups in today's healthcare sector, a highly regulated and federally scrutinized industry, where innovative stakes are escalated for patients throughout the healthcare continuum of care. To distill the creation and dissemination of new knowledge accumulation about the problem setting, we developed a clear and analytical research question to explore the problem: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services?

In the backdrop of this business issue, Dew et al. (2009) noted an entrepreneur's cognition was an important factor in decision-making. Similarly, Thiel (2014) emphasized, decision-making techniques that utilized critical thinking were key strengths for new startups. Research by Suryavanshi et al. (2020) is a recent and relevant study that linked our research topic, rationale for the study, and the research question by emphasizing that business literature theorizes crucial connections do exist between entrepreneurship and innovation. Miller & French (2016) underscored there was hope within emerging entrepreneurial hospitals that entrepreneurial-led innovations would serve hospitals by simultaneously prioritizing the fulfillment of patient needs and the needs of the hospital as a user of its own innovativeness. Complementary research by Small et al. (2017) hinted physicians are among the most significant prospective resources for innovations and physician-led innovations which is essential to

understanding the importance of the background for physician entrepreneurship and medical startups.

To provide foundational meaning for commonly accepted industry definitions, we explored longstanding, and verified sources, including the National Cancer Institute, Dictionary.com, and Merriam Webster dictionary. We identified indispensable industry terms that expressed critical background contexts for this research study: continuum of care, commercialization, and effectuation theory of entrepreneurship as well as the five principles of effectuation: Bird-in-Hand, Affordable Loss, Crazy Quilt, Lemonade, and Pilot-in-the-Plane, entrepreneur, healthcare innovation, innovation, physician, startup, and venture capital. (See Table 2).

Table 2: Table of Concepts, Industry Definitions, and References

<i>Concept</i>	<i>Definition</i>	<i>Reference</i>
Commercialization	The act or processes of making something available for sale as a commodity.	Dictionary.com. (n.d.). Commercialization. In Dictionary.com. Retrieved November 10, 2021, from https://www.dictionary.com/browse/commercialization
Continuum of Care	Continuum of care in medicine is the delivery of health care to patients with a disease over a period for all phases of illness from diagnosis to the end of life.	NCI Dictionary of Cancer terms, 2011.
Effectuation Theory of Entrepreneurship	A logic of entrepreneurial expertise that can be used by physician entrepreneurs to minimize the costs of failures during the uncertain times of medical startups from ideation, innovation, to commercialization.	Sarasvathy, 2001; 2008; Fisher, 2012
Effectuation Theory of Entrepreneurship Five Principles: #1 Bird-in-Hand	Operationalizing entrepreneurial means from all presently available resources under the control of the entrepreneur. Means are personal knowledge, skills, and social networks instead of focusing on goals.	Sarasvathy, 2001; 2008; Fisher, 2012
Effectuation Theory of Entrepreneurship Five Principles: #2 Affordable Loss	Entrepreneurs invest only the amounts of dollars that they are willing to lose opposed to what they expect to gain.	Sarasvathy, 2001; 2008; Fisher, 2012

Effectuation Theory of Entrepreneurship Five Principles: #3 Crazy Quilt	Entrepreneurial purposefully leverage stakeholder partnerships from the business start as a method to create new business means and opportunities.	Sarasvathy, 2001; 2008; Fisher, 2012
Effectuation Theory of Entrepreneurship Five Principles: #4 Lemonade	As an approach to controlling inevitable mistakes and emerging situations within the medical startups, entrepreneurs use these situations to seek new business opportunities.	Sarasvathy, 2001; 2008; Fisher, 2012
Effectuation Theory of Entrepreneurship Five Principles: #5 Pilot-in-the-Plane	An approach by entrepreneurs to control their startup's future like pilots who fly planes. Instead of predicting the future, the future (market value influenced by the innovation itself) is created and controlled by the entrepreneur's effectuated actions and decision-making.	Sarasvathy, 2001; 2008; Fisher, 2012
Employed Physician Practice	Physicians are employed within one of several practice modes. A hospital may purchase or manage a solo or group practice or directly hire physicians within their inpatient or ambulatory clinics. Clinics may be owned and operated by healthcare corporations.	Medical practice types. ACP. (n.d.). Retrieved November 10, 2021, from https://www.acponline.org/about-acp/about-internal-medicine/career-paths/residency-career-counseling/resident-career-counseling-guidance-and-tips/medical-practice-types .
Entrepreneur	A person who started a business and agreed to bare financial losses to make a profit	Merriam-Webster. (n.d.). Entrepreneur. In <i>Merriam-Webster.com</i> . Retrieved December 20, 2021, from https://www.merriam-webster.com/dictionary/entrepreneur .
Group Practice	A single or multispecialty practice where two or more physicians provide patients with one specific type of care. A multispecialty group is defined as offering various types of medical specialty care within one organization.	Medical practice types. ACP. (n.d.). Retrieved November 10, 2021, from https://www.acponline.org/about-acp/about-internal-medicine/career-paths/residency-career-counseling/resident-career-counseling-guidance-and-tips/medical-practice-types .
Healthcare innovation	Any new product, service, or redesign of care that improves patient experience, healthcare quality and reduces costs	Ostrovsky & Barnett, 2014
Innovation	Acts or processes to introduce new ideas, devices, or methods.	Merriam-Webster. (n.d.). Innovation. In <i>Merriam-Webster.com</i> . Retrieved December 20, 2021, from https://www.merriam-webster.com/dictionary/innovation .

		webster.com/dictionary/innovation
Physician	An educated, licensed, clinically experienced, and skilled person in the art of healing	Merriam-Webster. (n.d.). Physician. In Merriam-Webster.com. Retrieved December 20, 2021, from https://www.merriam-webster.com/dictionary/physician
Solo Practice	A practice without partners or employment affiliations with other practice organizations.	Medical practice types. ACP. (n.d.). Retrieved November 10, 2021, from https://www.acponline.org/about-acp/about-internal-medicine/career-paths/residency-career-counseling/resident-career-counseling-guidance-and-tips/medical-practice-types
Startup	A fledgling business enterprise	Merriam-Webster. (n.d.). Venture Capital. In Merriam-Webster.com. Retrieved November 10, 2021, from https://www.merriam-webster.com/dictionary/startup
Venture Capital	Capital invested or available for investment in the ownership element of new or fresh enterprise	Merriam-Webster. (n.d.). Venture Capital. In Merriam-Webster.com. Retrieved November 10, 2021, from https://www.merriam-webster.com/dictionary/venture%20capital

I.2 Purpose of Study

At a macro level, the purpose of this dissertation was to join scholarly debate at the forefront of the conversation entrepreneurial literature and advancing knowledge accumulation on the topic of physician entrepreneurship as a profession and individualized career experience. We aimed to add knowledge advancements about particularizations of physician entrepreneurs and the medical startups they lead within the stalled U.S. healthcare landscape. At a micro level, an aim of our research study was to bring awareness about the business of medical startups and to make knowledge accumulation within the reach and influence of physician entrepreneurs.

I.3 Theoretical Framing

Physician entrepreneurs experience business-critical decision-making situations in a high-risk and highly regulated healthcare environment. Ideations for a startup business originate within an entrepreneur's mindset, an explorer of non-quixotic ventures (Joshi, 2019). We conceptually framed our study through the lens of effectuation theory of entrepreneurship and the five effectuation principles from an extensive literature review. To answer our research question framed with effectuation theory, we investigated if five principles prescribed by effectuation theory of entrepreneurship can be applied to explain physician entrepreneurs' decision-making within their medical startups. We focused attention on understanding empirical evidence that answered the **research question: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services?** (See Appendix A and Appendix B).

I.4 Research Motivations

Our research was motivated by a desire to delineate excessively broad generalizations about entrepreneurship, fill in the identified knowledge gaps in extant literature around physician entrepreneurship, and to understand the decision-making behaviors of physician entrepreneurs who founded and led medical startups related to the problem setting and area of concern for this research study. Our research was further motivated by a drive to amplify the voices of physician entrepreneurial experiences that had not been previously collected or heard elsewhere. Guzman and Stern (2014) emphasized that prior scholars frequently used publicly available data to generate specific indices of entrepreneurship although the processes of growth for new entrepreneurial ventures still required attention. Research on physicians outside of clinical areas have not represented micro-targeted physician entrepreneurial experiences and how they

navigate medical startup hurdles - personal, professional, and economic – this has scarcely been understood.

I.5 Chapter Summaries

The paper is presented in six chapters. Chapter II. describes the study's area of concern, major entrepreneurial themes, traditional and emergent entrepreneurial theories, the startup business cycle, extant literature gaps, review of the literature summary, and the research question. Chapter III. discusses the theoretical framing for the study and details how the theoretical lens of effectuation theory of entrepreneurship and the five principles of effectuation theory were tested and leveraged to lift understanding about physician entrepreneurial decision-making frameworks available for exploitation by medical startups during ambiguity, commercialization, and new venture growth. Chapter IV. outlines our methodological approach, describes our research design & the methods of our qualitative, micro-targeted, multi-case study, provides details on our interview protocol procedures and techniques used to identify, select, collect, and analyze various data types.

CHAPTER V. describes the study's thematic results that were coded using the NVivo 12 data analysis software related to themes of Effectuation Theory of Entrepreneurship: Bird-in-Hand Principle Affordable Loss Principle, Crazy Quilt Principle, Lemonade Principle, and Pilot-in-the-Plane Principle. This chapter also provides an overview of the cross-case themes that emerged from the NVivo 12 data analysis process related to emergent themes on physician entrepreneurship, influences of youth & childhood, choosing medicine as a career, experiences in medical school, residency, fellowships & internships, business acumen development, ideation, innovation, & commercialization and funding strategies used by physician entrepreneurs. Chapter VI. provides insights through discussion about the study's contributions, limitations, and future research.

II CHAPTER II. LITERATURE REVIEW

II.1 Area of Concern

The relevance of entrepreneurship and entrepreneurial education has intensified over the last decade. Today, entrepreneurial studies are published through multidisciplinary journals. Entrepreneurship and innovation are the primary catalysts of a new wave of economic development (Morris et al., 2013). The United States of America lacks an innovative healthcare culture, and the healthcare marketplace is wrought with problematic issues including constant costs increases for health care provided by out-of-date medical devices, equipment, and services. Some costs can be inherently attributable the development and dissemination of new innovative technologies that often bring significant medical value. Health payment systems disproportionally reward volume production over the delivering of quality and valuable healthcare (Cutler, 2010). The area of concern for this study centered around physician entrepreneurship, medical startups, and decision-making processes from ideation, innovation, to the commercialization of new medical products and services. In this study, we expected to accumulate insights into who, how, when, and why regarding physician entrepreneurial decision-making processes, if they evolve, and the likelihood that decision-making behaviors and processes employed use of the dynamic effectuation cycle and five effectuation principles.

II.2 Top Three Major Entrepreneurial Themes

Entrepreneurial scholars have engaged in active debates that continue to fill the data-rich vaults of entrepreneurial literature. Much of today's literature currency centers around high growth funded entrepreneurial ventures from econometrics perspectives. Present literature has too few explorations into other forms of entrepreneurial enterprise that are more representative. Prior research inquiry on how entrepreneurs identify opportunities for new ventures argued entrepreneurs employed cognitive frameworks through alertness and pattern recognition, (Baron,

2006). Every moment in a startup business happens only once. The act of *creation* is singular, as is the creation moment (Thiel, 2014, p.1). Entrepreneurship is focused on the *creation* of new opportunities and concepts within uncertain environments (Kuratko & Morris, 2018).

Effectuation was linked to opportunity *creation* when high levels of ambiguity was present, and causation was linked to opportunity recognition when entrepreneurs perceived venture risks over uncertainty (Kuratko & Morris, 2018).

A recurrent area of contention has conspicuously been around entrepreneurial behaviors in decision-making. Research on entrepreneurs and the entrepreneurial process has regenerated among popular research themes as highlighted in Table 3. Cutler (2010) argued from an econometric perspective on policy, regulations, and healthcare reform that U.S. healthcare innovations lack sufficient information about healthcare quality and payment systems.

Table 3: Top Three Major Entrepreneurial Themes

Entrepreneurial Themes	Research Focus	Sources
1. Opportunity and the Entrepreneurial Process	How opportunities are uncovered and exploited through emergent processes	(Bygrave, 1989; McMullen and Dimov, 2013; Moroz and Hindle, 2012; Shane, 2000; Short et. al., 2009)
2. Venture Financing	Funding sources: venture capital, angel investor funding and innovative financing techniques.	(Busenitz, Fiet, and Moesel, 2004; Dimov, Shepherd, and Sutcliffe, 2007)
3. Entrepreneurial Cognition	Knowledge structures used to make assessments involving the evaluation of opportunities, new venture creation and growth.	(Grefoire, Cobett, and McMullen, 2011; Haynie et al., 2010; Haynie, Shephard, and Patzelt, 2012)

Note: Adapted from (Kuratko & Morris, 2018. p. 13).

II.3 Traditional and Emergent Entrepreneurial Theories

Historical models of entrepreneurship investigation draw from an economics approach to describe and explain how individuals or firms engage in entrepreneurial activity. Traditional

literature approaches have examined entrepreneurship from theoretically diverse lenses of econometrics of private equity and high profit realization models that yielded little advantages in understanding significant aspects of physician entrepreneurship. Focus has centered around economic elements like value creation, costs, and operational efficiencies. Economic theoretical approaches depend largely on the dynamics of supply and demand relationships, where demand for products and services exceeds available supply (Fisher, 2012).

Extant research studies on the phenomena of entrepreneurship focused on the use of different theoretical perspectives to explain entrepreneurial behavior by exploring underlying logic and actions. In contrast, emerging theoretical perspectives on entrepreneurship and entrepreneurs focus the different routes entrepreneurs take to identify and exploit opportunities. See Table 4 for comparatively listed aspects of traditional and emerging theoretical perspectives historically used to study the domain of entrepreneurship. The domain of entrepreneurial literature has become an all-encompassing label where a *mélange* of accumulated business research is housed (Shane & Venkataraman, 2000).

Within entrepreneurial literature, three prominent theoretical frameworks have traditionally been operationalized to study the domain of entrepreneurship: causal approach, discovery approach and the classical approach (Sarasvathy, 2001; 2008; Alvarez & Barney, 2007; Shah & Tripsas, 2007; Fisher, 2012). Two validated emerging theoretical perspectives offered alternative investigative frameworks for entrepreneurship: effectuation, largely disseminated through early works by (Sarasvathy, 2001; 2008; Fisher, 2012) and entrepreneurial bricolage popularized by (Baker & Nelson, 2005; Fisher, 2012) along with causation were recently used to compare the framework of traditional theoretical approaches to research on the topic of entrepreneurship (Fisher, 2012). Alvarez and Barney (2007) explored entrepreneurship

through the lens of discovery and creation theories and identified alternative sets of decision-making tools were available for use by entrepreneurs to create new products and services with emphasis placed on entrepreneurs who discovered opportunities as significantly different from other entrepreneurs.

(Chandler et al. 2011) effectuation theory as a formative construct comprised of four recognizable measures: 1) experimentation - trial and error approaches, 2) affordable loss - prearranged agreement on what one is willing to invest and lose, 3) flexibility - agile approaches to situations of uncertainty, and 4) precommitments - advance engagement guarantees from stakeholders to share startup risks. After extensive review of the rich body of entrepreneurial literature, we posit that effectuation theory of entrepreneurship was a conceivable decision making and cognitive framework available to physician entrepreneurs for exploitation (Sarasvathy, 2001, 2008; Fisher, 2012).

Table 4: Traditional and Emergent Theoretical Lens on Entrepreneurship

	<i>Traditional Lens</i>	<i>Emergent Lens</i>	<i>Emergent Lens</i>
	Causation Theory	Effectuation Theory of Entrepreneurship	Entrepreneurial Bricolage
Sources:	Sarasvathy (2001, 2008)	Sarasvathy (2001, 2008)	Baker and Nelson (2005)
What factors are part of the explanation?	Causation <ul style="list-style-type: none">• Causation: outcome is given• Select between means to achieve that outcome by:<ol style="list-style-type: none">1) Starting with ends2) Analyzing expected returns3) Performing competitive analysis4) Controlling the future	Effectuation <ul style="list-style-type: none">• Set of means are given• Select between possible effects that can be created with means by:<ol style="list-style-type: none">1) Start with Bird-in-Hand principle2) Apply Affordable Loss principle3) Apply Crazy Quilt principle4) Apply Lemonade principle5) Apply Pilot-in-the-Plane principle	Entrepreneurial Bricolage: <ul style="list-style-type: none">• Make do with what you have on hand• Create something from nothing<ol style="list-style-type: none">1) Making do2) Combining resources for new purposes.3) Using resources on hand
Phenomena of interest:	The process employed by entrepreneurs in identifying and exploiting an opportunity for a new product or service		
Note: Adapted from (Fisher, 2012, Table 1, Entrepreneurship Theories).			

II.4 The Evolution of Entrepreneurial Ventures

To empirically understand physician entrepreneurial decision making, meanings and quality of lived experiences, our research sample size included 21 cases of medical startups with

case representativeness across various stages within the startup business cycle. Research by Churchill and Lewis (1982) depicted a graphical framework germane to the startup business cycle and evolution of small and growing entrepreneurial businesses. (See Figure 1). Thiel (2014) popularized seven business-critical questions that entrepreneurs should seek to answer throughout all five stages of new venture evolution.

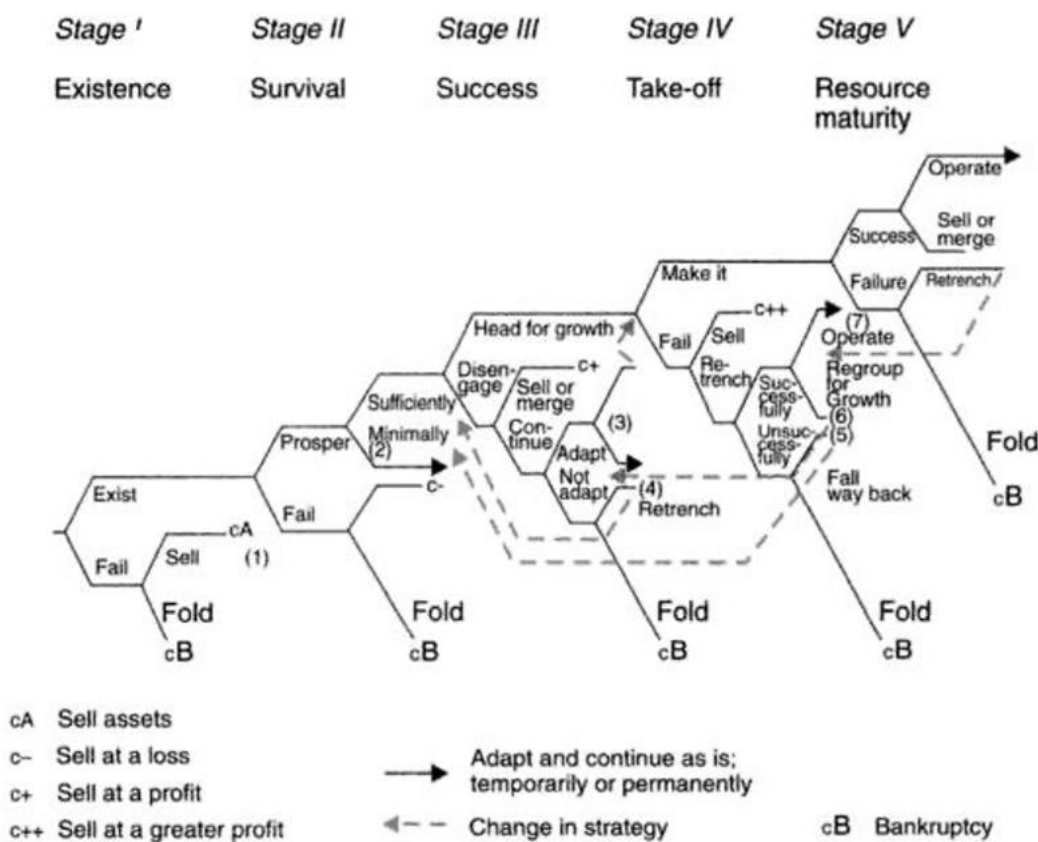


Figure 1: Five Stages: The Evolution of a Small Company
Source: Churchill and Lewis (1982), p.5.

II.5 Knowledge Gaps

Traditional theoretical explorations in entrepreneurial literature have muted the experiences of physician entrepreneurs into indistinguishable and generic assemblages of entrepreneurial inquiry, whereby data rich insights on this phenomenon have been characterized

through mass generalizations of wide-ranging entrepreneurial data points. Among the innumerable entrepreneurial research repositories, there remains limited insights into how physician entrepreneurs experienced decision-making and navigated their startups.

The challenge of how to commercialize an innovation, understand the requirements for starting a company, and prepare for investor requirement scenarios is complex (Bryder et al., 2016). The impact of clinical inventors (physician entrepreneurship) has been central to the innovation of medical devices in interventional cardiology (Donovan & Kaplan, 2012). Still, there are scant scholarly explorations that purposely investigated or succinctly collected important empirical data specific to the experiences of physician entrepreneurs as they navigated numerous of business-critical decision-strategies for their medical startups.

II.6 Review of Literature Summary

In review of extant literature, we found extensive research inquiry about entrepreneurship that was framed from an econometric perspective of high performing startups and a complementary theoretical lens. We discovered consistency within published studies, whereby research results were deeply generalized to the broader entrepreneurial industry. Our analysis of the literature findings was summarized and evaluated against the requirements of the background problem setting, area of concern, and the motivation of the study. Consequentially, we sought the next steps to formalize our research question.

Our inquiry and analysis of extant literature led to the development of a clear and analytical research question: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services? Guided by the research question, our work centered on previously unascertained data insights about physician founded and led medical startups and the particularizations expressed through voices of self-reflections about decision making by

physician entrepreneurs to advance what we don't know about the phenomena of physician entrepreneurship. The research question laid the foundation for our plan of approach to inquiry through case study research.

III CHAPTER III. THEORETICAL FRAMING

III.1 Effectuation Theory of Entrepreneurship

A comprehensive entrepreneurial theory can provide entrepreneurs with guidance on how to make strategic trade-off decisions and provide the startup businesses with progress measurability during times extreme uncertainty (Ries, 2011). To that end, effectuation theory of entrepreneurship by Sarasvathy (2001) has been among the most influential in current literature towards understanding enterprise formation and the behaviors of and decision-making logic of entrepreneurial founders. Effectuation theory provided a contrasting theoretical approach to causation theory (outcome driven-opportunity recognition).

Since the year 2000, effectuation theory of entrepreneurship has become one of the most dominant theories in national and international entrepreneurial research (Alvarez et al., 2016). Effectuation theory was developed by Dr. Sarasvathy as a counterpoint to causation theory from the findings of her landmark research study where 27 entrepreneurial founders across multiple industries were interviewed and invited to complete 10 tasks. Dr. Sarasvathy analyzed the ‘decision logic’ used by the 27 participating entrepreneurial founders. The decision logic was later named effectuation theory of entrepreneurship. Scholarly research using effectuation theory and the five principles has been traditionally applied to investigate inquiry about general entrepreneurship and entrepreneurs across multiple industries (Gil-Barragan et al., 2021).

Our research is a first-of-its-kind application to bridge understanding between academics, practitioners, and communities of stakeholders about physician entrepreneurial decision-making processes and behaviors in the medical startup context where physicians the founding entrepreneurs. We leverage the qualitative multi-case study approach to understanding the phenomena of physician entrepreneurship and the commercialization of medical products and services through the theoretical framed lens of effectuation theory. In this paper, we drew upon

the effectuation theory of entrepreneurship as the over-arching lens on decision-making frameworks available for use during new venture development processes (Sarasvathy, 2001; 2008; Fisher, 2012). This study presented original and contextualized understandings of decision-making and operationalized strategies exploited by physician entrepreneurs as mechanisms for navigating the complexities of medical startup ventures.

Effectuation theory of entrepreneurship is a means driven approach to opportunity creation that is not outcome driven. According to Sarasvathy (2001), effectuation is a logic available for use by entrepreneurs during entrepreneurial processes and is an approach to decision-making and action performances. One example of effectuated actions is when physician entrepreneurs make decisions and actions that minimize the costs of failures during times of business uncertainty for their medical startups from ideation, innovation, to commercialization. For more on effectuation theory and the five principles, see Appendix A and Appendix B.

III.2 Five Principles of Effectuation Theory of Entrepreneurship

In this study, we operationalized effectuation theory of entrepreneurship to leverage understanding of the five principles of effectuation: Bird-in-Hand, Affordable Loss, Crazy Quilt, Lemonade and Pilot-in-the-Plane. (See Appendix A and Appendix B). Decisions strategy opportunities for venture-creation happened in unpredictable ways during times of ambiguity for medical startups (Sarasvathy, 2001; 2008; Fisher, 2012). Literature contributions made by Eisenhardt and Schoonhoven (1996) found the firm's industry and top management team were relevant predictors of strategic alliance development for the commercialization of new products.

IV CHAPTER IV. METHODOLOGY

IV.1 Research Design & Methods

Prior qualitative research methods and sourcebooks by (Miles et al., 2020; Myers, 2019; Yin, 2018) were influential throughout our methods decisions and research design methodology for the study. The development of our methods decisions was essential to the establishment of requisite conditions for empirical data collection and analysis. Our study's specific focus was on understanding physician entrepreneurship from the perspectives of founding and leading physician entrepreneurs for 21 medical startup cases. For our research inquiry, we designed a qualitative, micro-targeted, multi-case study design to answer the research question: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services?

To qualitatively answer the research question, we adapted the multi-case study method from Yin (2018). (See Figure 2). This method was ideal to capture rich descriptive data, contexts, meanings, decision-making processes, quality, or meanings human experiences. At a deeper level, a qualitative micro-targeted multi-case study approach has proven to be beneficial to researchers who aimed to identify compelling themes, processes, and emerging relationships across multiple cases (Miles et al., 2020).

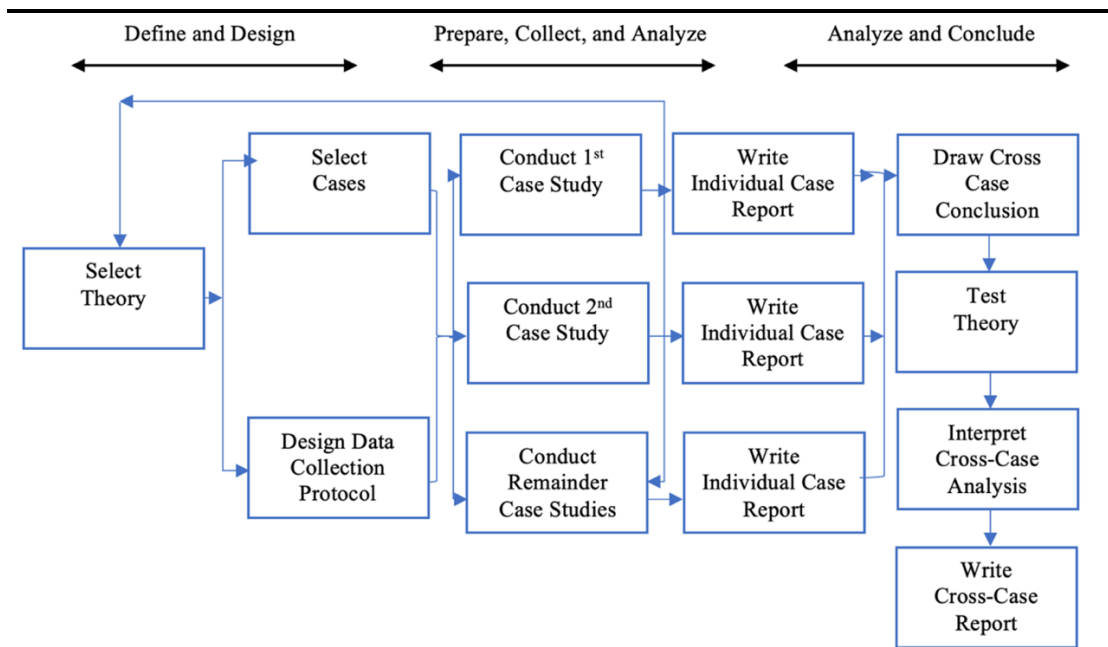


Figure 2: Multiple-Case Study Method & Procedure

Source: Adapted from Yin (2018, p.57).

IV.2 Sample Size, Cases, and Participants

Adaptations for a small array of cases ≤ 20 cases in a multi-case study replication design are adequate to reach important findings and draw powerful conclusions (Yin, 2018). To immerse thought into physician entrepreneurial experiences, we investigated a sample size of 21 physician entrepreneurs who founded and built a medical startup business around their ideations for new medical products and services. We centered this study at the individual level of analysis where the primary points of reference were the founding physician entrepreneurs. Each participant was scheduled to share their voice through an in-depth semi-structured interview lasting up to sixty-minutes. Homogeneous sampling allowed for deeper understanding about the phenomena of physician entrepreneurship and how this group of 21 cases effectuated actions and utilized decision-making mechanisms within their medical startups.

IV.3 Interview Protocol

For this study, our interview protocols were first proposed to and approved by the Institutional Review Board (IRB) at Georgia State University. Our protocols were designed to allow individuals to reflect upon their own quality or meaning of experiences and to subjectively express attitudes, behaviors, and decision-making situations that were not directly observable (Van de Ven, 2013). This research study was conducted through semi-structured in-depth interviews for each research participant. Invitations for interviews took place securely and confidently via digital conferencing tools that were password protected and encrypted. The interview protocol followed the same repetitive process for each research case participant until all questions were answered and all case study interviews were conducted. (See Table 5).

Table 5: Interview Protocol

GEORGIA STATE UNIVERSITY	
Title: Physician Entrepreneur: The Rise of Physician Founded & Led Medical Startups Principal Investigator: J.J. Hsieh, Ph.D. Student Principal Investigator: Charleata Battle, MBA Approximately 60 minutes	
Focus of Research	Question
To understanding participant's background, early influences, decision making, career aspirations as a physician or entrepreneur.	1. Tell me about your medical school, residency, fellowship experience including your graduation year and any medical specialties and sub-specialties you trained in. 2. How did you know the time was right? How did you decide on what resources to use to advance your idea?
To begin understanding decision making, entrepreneur, their idea, innovation, medial startups.	3. How would you describe your general decision-making approach? (Adapted from: Fisher, 2012, Questions Used in Developing Each Case Study, p.1048). 4. How did your pledge to the Hippocratic Oath play a role in your decision making? Your new business? Other?
To understand how a physician entrepreneur defines and perceives their role as a physician entrepreneur.	5. How would you define a physician entrepreneur? How was your first entrepreneurial experience? How did you handle any barriers?

To understand decision-making entrepreneur's lived experience leading a medical startup.

6. How would you describe what you experienced when deciding on what strategies to employ? How to create partnerships? (Adapted from: Fisher, 2012, Questions Used in Developing Each Case Study, p.1048.

To understand the theoretical lens of Effectuation Theory of Entrepreneurship and Five Principles:
To understand decision making related to Principle 1: Bird-In-Hand.

1. How did you follow your idea to start your new venture?

To understand decision making related to Principle 2: Affordable Loss.

2. How would you describe your experience with dealing with financial losses and gains?

To understand decision making related to Principle 3: Crazy Quilt.

3. How did you experience the development and alignment of stakeholders for your new venture?

To understand decision making related to Principle 4: Lemonade.

4. How did you handle when things in your startup did not go as planned?

To understand decision making related to Principle 5: Pilot-In-The-Plane.

5. How go about estimating or forecasting the future of your business?

Demographic Questions

1. What describes your gender, age, ethnicity, and highest level of education you have achieved?

Bonus Question: As I speak with more physicians, I may learn new information of interest to you. Are you open for a follow up conversation?

IV.4 Data Collection

Our data collection method executed was through secure, password-protected, encrypted, digitally mediated, and in-depth interviews open to the collection of audio, video, images, documents, and other data types. The safekeeping of data confidentiality was maintained through password-protected and encrypted interview meeting links along with encrypted transcriptions of the digital interviews. Following Langley (1999) we expected to collect data from stories about

physician entrepreneurship, medical startup processes, and descriptive details about how decisions were made, who made the decisions, and how certain activities and events unfolded through the commercialization of new medical products and services. We initiated two forms of recruitment for this study: 1) Recruitment for the research study was distributed nationwide by an electronic recruitment email in the United States among professional associations for physician entrepreneurs. Phase 1) Respondents to the electronic recruitment email were screen against the requirements of the eligibility questionnaire. (See Table 6).

Table 6: Eligibility Questionnaire

<ul style="list-style-type: none"> • I completed graduate medical education and graduated from medical school (completed residency and/or a fellowship or internship equivalent).
<ul style="list-style-type: none"> • I hold or previously held a license to practice medicine.
<ul style="list-style-type: none"> • I am a person who, either as individuals or as part of a team, have founded at least one company and continued with at least one company I founded and have taken the company public or am in the process of taking it public in the future.
<ul style="list-style-type: none"> • My company received or is in the process of receiving external investments, angel investments, venture capital investments, and/or other third-party investments.
<ul style="list-style-type: none"> • I volunteer to be interviewed for about 60 minutes.
<ul style="list-style-type: none"> • To participate in the study, I agree to be contacted and interviewed by digitally mediated web tools (email, phone, Zoom, Skype, WebEx).

Phase 2) Respondents who met the study's eligibility requirements were invited participate. Phase 3) Respondents who met the study's eligibility requirements and committed participate were scheduled for a semi-structured and in-depth interview via encrypted invitation links to a password-protected and encrypted digital interview meeting date and time. All other respondents were dropped from the prospective pool of study participants. (Miles et al., 2020) noted in qualitative multi-case study design, the method of homogenous sampling placed emphasis on respondents with similar demographic and social characteristics. Each participating physician founder was interviewed once with permission to contact for follow-up.

This method allowed for collections of rich data sets of individual responses and reflections from current and past physician entrepreneurial experiences.

IV.5 Data Analysis

As Welsh (2002) mentioned, ‘computer assisted qualitative data analysis software (CAQDAS) has been seen as aiding the researcher’s search for an accurate and transparent picture of the data whilst also providing an audit of the data analysis process as a whole.’ Our data analysis of the NVivo 12 data coding was used to provide useful discussion on the data, contexts, and meanings, our data analysis used replication logic techniques to illustrate emergent themes, patterns, contrasts, and comparisons of the research data (Miles et al., 2020; Van de Ven, 2013). In this study, the collection of data was analyzed using Microsoft Excel for data analysis and data visualizations and NVivo 12 qualitative data analysis software tools were applied to discover deeper insights, pinpoint patterns, and to draw clearer conclusions.

IV.6 Data Coding

(Miles et al., 2020) used NVivo 9 to descriptively micro-code qualitative data from units of phrases, sentences, and paragraphs to identify patterns, themes, code co-occurrences between structural codes and context codes for cross-case understanding. We followed the data analytic strategy of (Miles et al., 2020) by micro-coding our transcribed qualitative interview data using NVivo 12. We coded for co-occurrences between our structural codes and context codes to understand the emergence of themes, patterns, and word frequency that revealed intricate ways in which participants experienced multifaceted physician entrepreneurs experienced of empirical data from interview files using three techniques within the NVivo 12 software for data analysis tool (Automatic Coding in Documents, 2022).

Manual coding was completed based on the constructs codes, structural codes, and context codes identified from our systematic literature review after the research question was

developed. An original auto coded NVivo 12 themes technique was used to compare manual coding to automated coding for our constructs, structural codes, and context codes. The third application of NVivo 12 auto coding based on the constructs and structural codes of the five effectuation principles to allow for identification of patterns and themes in the data coded specific to these theoretical principles. Our preparation processes for data coding followed steps to standardize data files and perform data clean up on each file before coding with the NVivo 12 data analysis software tool (Automatic Coding in Documents, 2022). The process is represented in Figure 3. The results of the NVivo 12 data coding, patterns, themes, and cross case comparison are described and interpreted in section V.1.

Data Preparation and Coding Processes

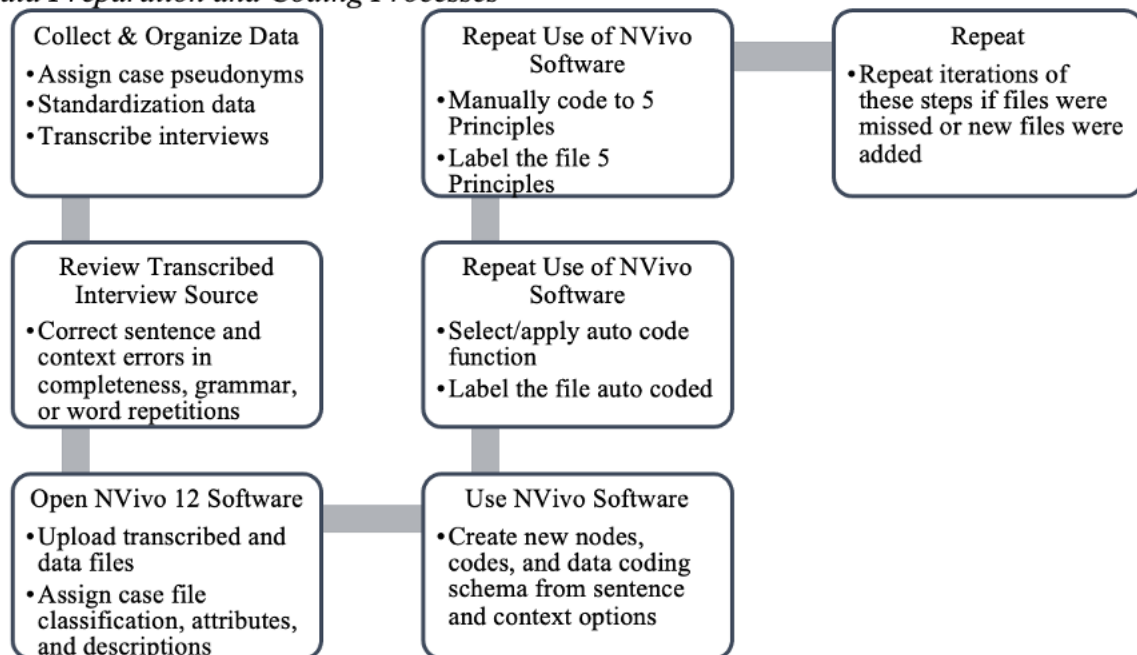


Figure 3: Data Preparation and Coding Processes

Source: Adopted from Automatic Coding in Documents, 2022

IV.7 Cross-Case Attributes: Types of Healthcare Innovation Delivery

In our study, case participants shared micro-perspectives and industry-specific data such that our results revealed formal medical education training in medical school, residency, and fellowship programs transcended across the development of the clinical expertise brought into the new venture. A side-by-side comparison of medical specialty by training to the healthcare innovation delivered through the 21 cases of medical startups is detailed in Table 7. This data contributes to new understanding about differences and similarities in medical training and the future trajectory of healthcare innovation delivery types.

Table 7: Type of Specialty by Training Compared to Type of Healthcare Innovation & Medical Startup

Medical Specialty	Healthcare Innovation	Source
Cardiology	Medical Device: Angioplasty Heart Stent	Takdoa, personal communication, September 14, 2021
Cardiology	Technology: Digital Health Platform	Ian, personal communication, October 12, 2021
Cardiology-Pediatric	Technology: Artificial Intelligence in Medicine	Agustin, personal communication, September 22, 2021
Emergency Medicine	Medical Device: Digital Otoscope + Finance: Venture Capital*	Jaxon, personal communication, September 16, 2021
Emergency Medicine	Technology: Technology Platform + Finance: Venture Capital*	Uberto, personal communication, September 14, 2022
Emergency Medicine	Group Practice: Holistic, Alternative & Integrative Medicine	Thandi, personal communication, October 4, 2021
Emergency Medicine	Artificial Intelligence: Software as a Medical Device	Lakshmi, personal communication, October 21, 2021
Family Medicine	Group Practice: Family Medicine	Jabari, personal communication, September 21, 2021
Family Medicine	Healthcare Workforce: Coaching	Parker, personal communication, September 27, 2021

Internal Medicine, Endocrinology, and Diabetes	Medical Device: Automated Glycemic Control	Tinsley, personal communication, September 21, 2021
Orthopedic	Medical Implant: Spine	Fergus, personal communication, September 14, 2021
Osteopathic Medicine	Medical Implant: Dialysis Device	Neo, personal communication, September 27, 2021
Otolaryngology/Facial Plastic Surgery	Technology Platform + Medical Device*	Adonnis, personal communication, September 3, 2021
Physical Medicine Rehabilitation & Wilderness Medicine	Medical Implants: Hip, Knee, and General Bone + Group Practice: General Bone & Joint*	Tommaso, personal communication, September 22, 2021
Surgery - General	Legal Services: Physicians Only	Paige, personal communication, October 4, 2021
Surgery - General	Solo Practice: Pathology	Saanvi, personal communication, September 19, 2021
Surgery - Orthopedic	Solo Practice: Orthopedic Surgery	Mace, personal communication, October 8, 2021
Surgery - Reconstructive	Group Practice: Plastic Surgery, Microsurgical Reconstructive + Finance: Venture Capital*	Fabio, personal communication, October 7, 2021
Surgery - Thoracic	Technology: Telehealth + Healthcare Workforce: Medical Staffing*	Wesley, personal communication, September 24, 2021
Surgery - Thoracic	Technology: Digital Healthcare + Finance: Venture Capital*	Esteban, personal communication, September 27, 2021
Surgery - Trauma, Head & Neck	Group Practice: Plastic Surgery, Reconstructive Head & Neck	Maartin, personal communication, September 21, 2021
Note: An * indicates where the physician entrepreneur simultaneously started and led a second medical startup business		

Additional results indicated 33% of participating physician entrepreneurs were self-described serial entrepreneurs - having founded, led, and stayed with more than one medical startup. Ding (2011) shared the importance of understanding a physician founder's educational

background and influence on the organization's ability to develop new venture strategies, as the founder's vision and model of the organization tended to be embedded for long-term impacts on the firm's organizational structure and growth strategy.

Physicians who were medically trained as emergency physicians comprised the largest type of physician entrepreneur. An interpretation of this data indicated that physicians with emergency medical are well versed in making quick, accurate, and wide-ranging life preservation decisions. The dexterity of decision-making translated into physician entrepreneur's medical startup up business and series of effectuated actions across ideation, innovation, and the commercialization of new medical products and services. 19% of the participating physician entrepreneurs in our study were trained in emergency medicine.

Similarities. 50% of the medically trained emergency medicine physicians started a second business as a venture capital fund designed to invest in early-stage physician-led medical startups. Consistent motivations expressed for starting a second business derived from poor personal experiences with cold-call-pitch venture capital investors. The physicians were frustrated with the lack of venture capital funds with medical knowledge and unwillingness to invest in medical startup ventures.

Differences. 50% of the physician entrepreneurs who were medially trained in emergency medicine were male and 50% were female. 100% of physician entrepreneurs who were trained in emergency medicine created different healthcare innovations: 1) medical device, 2) technology platform, 3) group specialty practice, and 4) artificial intelligence in medicine.

Data interpretation. Physician entrepreneurship as a healthcare innovator can be a path of career diversity for trained emergency medicine physicians regardless of the medical specialty training received. Physician entrepreneurs created healthcare innovations across multiple

categories despite having little or no formal training or experience in the type of innovation delivered through their medical startups. Physicians can and do become entrepreneurs who bring unique and individualized expertise, experience, and decision-making behaviors that are effectuated for the benefit of the medical startup and its related products & services.

IV.8 Cross-Case Themes: Top 10 Themes from Original Thematic Framework

In qualitative research, thematic analysis using NVivo 12 software tools is a common data analysis technique used to leverage, identify, analyze, and pinpoint emergent cross-case themes from rich descriptive data. After reading through the transcribed data, we manually developed, assigned, and coded thematic frameworks that revealed novel insights into the significance and frequency of themes expressed by the 21 participating physician entrepreneurs. (See Table 8).

Decision-making was a top coded node within the original thematic framework coded across 21 case files at 576 data points of reference. This was a central point to draw further conclusions from about the decision behaviors and mechanisms exploited by physician entrepreneurs through the echoes of self-reflection.

Table 8: Top 10 Themes from Original Thematic Framework, Manually Coded

Theme Name	Number of Case Files Coded	Data Points
Decision Making	21	576
Commercialization	20	547
Acumen Development	20	314
Experience-Physician Entrepreneur	21	240
Healthcare Industry & Systems	20	194
Medical School	21	174
Entrepreneurship	16	138
Experience-Practicing Physician	19	113
Drive, Motivation, & Passion	19	79
Startup Challenges & Mistakes	18	60

Differences and similarities among the top 10 original themes from structural coding can be explained by the potential advantages and trade-offs that physician entrepreneurs experienced when they described a) the quality, meaning, and experiences of decision-making; b) the quality, meanings, descriptions, and experiences of the commercialization processes; c) the quality, meaning, and descriptions about acumen development; d) descriptions about the lived human experiences of being physician entrepreneurs; e) the meaning, quality, and descriptions about the healthcare industry and systems where participants were employed or operated as physician entrepreneurs; f) descriptions about the meaning, lived experiences, and quality of medical school; g) the meaning, description, and quality of the lived human experiences as a professional entrepreneur; h) the quality, meaning, lived experiences in clinical settings as a practicing physician; i) descriptions, meanings, quality, and sentiments about personal and professional drive, motivation, and passions; and j) the meaning, lived experiences, quality, and descriptions about startup challenges and mistakes that led to lessons-learned as a physician entrepreneur and leader of a medical startup company.

Similarities. 100% of physician entrepreneurs expressed having experiences with decision making under routine, ambiguous, high, and low stress, high and low risks, ambiguity, and certainty. 100% of participating physician entrepreneurs discussed their decision making and effectuated behaviors related to the experience as a physician entrepreneur and medical school. 95% of participants expressed experiences navigating commercialization, bridging scientific and business acumen, and dealing with barriers and enablers to physician entrepreneurship with the built environments of the healthcare industry and related health systems. 90% of participants choose to describe details about their drive, motivation, passion, and experiences as a practicing physician.

Differences. Between 75-85% of physician entrepreneurs choose to share micro-perspectives and deeper reflections about their ideas on entrepreneurship as a profession and how they navigated some medical startup challenges and mistakes. The decision-making strategies and mechanisms were unique to 25% of participants.

Data interpretation. We find support of effectuation theory through emergent themes that indicated the appropriateness of applying the theoretical framework of effectuation theory as a mechanism used by entrepreneurs to make decisions. The extent to which our 21 cases used this framework signaled our next phase of our in-depth cross-case coding based on the application of effectuation theory of entrepreneurship its five principles was applicable. In the following section, V.3, we describe the translation of the application of NVivo 12 cross-case data analysis techniques used to leverage, identify, analyze, and pinpoint emergent cross-case themes from rich descriptive within the 21 cases of physician entrepreneurship related specifically to the effectuation theory of entrepreneurship and the five principles to understand deeper insights into

how physician entrepreneurs made decisions and effectuated actions and behaviors in their medical startups.

IV.9 Cross-Case Themes: Coded to Effectuation Theory of Entrepreneurship

We further distilled our empirical data through an in-depth and structured data analysis process. Our results revealed a rise in the number of founding physician entrepreneurs. As indicated earlier, we applied the framing and theoretical lens of effectuation theory and the five principles of effectuation against the backdrop of rich descriptive data sets that were collected through in-depth semi-structured interviews of 21 founding physician entrepreneurs. Our cross-case analysis provided clearer understandings and introduced novel ways that physician entrepreneurs explicitly shared exploited effectuation theory and the five principles under certain conditions during their medical startups and provided (Sarasvathy, 2001; 2008; Fisher, 2012). (See Table 9). Our data revealed wide-ranging degrees of entrepreneurial exploitations of the 5 effectuation principles. The Bird-in-Hand principle was reportedly utilized most often, followed by the remainder principles in this order: Crazy Quilt, Lemonade, Pilot-in-the-Plane, and Affordable Loss exploitations.

Table 9: Nodes Coded to 5 Principles of Effectuation Theory, Manually Coded

Principle Name	Description	Number of Files	Data References
Bird-in-Hand	Begins with the operationalization of entrepreneurial means: who I am, what I am, and whom I know. Effectuated means are oriented towards decision making for growth, performance, and sustainability (Sarasvathy, 2001; 2008; Fisher 2012).	16	74
Affordable Loss	Entrepreneurial decisions are made based on what the entrepreneur can afford to lose (Sarasvathy, 2001; 2008; Fisher, 2012).	16	42
Crazy Quilt	From the start, entrepreneurs leverage pre-commitments of stakeholder alliances to leverage their expertise (Sarasvathy, 2001;2008; Fisher, 2012)	17	65
Lemonade	Entrepreneurial mindset that exploits and operationalizes contingencies during times of business ambiguity as a control measure (Sarasvathy, 2001; 2008; Fisher 2012)	18	58
Pilot-in-the-Plane	Entrepreneurs do what matters to control verses predict their future with forecasts; the future is controlled by the entrepreneur's effectuated actions and decision-making (Sarasvathy, 2001; 2008; Fisher, 2012)	15	57

IV.9.1 Effectuation: Bird-in-Hand Principle

Our study's findings supported prior claims about effectuation theory of entrepreneurship as a decision framework to explain entrepreneurial decision making and action performances during various times within their medical startups (Sarasvathy, 2001; 2008; Fisher, 2012). We know the value of having and effectuating means is critical to a physician entrepreneur within the dynamic effectuation cycle. Our results indicated recollections of specific use of means by physician entrepreneurs whereby 76% expressed decision making exploitations that supported the tenets of the Bird-in-the-Hand principle. Our results generated 74 reference points from self-reflections and descriptions of the quality and meaning of their experiences.

(See Appendix A, B, E, and J). This is an important finding that supports the effectuation theory and application of this principle as a decision-mechanism available and exploited by physician entrepreneurs. Participants emphasized how they created value with their available means, mindsets, and through decision behaviors:

I say, if you want to be an entrepreneur, create a medical product, or open your own business, just do it. (Thandi, personal communication, October 4, 2021).

I went to Home Depot and bought some tape and used some supplies I had at home to design the shape a few times until I got it like I wanted it. We had access to financial resources of our own and connected with an engineer buddy to get the device designed properly. In terms of commercializing the products, services, and many startup businesses, well I think most entrepreneurs do utilize their own resources. Rather that is family funding resources or their personal resources. I do think and in my case that is what I did. I self-funded and my co-founders also self-funded everything. Secondary resources were in the form of investments from our social network, other doctors, you know. (Adonnis, personal communication, September 3, 2021).

You can build a business around it, great, sometimes the solutions are small and sufficient, and sometimes they're big enough to create a company. (Mace, personal communication, October 8, 2021).

From reading about startups, I learned there's some blocking and tackling that's right down the middle of the plate. (Ian, personal communication, October 12, 2021).

Self-funded was important to start. (Maartin, personal communication, September 21, 2021).

I knew I had skillsets in technology that were very, very promising towards bringing healthcare into the realm of other industries. (Fabio, personal communication, October 7, 2021).

I was exposed to several clinicians who were very involved in clinical practices and successfully running different businesses or participating in research at the same time. I was curious and wanted to learn more about diversifying my medical skills into other businesses. (Agustin, personal communication, September 22, 2021).

So, there were lots of lawyers, a lot of businesspeople around in that environment. I was the only medical person and I saw people that had expertise. So, with my expertise in healthcare, I'll be able to pull some strings around certain business

kind of things. And that is how it happened. I was an entrepreneur creating businesses, doing medical research, from that taking ideas to test for market, commercialization, and stuff. (Esteban, personal communication, September 27, 2021).

You know it was important for me to use my skills in medicine and knowledge of technology to remove what I call interference by third parties into the doctor-patient relationship. (Lakshmi, personal communication, October 21, 2021).

Similarities. Situational uniqueness of developed clinical expertise and evidence-based practices was shared by 100% of the participating physician entrepreneurs. 76% of all participants directly described decision-making about how they operationalized their own sets of means where means defined as: scientific and business acumen, medical skills, money, mindset, motives, knowledge, and capabilities within their control and influence [Bird-in-Hand].

Differences. There was variation in the words used by physician entrepreneurs describe what they believed entrepreneurial means to be. Each case described means differently and expressed different ways in which they decided to operationalize their own sets of means.

Data interpretation. While data pointed to different descriptions and interpretations of physician entrepreneurial means, among our 21 cases, most participants shared similar beliefs about what constituted means, the value of means, and the important role of means in their physician entrepreneurial experiences. We better understand how physician entrepreneurs identify, interpret, and simultaneously exploit and explore entrepreneurial means to support their medical startups. We found support for Bird-in-Hand principle as a decision-making mechanism used by physician entrepreneurs.

IV.9.2 Effectuation: Affordable Loss Principle

Our results supported (Sarasvathy, 2001; 2008; Fisher, 2012). Affordable Loss relates to how predetermined risks and losses were managed by the physician entrepreneurs. Our results indicated that 76% of physician entrepreneurs expressed decision making exploitations that

supported the tenets of the Affordable Loss principle. Our results generated 42 reference points from self-reflections and descriptions of the quality and meaning of their experiences. (See Appendix A, B, F, and K). Through their own voices, physician entrepreneurs shared how they managed risks and affordable loss of personally invested funds as primary investors of their own medical startups:

I tried a few angel investors and one venture capital fund a few years ago but for me, it was a terrible experience. So, you know I had to do it all by myself and no one really helped me. (Ian, personal communication, October 12, 2021).

I started out taking my time with the startup and self-funded to the point where I knew that I needed to bring in blockchain talent and pay competitive salaries to produce at least a minimally viable product for demo to prospective customers, engineers, and to build and test our use cases. (Lakshmi, personal communication, October 21, 2021).

I was exposed to designing the technology and raising money on top of maximizing the use of grants for funding business. I learned how to navigate and avoid some business hurdles. (Uberto, personal communication, September 14, 2021).

What I mean is that the mission, goal, or value must be personal, but you don't take the outcome personal rather it's successful or fails you must have a strong motivation for doing so uhm be risk tolerant and be able to balance opportunity cost is not just a dollar amount you have to look at the cost and benefits tangible and intangible costs and benefits there's also a psychic cost of benefit. (Adonnis, personal communication, September 3, 2021).

A new doctor, a friend of mine just said to me, I've got a family. I've got a steady job. I'm not about to just dump this and go start a business, and I don't know that I have time for. So, how can I get involved in innovation and entrepreneurship without taking a financial risk? Some people are more risk averse. Some people have the luxury of being less risk averse because they have more resources. (Mace, personal communication, October 8, 2021).

Similarities. 76% of physician entrepreneurs decided to describe in detail how they made decisions about pre-allocations of funding, materials, time, and effort to invest in the startup venture and most importantly they pre-determined acceptable risks and financial losses [Affordable Loss]. Entrepreneurial decisions were made based on what the physician

entrepreneur determined they could lose. Pre-allocating affordable losses was an iterative process that occurred at various developmental stages throughout the startup business cycle. 100% of physician entrepreneurs described contributions to an affordable loss budget was derived from their personal savings and other financial means under their direct control and influence.

Differences. Physician entrepreneurs created and planned diverse affordable loss budgets at various stages within their medical startups. Some preplanned a budget for losses only at the time of product prototype development, others preplanned a set budget they could afford to lose per year, still others pre-allocated a one-time set budget for financial investments they were willing to lose for the sake of product and service development or for business operation costs.

Data interpretation. 100 % of participants described some type of pre-planned affordable loss budget as a part of their overall strategy and operations when creating their medical startups and when they followed their ideas from innovation to commercialization into new markets with new customers. We better understand how physician entrepreneurs proactively prepared for the unexpected situations to occur within their medical startups and found support for Affordable Loss principle as a decision-making mechanism used by physician entrepreneurs.

IV.9.3 Effectuation: Crazy Quilt Principle

Our results supported (Sarasvathy, 2001; 2008; Fisher, 2012). The importance of stakeholders and networks are underpinnings that support entrepreneurial ventures throughout the dynamic effectuation cycle. Study findings revealed 81 % of physician entrepreneurs shared industry-specific insights regarding the medical startup's stakeholders at 65 reference points made through self-awareness and detailed descriptions of the quality and meaning of their experiences. (See Appendix A, B, G, and L). Among the Crazy Quilt themes that emerged in our results were revelations that pointed to well-established and long-term relationships between physician entrepreneurs and stakeholders within the medical startup. The existence of many

significant relationships dated as far back to undergraduate, graduate, medical school, residency, and fellowship experiences. Other stakeholder relationships emphasized a strong trust between and among physicians with one another. Stakeholder networks were instrumental to the experiences and roles as practicing physicians and carried well into the roles of physician entrepreneurs. In our study, participants freely described leveraging stakeholder expertise and expressed decision making exploitations that supported the tenets of the Crazy Quilt principle among stakeholder partnerships and precommitments:

- Practicing physician colleagues as partners, co-founders, and board members (long-term friends, network, prior relationships)
- Other physician entrepreneurs (long-term friends and network)
- Physicians as angel or venture capital investors
- Physicians who served to demo, test, and validate medical products and services along the commercialization processes
- Physician and/or purchase their medical products and services as customers
- Physician entrepreneurs self-described how partnerships, networks, and stakeholders provided new means and shared startup risks as the medical startups were being created

I had exposure and took advantage of asking questions and learning all that I could. You don't need to go to business school or get a formal degree in finance or business to be good at running your startup or soliciting for investments. I better understood the business side of things because I had buddies who started businesses in residency and at the same time they were in clinical practices. I had good advice to help me get started and a network of people to ask. I am not sure a lot of entrepreneurs have a vast network of people or places to have these kinds of conversations, so maybe they get stuck or make enough mistakes that they wind up successful after all. I was lucky and thankful for a buddy of mine who introduced me to the world of financing for entrepreneurs. (Fergus, personal communication, September 14, 2021).

You know, doctors trust other doctors. (Adonnis, personal communication, September 3, 2021).

You can't start something if you don't have any collateral. Those costs are too high. The chief of staff of the hospital just called one of the banks and said loan to this guy. Those pick up the phone lending days are over. I mean that just that doesn't happen anymore and so the problem is you've got a tremendous debt. (Tinsley, personal communication, September 21, 2021).

Look for any grants, look among physician colleagues to be your first investors and testers. (Fergus, personal communication, September 14, 2021).

Initially, I was self-funded, then other colleagues (physicians) bought into my idea and helped for the business. (Tommaso, personal communication, September 22, 2021).

Talk to and network as much as you can to affiliate yourself with people that are like-minded. Stay away from negative people. (Wesley, personal communication, September 24, 2021).

We do have a board of people who are experts in their industries, but that we consider friends, people who we trust, and who trust me, people who have a personal interest in helping our business be successful. (Fabio, personal communication, October 7, 2021).

Similarities. 100% of Physician entrepreneurs described trusted, long-standing, and well-developed relationships that were connected and dated back from high school, undergraduate school, medical school, residency, fellowships, and through their early medical careers as new practicing physicians. Many described the importance of the deep-rooted relationships and how they leveraged their personal network of physicians for peer-to-peer support in similar forms within the dynamic stages of their medical startups. Throughout their expansive networks, physician entrepreneurs secured venture capital investors, board members, product designers, testers, and validators for FDA approvals, physician entrepreneurs and practicing physicians became customers of medical startups led by physician entrepreneurs, contributions from peers provided various approaches of 'how to' start, navigate, and overcome challenges in the processes of commercialization of medical products and services. Some physicians shared the

same venture capital fund investor or experienced cross-investing in each other's medical startups as medical peers.

Differences. There was no single path of network development that matched 100% across all 21 cases. Each stakeholder network was unique and individualized based on the physician entrepreneur's own experiences. The pathway to the establishment of entrepreneurial stakeholders was different across all cases.

Data interpretation. Central to the web of stakeholder relationships was the idea that physicians trusted other physicians. The expertise of physician colleagues was leveraged by physician entrepreneurs within their medical startups throughout the dynamic effectuation cycle and business phases. Physician entrepreneurs described making decisions that leveraged pre-commitments and expertise from members of their stakeholder alliances. We better understand the role of stakeholder relationships and commitments within medical startups led by founding physician entrepreneurs and found support for Crazy Quilt principle as a decision-making mechanism used by physician entrepreneurs.

IV.9.4 Effectuation: Lemonade Principle

Our results supported (Sarasvathy, 2001; 2008; Fisher, 2012). Lemonade placed emphasis on the entrepreneur to effectuate actions and behaviors that managed unexpected situations along the startup journey and to pre-plan contingencies to the greatest benefit of the medical startup. (See Appendix A, B, H, and M). Study findings indicated that 86% of physician entrepreneurs expressed decision making exploitations that supported the tenets of the Lemonade principle. Our results generated 58 reference points of self-awareness and descriptions of the quality and meaning of their experiences. Physician entrepreneurs in our study revealed how they through, made decisions, and approached the management of inevitable business surprises and mistakes by leveraging contingencies for the benefit of the medical startup:

The other thing is you need to prepare for rejection. A lot of rejection. Through learning and making mistakes, I think you naturally get better at learning how to communicate and share the story of your idea, innovation, or device. I found my way to make the startup work out. (Fergus, personal communication, September 14, 2021).

Most physicians have no idea what they're doing in the business world largely because they've never been taught anything. They've lived in the medical realm during their whole lives. At times I've had to go get private consultants. (Tinsley, personal communication, September 2021).

I learned was not to be scared in pivoting. But you have to have your eyes open wide enough to pivot because those opportunities will come and if you dismiss them because they're scary or they're unknown to you. So, learning to pivot is key to understanding that I may make a mistake and it's OK. But learning to pivot. So, my life has been about pivots. (Neo, personal communication, September 27, 2021).

So, through some personal mistakes, I think I was able to find the right group of investors, build a great clinical team and support staff to deliver the kind of personal and individualized healthcare that I had in mind. I self-funded the start of the business until more money was needed to expand and to operationalize our office, buy medical equipment, and other things, you know. (Fabio, personal communication, October 7, 2021).

Similarities. 86% of physician entrepreneurs decided to share explicit self-reflections about their experiences, mindsets, and frame of reference when faced with decision making situations and effectuating actions designed to exploit and operationalize contingencies during periods of business ambiguity. 100% of the participants described dealing with unexpected challenges of entrepreneurial lemons and willingly making lemonade to ensure their medical startups, products, and services found a way to overcome challenges and continue in existence. When faced with challenges and business uncertainty, physician entrepreneurs unanimously described dealing with iterative and various points within the dynamic effectuation cycle of entrepreneurship.

Differences. The methods by which physician entrepreneurs dealt with planned and unexpected contingencies was unique and individualized to the entrepreneur. Each of the 21 cases approached resolution of issues and leveraging contingencies in different ways.

Data interpretation. Physician entrepreneurs proactively planned for the likelihood that unexpected business situations would occur. The preparations allowed the entrepreneur to actively engaged in effectuated actions and decision-making behaviors that maintained the medical startup venture during times of business uncertainty and volatility. We better understand how physician entrepreneurs leveraged the Lemonade principle and found support for Lemonade principle as a decision-making mechanism used by physician entrepreneurs.

IV.9.5 Effectuation: Pilot-in-the-Plane Principle

Our results supported prior findings by (Sarasvathy, 2001; 2008; Fisher, 2012) about entrepreneurs and the importance of effectuation theory of entrepreneurship and the five principles. We found similar exploitations of pilot-in-the-plane decision mechanisms utilized by the 21 physician participants in our research. Study findings indicated that 71% of physician entrepreneurs expressed decision making exploitations that supported the tenets of the Pilot-in-the-Plane principle whereby physician entrepreneurs navigated and charted their own entrepreneurial experiences for the medical startup instead of deploying predictive tactics. (See Appendix A, B, I, and N). Our results generated 57 reference points of self-retrospection and detailed descriptions about the quality and meaning of those experiences. Physician entrepreneurs in our study revealed how they controlled the creation of their startup's future through effectuated actions and decision-making and their experiences of commercializing new medical products and services:

There are tons of stories like this. I mean there are tons of medical device ideas, the problem to get new devices out through the FDA and whatever and development costs. Now the costs are extreme! Unfortunately, I think you're

going to see less and less of these great devices. Why isn't there a system out there available where things could be developed? (Tinsley, personal communication, September 21, 2021).

Regarding the development of products within the medical space offering and how you navigate the translational world from idea and innovation into creating a product...nobody has any idea how to do that right unless you happen to have bids from the engineering background or something where you may have done you know translational work in some other field. (Maartin, personal communication, September 21, 2021).

One of my goals is and has been to advance healthcare by exploring usefulness of artificial intelligence and data science to help the healthcare sector catch up to other industries and to improve the lives of patients. (Agustin, personal communication, September 22, 2021).

Similarities. Shared among the 71% of physicians entrepreneurs who described exploiting Pilot-in-the-Plane were effectuated actions and decision-making behaviors that focused on centering entrepreneurial control over the future of the business compared to predicting the future with predictive analytics. Entrepreneurial innovations in healthcare were deliberate effectuated actions on behalf of the physician entrepreneurs who led the medical startups.

Differences. Personal, individualized, and unique approaches to controlling innovations and the future of the business were predominantly exploited by the physician entrepreneurs in our study. There were diverse and numerous manners used to simultaneously explore and exploit controlling for the future by all cases.

Data interpretation. Physician entrepreneurs creatively made decisions about the future of their medical startup business, products, and services in unique ways that are rooted from their personal and individualized experiences, effectuated actions, and sets of decision-making behaviors. There was no single approach to navigate their future as the approaches varied as

widely as the healthcare innovation delivered by the medical startup. We better understand how physician entrepreneurs think about decisions and found support for Pilot-in-the-Plane principle.

IV.10 Cross-Case Themes: Auto Coded in NVivo

Following (Miles et al., 2020) who used NVivo 9, we utilized NVivo 12 to auto code rich descriptive data to reveal themes and patterns of information. From our cross-case theme analysis, we discovered several interesting and unexpected insights about physician entrepreneurs beyond effectuation theory of entrepreneurship and the five principles. To mobilize this new knowledge from the individual case studies, we examined emergent themes across cases for similarities and differences expressed from physician entrepreneurs in their own words. The results from our cross-case themes lift the voices of the physicians in featurettes of about cross-case themes that emerged from our data analysis. The remainder of cross-case themes will highlight commentary around the experience and definition of physician entrepreneurship, innovation voices and the Hippocratic Oath, influences of youth & childhood, medicine as a career, experiences of medical school, residency, and fellowship, business acumen development, ideation, innovation, and commercialization, and funding strategies. Each theme is described and discussed in the remainder of section V.4.1 through V.4.10.

IV.10.1 Physician Entrepreneurship

In the landmark research by Shane and Venkataraman (2000) drew attention to unexploited entrepreneurial opportunities and explicitly stated a core obstacle has been the creation of a representative framework for the field of entrepreneurship spawned out of insufficient and inconsistent definitions of entrepreneurship. We posit contributing barriers to the development of a representative framework take root in the crevices and gaps of extant literature where the voices of the physician entrepreneurs remain unamplified and unheard.

Participant physician entrepreneurs shared their experiences of opting to become entrepreneurs and take on various aspects of healthcare innovation challenges to solve larger societal health concerns. Johnson and Rogers (2012) defined a surgeon entrepreneur as one who could potentially extend the surgical boundaries for medicine and possibly lessen the health concerns of present and future generations. In our study, we sought to hear and amplify the voices of 21 medical startups cases led by self-described physician entrepreneurs.

Although this study was not centered on motivations or entrepreneurial intention, some physicians decided to share details about how they experienced motivations and intentions behind their healthcare innovations. Some physician entrepreneurs enthusiastically expressed they deliberately placed medical innovation emphasis on resolving urgent issues related to healthcare quality, quality of life, patient safety and satisfaction for both the physician and patient during health encounters. In the interview, we asked each physician entrepreneurship to define a physician entrepreneur from their own subjective thoughts and reflections. Our empirical data collection revealed 100% of participant cases described a unique definition of a physician entrepreneur. (See Table 10).

Table 10: Physician Entrepreneur as Defined by Physician Entrepreneurs

<i>Physician Entrepreneurs</i>	<i>Definition of Physician Entrepreneur</i>	<i>Source</i>
Adonnis	Physician entrepreneurship is the pursuit of opportunity by doctors and other health professionals under VUCA (volatile, uncertain, complex, and ambiguous) conditions.	Adonnis, personal communication, September 3, 2021.
Agustin	A physician entrepreneur is a clinician who believes in bringing value to healthcare by using innovation to deliver that value.	Agustin, personal communication, September 22, 2021.
Esteban	Being an entrepreneur is about blending your own creativity, innovation, knowledge, medical expertise, power, and influence to improve the health of humanity.	Esteban, personal communication, September 27, 2021.

<i>Physician Entrepreneurs</i>	<i>Definition of Physician Entrepreneur</i>	<i>Source</i>
Fabio	It is a person who is willing to strategically take on and challenge norms within the healthcare industry and established ways of doing things by applying their clinical skills and innovative ideas to bring new medical products and services into the market to deliver safe, quality, and improved public healthcare and the delivery of individualized healthcare.	Fabio, personal communication, October 7, 2021
Fergus	Someone who does a project outside of the scope of direct patient care in order to create a business in a defined specialty.	Fergus, personal communication, September 14, 2021.
Ian	Someone who has an idea on improving healthcare through the development of a new product and service that is commercialized, sold through a startup, and brings value to customers (patients) first and to other users of their innovations.	Ian, personal communication, October 12, 2021.
Jabari	A person who knows how things should be done in his world and sees that the best path to that is to blaze that trail himself. A very independent person and forward-thinking person .	Jabari, personal communication, September 21, 2021.
Jaxon	An entrepreneur is somebody that is capable of seeing something that needs to be improved, ok with being unconventional , is comfortable with uncertainty and has curiosity. Most importantly, they have tenacity, because nothing ever works out the way you expect.	Jaxon, personal communication, September 16, 2021.
Lakshmi	A medical doctor who wants to use their clinical expertise and skills to make healthcare better . The medical specialty does not matter, but what I think is special about a physician innovator or entrepreneur is the clinical skills that that bring to product or service development.	Lakshmi, personal communication, October 21, 2021
Maartin	A physician who not only decides to establish and cultivate a private practice but does so in a manner that expands their personal role and the reach of their brand to medicine in some new or novel direction.	Maartin, personal communication, September 21, 2021.
Mace	A physician in their daily practice, not constrained by the current rules ... they look to improve the field...an entrepreneur is somebody who sets out to build a business around that.	Mace, personal communication, October 8, 2021.
Neo	Someone who has the ability and allows themselves to think outside the box to challenge themselves to be innovative.	Neo, personal communication,

Lakshmi	A medical doctor who wants to use their clinical expertise and skills to make healthcare better . The medical specialty does not matter, but what I think is special about a physician innovator or entrepreneur is the clinical skills that that bring to product or service development.	Lakshmi, personal communication, October 21, 2021
Paige	A person or group of people who see a problem and work to deliver healthcare innovations that improve health , you are solving for the problems of society.	September 27, 2021. Paige, personal communication, October 4, 2021.
Parker	A physician with an unwillingness to accept the status quo who has the capacity to innovate and get rid of waste.	Parker, personal communication, September 27, 2021.
Saanvi	Someone who knows what a doctor goes through all the way through the other side of healthcare administration. It is someone who wants to improve things for the patient, for the hospital by using their resources .	Saanvi, personal communication, September 19, 2021.
Takoda	Someone who has a passion for solving a problem .	Takoda, personal communication, September 14, 2021.
Thandi	It is somebody who is passionate about finding solutions, answers, and healing for people. A person who has an idea that may be new or considered an improvement on some existing healthcare practice .	Thandi, personal communication, October 4, 2021.
Tinsley	People with medical knowledge and equally strong business knowledge .	Tinsley, personal communication, September 21, 2021.
Tommaso	A physician entrepreneur is someone who seeks to change the human condition and scale with an innovative perspective through the lens of medicine seeks out a problem and resolve it.	Tommaso, personal communication, September 22, 2021.
Uberto	A person who works on the frontline day-to-day. They see a problem and work out a way to solve the problem or has a solution that they think will work . Their solutions may tend to be more practical and applicable than a businessperson creating a medical startup. The physician has that inside validity, and they take the opportunity to do something about fixing a problem.	Uberto, personal communication, September 14, 2021.

Lakshmi	A medical doctor who wants to use their clinical expertise and skills to make healthcare better . The medical specialty does not matter, but what I think is special about a physician innovator or entrepreneur is the clinical skills that that bring to product or service development.	Lakshmi, personal communication, October 21, 2021
Wesley	A physician entrepreneur is someone who explores various ways to create their own economy .	Wesley, personal communication, September 24, 2021.

Similarities. We found patterns of frequently used and similar thematic keywords that were independently used by the 21 physician entrepreneurs during their interviews to describe and define what they perceived to constitute a physician entrepreneur. Among the top words or synonyms used were change, expertise, exploration, idea, innovation, medicine, medical, practice, and problem solving. Strong similarities of shared meaning, value, and experiences among the 21 founding physician entrepreneurs are highlighted in bold in Table 10.

Some of the most significant words and phrases frequently used to describe physician entrepreneurs included: ‘**the pursuit of opportunity by doctors and other health professionals**’ (Adonnis, personal conversation, September 3, 2021); ‘**brining value to healthcare by using innovation to deliver that value.**’ (Agustin, personal communication, September 22, 2021); **blending your own creativity, innovation, knowledge, medical expertise** (Esteban, personal communication, September 27, 2021); ‘**applying their clinical skills and innovative ideas.**’ (Fabio, personal communication, October 7, 2021); ‘**development of a new product and service that is commercialized, sold through a startup, and brings value to customers (patients).**’ (Ian, personal communication, October 12, 2021); ‘**a forward-thinking person.**’ Jabari, personal communication, September 21, 2021; ‘**ok with being unconventional.**’ Jaxon, personal communication, September 16, 2021; ‘**expands their**

personal role and the reach of their brand.' Maartin, personal communication, September 21, 2021; '**someone who explores various ways to create their own economy.'**' Wesley, personal communication, September 24, 2021.

Differences. 100% of the study participants described and defined a physician entrepreneur differently. Cross case analysis revealed there were no two definitions that were the same and each definition was a unique and individualized expression without regard to medical specialty by training or the type of medical innovation delivered through their medical startup.

Data interpretation. The extent to which physician entrepreneurs independently expressed shared meanings about what they believe defined and described them as a physician entrepreneur was more similar in patterns than it was dissimilar. Key words used among the 21 participating physician entrepreneurs included innovation, clinical skills, and having a willingness to go against the status quo to improve health care delivery through innovation. By identifying patterns and understanding among the micro perspectives, our study contributes new insights into the physician entrepreneurial mindset when framed from the perspectives of effectuation theory about their decision making and behavioral actions. Our results shed light on the similarities and differences that contributed to insights into the benefits of diversity of thoughts and experiences of the physician entrepreneurs in this study.

IV.10.2 Voice of Innovativeness & Hippocratic Oath

The voice of innovativeness of the practicing physician has traditionally been shuttered in U.S. healthcare system with tenuous hierarchical cultures that inadvertently prioritize maximization of patient billing events. Unknowingly, archaic healthcare business models and the establishment of long-standing third-party relationships work to marginalize physicians employees through contractual and other constraints. In (Greek medicine - Hippocrates, 2012) a version of the oath undertaken at many U.S. medical schools shares agreements that millions of

medical students swear by as they enter the medical profession. In understanding the voices of participants, our results indicated reflections about their innovation voices and the Hippocratic Oath. A participant reflected on her perception of a micro-experience in clinical culture related to the perceived value of her voice of innovation when she changed roles from a general surgeon to a palliative medicine physician. Another physician commented about innovation and the influence of the Hippocratic Oath on his medical experience that remained a part of his mantra as a physician entrepreneur leading a medical startup venture:

The deep downside of sticking with tradition means innovations suffer, they just don't happen when minds are closed and already made up not to embrace new ideas. They maintain this structure to keep order. (Fabio, personal communication, October 7, 2021).

Surgeons carry a lot of authority and a lot of weight. And so, I lost my voice in not wearing a surgeon's hat when I was a palliative medicine physician, and it really struck me the difference and clinical culture of how surgeons are treated and how palliative medicine doctors are treated. (Paige, personal conversation, October 4, 2021).

The Hippocratic Oath is a pledge that we take to of course, do no harm and other things during our practice of medicine. The pledge has progressed with the times, so you may have several versions of this but still it serves a uniform purpose among doctors. It normalizes acceptable behaviors and is a guide for how we deliver care. So, if I think about it related to being an innovator or entrepreneur, it remains the same for me. I think to treat the sick to the best of one's abilities is a driver for many physicians who have crossed into innovation or medical startups. (Takoda, personal communication, September 14, 2021).

Make the good work of your innovation personal. I would say, the Hippocratic Oath has been an underlying guide or north star for how we intend to practice medicine. With that said, the Oath is a what I call a shared belief or set of norms that guide intentions to practice medicine ethically, professionally, and to first do no harm to patients in the process. (Adonnis, personal conversation, September 3, 2021).

Similarities. The value of expressing human voices was important to 100% of physician entrepreneurs. In our study, several participants described their experiences of longing to have their voices to be heard by their employers when they were employed as practicing physicians.

Others expressed experiences of having their voices silenced in various workplace settings and within the hierarchical culture of healthcare systems and healthcare organizations. Those who choose to share experiences and perspectives about the Hippocratic Oath shared a similar reverence and experiences of shared meanings about what the Oath stood for in their education and careers as physicians and physician entrepreneurs.

Differences. Some physician entrepreneurs had more direct encounters and impressionable experiences of what they described as voice-silencing and situations where their innovativeness to solve a healthcare problem was promptly shut down or completely ignored by an employer within workplace settings. Among those who choose to express this experience, the circumstances and situations were different and individualized such that it was clear that each physician entrepreneur resolved the matters by exploiting different approaches. There were no single or best lessons learned about confronting the physician's voices being silenced or ignored.

Data interpretation. An examination of the research data pointed to an issue where the voices of the physicians have struggled to find a place to be heard within medical settings, among academic scholarly literature, within built healthcare environments, and among the business community of economists and econometric scholars alike. We interpret the emergence of this theme as a message that having physician voices being heard by broad healthcare audiences is important. Extending opportunities for front line physicians to communicate novel and innovate approaches to solving today's multitudinous healthcare challenges increases the likelihood of prospective collaboration and narrowing of the gaps between academia, practice, and wide-ranging stakeholders in the healthcare industry. The practice of role-based voice amplifications that silence physician entrepreneurship is damaging to practicing physicians, prospective, and current physician entrepreneurs. When practices to shutter voices take place, the

U.S. healthcare system can only expect to continue lagging behind in generating innovative health care solutions that could be commercialized to save lives, improve health, and health benefits to society. We believe the issue of voice representation presents an opportunity for collaborative engaged scholarship among members of the scientific community, medical community, governmental agencies, and foundations. When more voices are heard, the diversity of thoughts, and solutions to problems is exponentially improved. Through this study, we translate the voices of the physicians such that members of the academic community and medical communities might create and implement interventions to improve opportunities for the physician voices to be heard more frequently in evidence-based managerial settings.

The importance and description of shared meaning and experiences of taking the Hippocratic Oath as a part of the medical school experience and training to become physicians indicated that the particularizations of our study's findings could be extended and generalized among other physician entrepreneurs.

IV.10.3 Influences of Youth & Childhood

Some participants decided to share observations through micro perspectives about some early experiences and decisions from their youth and childhood to share how they shaped their future to choose medicine as a career. Physician entrepreneurs described how those familiarities from early ages were connected to some of their later decision-making processes about entrepreneurship, medical careers, innovativeness, and other experiences as physician entrepreneurs:

I think a lot of my motivation has to do with my childhood. Making my first dollar independently, I think, was very important to developing maybe an early entrepreneurial mindset but you know kids don't fall far from their parents. (Adonnis, personal conversation, September 3, 2021).

I was an entrepreneurial kind of kid, I mowed lawns, delivered newspapers, and took other odd jobs. So, I always knew I wanted to be an entrepreneur of some

sort and to start my own business. I am a mechanical engineer by training. Unlike most of the folks you have or probably will interview, I took a different route before medical school. I had enjoyed a successful career before entering medical school at age 41. (Jaxon, personal communication, September 16, 2021).

Since I was little, I was always interested in being a doctor. You know, the usual stuff, I liked people, never really thought of being anything else. I was inspired by the challenges that clinicians face when focusing on their patients. My goal was to have the best possible healing interaction between a physician and their patients. (Parker, personal communication, September 27, 2021).

Similarities. Early awareness was shared among some physician entrepreneurs who expressed primary insights about their mindsets and approach to entrepreneurship and becoming a physician from youth and childhood experiences. Many were enterprising children and youths who shared early work experiences like working in their father's pharmacy pressing pills, delivered newspapers, cut lawns, and or worked as emergency medicine technicians during high school years.

Differences. Early and youthful inspirations experienced by physician entrepreneurs was different and unique as the individual physician. Some shared early awareness came about from inspirational television characters, illness experienced by a family member, or from a youthful desire to end human suffering and improve human conditions within society.

Data interpretation. Some physician entrepreneurs followed their youthful desire to help end human suffering by becoming a physician later in their lives and ultimately turned to physician entrepreneurship to extend the practice of medicine through the creation of a healthcare innovation in the form of medical products and services.

IV.10.4 Choosing Medicine as a Career

According to (*Deciding on a career in medicine*, 2021) the decision to choose medicine as a future career can be a rewarding journey that spans 4 to 10 years, depending on the medical specialty selected. Some participants in our study shared reflections on their experience in

choosing medicine as a profession. Personal reflections through their own words described what participants believed to be affirmations that supported their decisions to pursue the study of medicine and experiences that led them to become practicing physicians:

Being a doctor, it was the only thing ever thought about doing from the time I was three years old. My parents always said, ‘since you were three you want to be a doctor!’ They always said before that you wanted to be a cowboy, but after turning three years old, all I wanted was to be a doctor. (Jabari, personal communication, September 21, 2021).

In high school, I had a job and worked at was an emergency medical technician. I think this set my future in motion to become a physician. The combination of working at an early age and having the responsibility of caring for other people set the stage for my admiration for healthcare professionals and doctors. I knew early what I wanted to do and that was to be a doctor. (Fabio, personal communication, October 7, 2021).

I was challenged by a professor who saw me walking around in scrubs. He asked who I was, what I was doing, and what did I find frustrating about my coursework. Because he asked me tons of questions and invited me to join a healthcare business program, that set my career trajectory (Neo, personal communication, September 27, 2021).

Similarities. Choosing medicine as a career was positively expressed by 100% of the physician entrepreneurs in this study. Many passionately described similar motivations behind their desire to pursue a career in medicine and similarities in their mindsets about what a career as a medical professional would be like. 100% participants shared they were undaunted by the numerous requirements and years of commitment to gain and develop clinical expertise. All physician entrepreneurs shared an undeterred interest and fortitude to persevere through medical school training, residency, fellowships, and varied state medical license requirements.

Differences. The physician entrepreneurs expressed differences in their interest for medical training, specialties, and sub-specialties. There was widespread diversity of interest in focus on types of diseases, human anatomy, and areas medical interest in

medical education and expectations for outcomes when choosing medicine as a career choice.

Data interpretation. Most participants expressed a shared interest in curing **diseases, saving patient lives, and positively impacting society through the practice** of medicine. The differences in medical specialty interest were a common theme that emerged in addition to the differences in the types of medical innovations that were created by the entrepreneurs.

IV.10.5 Experience: Medical School, Past and Future

Medical schools traditionally provide specialized medical education aimed at training physicians in the art of medicine to improve the health of society. The standard MD program at Harvard Medical School is 4 years in duration and allows for students apply for postponement of their graduation by one year under certain circumstances: obtaining another degree, a 12-month scholarly project, or 12 months of additional coursework. *(1.05 five-year MD program-- Pathways)*. Ding (2011) added entrepreneurial insights by emphasizing findings that supported education as a background variable in entrepreneur research was widely studied and noted there remained gaps and opportunity for research in the areas the physician founder's educational background and influence the organization's ability to develop new venture strategies. The medical school experience is routinely followed by a medical residency and the prospects of a medical fellowship placement. Some participants choose to share reflections and commentary about their medical school experiences and share insights about the future of medical school experiences:

The way medical training works is equal parts of following your interest and luck because once you get plugged into clinical rotations you get exposed to as much as a student learn. (Maartin, personal communication, September 21, 2021).

I think it is the responsibility of the student to look for and to apply to the medical school experience they want and what best aligns for the way they think they are going to practice medicine. (Agustin, personal communication, September 22, 2021).

I think there's a gap because the idea of medicine as a business is not something that medical schools really ever tell students, residents, or fellows. There is a gap of understanding between connecting the dots of what you learn in medical school to the actual clinical practice and business side of things, especially how you are supposed to meet volume-based patient care to generate revenue for your employer - a hospital or giant healthcare system. (Wesley, personal communication, September 24, 2021).

In general, the practice of medicine is going to be different because of customer service. It will be about the customer service experience in health. Artificial intelligence (AI) could reduce errors; technology applications can easily transform and improve medical practice. These improvements translate into changes in healthcare, changes in the healthcare experience for patients. These experiences translate into the patient health encounter that leads to better medical outcomes. (Esteban, personal communication, September 27, 2021).

For me, at a young age, I was focused on medicine and really did not think much about the business. The business did not really matter. I focused on medicine only and committing my expertise there. You can be taught medicine, how to run a great business and take care of others and have social entrepreneurship. I would have been open to embracing the business of medicine, maybe if it was introduced to me at a much younger age. (Tommaso, personal communication, September 22, 2021).

Similarities. Similarities existed across the various medical school attended by the participating physician entrepreneurs related to the number of course hours required and other steps to earn a medical degree. Most agreed that medical school business models from the past - those that they experienced - are outdated and require an urgent refresh for medical curriculum. A majority agreed that incoming and new medical school students have greater challenges ahead and different expectations from the medical school experience and from the practice of medicine. Some physician entrepreneurs simultaneously held dual roles as assistant or associate professors at medical schools and were actively engaged in teaching new generations of future physicians. For those who

were not actively teaching or directly connected to medical school curriculum, they continued to read and stay engaged in community dialogue about the status of medical school and the outcome of future physicians.

Differences. No all-physician experiences were the same during the time they spent in medical school training. Some physician entrepreneurs shared experiences of being exposed to the development of both scientific and business acumen as early as undergraduate school and throughout the course of their medical education training. Others described little to no exposure to business during the three key points of their medical training: graduate medical education, residency, and fellowship. Many physicians described the benefits of full incorporation of foundational business courses into medical school curriculum, however, there was not agreement at what point was most appropriate to introduce such courses. We learned that some believed the responsibility for gaining business education rested with the student while others believed there was a shared responsibility between the student, medical schools, and business schools.

Data interpretation. Medical school experiences from the past, schools of the future need to look towards changing the current business models graduate medical education training and work life balance. Some physicians described early elementary school programs have invested significant financial and other resources into science, technology, engineering, and math to provide advance training readiness for future careers in medicine. Although some participating physician entrepreneurs held dual roles at medical schools and as physician entrepreneurs, all physicians shared a common theme

of deep interest and concern about the status of the profession and the trajectory of the future of the practice of medicine.

IV.10.6 Experience: Medical Residency

The experience decision-making and complex steps to apply for medical residency can be daunting for some students (Apply smart for residency, 2021). Information is provided through numerous decision-support resources and information to help students navigate to a good residency selection and experience. Some of the study participants reflected on their experiences attending residency programs and how those experiences related to their careers in medicine and to their future decisions to become founding physician entrepreneurs:

In residency we got essentially no exposure to business of any kind. We didn't get splitters, we didn't get any visitation by business leaders, we didn't have any exposure to how to run a business or medical practice or otherwise. It's, I think, I'm almost certain, it's the same way today. (Jabari, personal communication, September 21, 2021).

From the time I started into medicine, my interest or pathway was in plastic surgery. I was fortunate to be exposed to facial plastic surgery as a student and resident, I was able to develop a good expertise in this area. In my private practice, our goal is to create life-long relationships with each patient. We help them with the presentation of that outward appearance by delivery solutions that solve for their aesthetic needs. (Maartin, personal communication, September 21, 2021).

When you leave from residency and even when you are in residency, you are working in a medical business. You're just working for the healthcare system which is a big business. Just because you are in the role of a physician, you are running a business and making business decisions every day. (Mace, personal communication, October 8, 2021).

Similarities. Shared meaning through self-reflection among 100% of the physician entrepreneurs were indicated in the descriptions and reflections about their medical residency program as newly minted physicians once they graduated from various MD programs. Why is this theme important? The emergence of data patterns indicated the 21 participating physician entrepreneurs in our study reflected similarly on their

medical residency programs with a few exceptions. This is indicative that medical schools across the United States offer consistency in how physicians are educated and medically trained. This theme indicates the low variability in how physicians approach healthcare delivery for patients in the US. Collectively, physicians shared descriptions of recollections about their series of medical training that was routinely provided after graduating from medical school and entering the next set of training as medical residents. Physician entrepreneurs also described earning similar residential salaries although they attended 21 different medical residency training programs.

Differences. During residency, medical specialty and sub-specialty training is provided to hone and develop medical expertise in certain areas. Not all physician entrepreneurs selected the same medical residency program pathways as they all attended different universities and medical residency programs. None had the shared experience of attending the same medical school at the time of their educational experiences. Some experienced very formal and hands-on residency training, while others experienced doing a larger percentage of time that was allocated to shadowing other physicians in order to learn from watching others perform procedures, conduct exams, and other patient treatments.

Data interpretation. The experiences of medical residency as a newly graduated physician offers some similarities and differences that are as unique as the residency program, the location of the program, and the focus of the medical specialty training outcome expectations. Some physician entrepreneurs aimed for residency programs and matching based on the anticipated medical training and the reputation of the healthcare system or healthcare organization that organized and provided the specialty training. The

residency experience was as unique and diverse as the 21 physician entrepreneurs in the study.

IV.10.7 Experience: Medical Fellowships

The experience of medical fellowship are common and traditional practices that follow completion of medical training through medical residency programs (Training opportunities, residents, and fellows, 2021). Physician entrepreneurial participants decided to share experiences of participating in medical fellowship opportunities beyond their medical residency programs concluded. Our results indicated that fellowship experiences and the medical knowledge was very individualized and centered around what a fellow happened to be exposed to at their participating healthcare system or specialized medical training that might have been exclusive to the individual fellowship program itself:

I also think there is undeniable change coming to healthcare that will impact medical schools, residencies, and fellowships for the better. (Lakshmi, personal communication, October 21, 2021).

It was an experience of a lifetime; I got to travel overseas and see the world as a bigger place and practice medicine in unique ways that med school did not really prepare me for. It was exciting and interesting. I got hands on experience with practicing, not your typical medicine practices and deal with infectious diseases. (Tommaso, personal communication, September 22, 2021).

After I got out of fellowship, I had a choice between an academic career or going into a private practice for a friend of mine in endocrinology. I choose the private practice. (Tinsley, personal communication, September 21, 2021).

Yes, so you know most of our fellowships and plastic surgery are a private practice fellowship. Mine was, so you know, in that way kind of by definition, during that fellowship, year over years you get exposed to what a small private practice is like. You get some idea of how things function in facial plastic surgery. At least when I went through, and this was 20 years ago. (Maartin, personal communication, September 21, 2021).

Similarities. For those physician entrepreneurs who described attending fellowship programs for specialized medical training post-graduation and residency, they described

comparable and rigorous training programs. Salary equivalents were also shared among those who attended fellowship for a designated period of medical training.

Differences. Some participating physicians described their residency experiences as the ‘luck of the draw’ due to the wide-ranging fluctuations they experienced from changes in medical instructors and practicing physicians. A portion of participants noted they had exposure to the development of business acumen while attending residency.

Data interpretation. The aim of fellowship programs is to provide specialized medical training for a period. All participants who took part in a fellowship program had different and unique experiences that were impacted by the healthcare or hospital systems that provided the medical training. During fellowship, the 21 cases of physician entrepreneurs experienced comparable and different clinical rounds, rotation, degrees of direct patient interaction, and other medical training.

IV.10.8 Business Acumen Development

Entrepreneurial investigations by (Alvarez and Barney, 2007) framed studies from the lens of discovery theories posits entrepreneurial discovery of opportunities was central to business of entrepreneurship. However, our research data indicated the effectuated actions by the physician entrepreneur supported the effectuation theory of entrepreneurship and its five principles popularized by landmark studies from (Sarasvathy, 2001; 2008; Fisher, 2012). The development and applications of business acumen is a critical success factor for medical startups.

In our study of 21 cases, some physician entrepreneurs provided feedback on their experiences with traditional undergraduate, graduate, and graduate medical education models. Based on the descriptions of the participants, diverse avenues were exploited by physician entrepreneurs at various points to develop business acumen requisite for the creation of a medical startup and innovating beyond the idea phases. Some physician entrepreneurs were self-taught in the areas business administration, finance, had access to expert business stakeholders, or had

prior experience in business before creating their medical startup. Below are some of the expressed experiences regarding business acumen development:

Nothing about my medical education, residency or fellowships prepared me to manage people, build a business plan, or even have an idea of what to do with my idea. There was no curriculum on business subjects and no one encouraging information sharing on how to get started or what to do. I think med schools, traditional one stay that way because foundationally, it relies on hierarchy where the structure is rigid, and roles are clearly defined for faculty, students, residents, and fellows. The structure is designed teach clinical skills that are transactional compared to being transformation clinicians. They maintain this structure to keep a certain order, you know (Fabio, personal communication, October 7, 2021). So, the problem becomes if you want innovation, right? Which is the big question how you continue innovation and blend medical school education? I mean how do you continue to have people with a medical knowledge and equally strong business knowledge? (Tinsley, personal communication, September 21, 2021).

I had to sort of figure things out on the business side, but I wish I had some prior insights or foundational business skills before making the jump. (Lakshmi, personal communication, October 21, 2021).

I had some business background, and I knew early on as a kid what I wanted to do. I have always set my sights on something and worked my ass off to make it happen. I am an adventurous person. (Tommaso, personal communication, September 22, 2021).

For me, I had the good fortune of working quietly, but working well. So even in medical school, I was selected to work on special projects and assigned to leadership roles. That gave me early exposure to understanding the administrative side of the house, so to speak. The business side of how medicine is run from charging the patients for services to ordering supplies and managing logistics. I saw early on why there were conflicts between doctors and administrators. (Saanvi, personal communication, September 19, 2021).

Really the absence I would say in my experience of medical school, residency, and fellowship. Whenever I had an idea, there was no one again to help me, students, residents, or physicians break into entrepreneurship or even understand what the hell we needed to do next with an idea. There was nothing about leadership or talk about your value as a physician beyond healthcare. I took it personal - it made me just very angry, as I said, I'm still angry about it. (Adonnis, personal conversation, September 3, 2021).

Similarities. 100% of the physician entrepreneurs described various decision situations where they recalled demonstrating a high degree of ambidexterity by simultaneously exploit and

explore decision-making behaviors in within two domains: scientific and business acumen. The findings of these effectuated behaviors supported effectuation theory [Bird-in-Hand, Affordable Loss, Crazy Quilt, Lemonade, and Pilot-in-the-Plane].

Differences. 29% of all physicians had some degree of business exposure and business experience prior to starting medical school, during medical school curriculum, or from prior careers in business that developed business acumen before earning a medical doctor degree to become a physician. This was a relatively low number of participants who had specific business background knowledge development that preceded a career as a physician entrepreneur.

Data interpretation. Although 71% of physician entrepreneurs described little to no exposure to foundational business education curriculum throughout their academic and medical careers, physician entrepreneurship was still within their reach and influence. Physicians often described events where self-developed business acumen was combined with their scientific acumen. Most participants believed the purpose of their medical school, residency, and fellowship training was centrally focused on singularly developing their scientific acumen as future doctors. Although some pointed out the lack of business education and business exposure during their medical education was a barrier, 100% of the physician entrepreneurs found various ways to overcome those challenges when they started and led their medical startups.

IV.10.9 Ideation, Innovation, and Commercialization

Physician entrepreneurs have been drivers of change and engines of innovative healthcare delivery by opting to follow and operationalize their ideas to solve longstanding healthcare challenges through the innovation and commercialization of new medical products and services. Ding (2011) stated the founding entrepreneur's ideations, vision, and model of the organization tended to be embedded long-term in the firm's organizational structure and growth strategy. Our results illuminated details into how physician entrepreneurs experienced bring some medical

products into the market such as implantable diagnostic, medical maintenance, or treatment devices, and the approval processes required from the federal government and other healthcare oversight agencies. The approval journey for newly innovated medical devices can be filled with approval challenges that span from metals, materials, clinical trials, and other rigorous and inflexible requirements. Some participants decided to share reflections about the processes to advance their ideas into the innovations and commercialization phases by sharing how they experienced those processes as physician entrepreneurs:

I was an entrepreneur creating businesses, doing medical research, from that taking ideas to test for market, commercialization, and stuff. (Esteban, personal communication, September 27, 2021).

I had been so focused on learning how to care for patients that I was not thinking about going solo or starting a business until about 10 years after I had been practicing medicine. (Lakshmi, personal communication, October 21, 2021).

I'm hearing that people have thought about and decided to operationalize their ideas in many different ways. But the absence of having an introduction to business courses at any point of their graduate medical education, residency, or fellowship, they just went various ways of making mistakes to get it done. Like I did as well. (Neo, personal communication, September 27, 2021).

For years, healthcare has been paralyzed by the lack of insights into data understanding. One of my goals is and has been to advance healthcare by exploring usefulness of artificial intelligence and data science to help the healthcare sector catch up to other industries and to improve the lives of patients. (Agustin, personal communication, September 22, 2021).

Oh yeah! We've been dealing with the FDA for over a decade now. We have what's called an IDE - investigational device exemption. Everything we do, every time, if we sneeze, it goes to the FDA and in Europe, the CE mark. What's happened is the FDA has gotten a little bit better in recent years but the Europeans which used to be a lot easier bar to jump have tried to become better than the FDA. (Tinsley, personal communication, September 21, 2021).

Well, the medical devices, which is largely what I do, has to have so many approvals. You have to have thick skin and dedication to believing and seeing your business through. My colleagues helped validate my products and clinical trials needed for FDA and other approvals. It is tough sometimes to get your

products validated to the point that they need to be and also manage not running out of money. (Takoda, personal communication, September 14, 2021).

I was exposed to designing the technology and raising money on top of maximizing the use of grants for funding business. I learned how to navigate and avoid some business hurdles. Later in my career, when I saw a gap and need for a technology platform. (Uberto, personal communication, September 14, 2021).

Similarities. Among the participating physician entrepreneurs, physicians shared common experiences in originating unique and novel ideas for healthcare innovation delivery. 100% of the entrepreneurs described having an idea, following that idea into the creation of a healthcare product or service, and later deciding to build a business around that idea. This unique position demonstrates this group of entrepreneurs set out initially to solve healthcare issues as a primary motivation for the existence of the medical startup. Similarities in the number, type, and impact of challenges when transforming ideas into innovations and subsequently commercializing a new product or services were expressed by a majority of physician entrepreneurs.

Differences. There were different ideas, innovations, and unique barriers that were experienced by 100% of the medical startup cases. There were no ideas, innovations, or commercialization experiences that were the same for any segment of the physician entrepreneurs.

Data interpretation. The nature of diverse healthcare ideas and innovations led to dissimilar experiences across the sample. Each physician entrepreneur's experience had unique elements that were central to the medical device, medical implant, and the medical service requirements, regulations, and oversight by medical boards. This had a direct impact on the differentiated experiences in ideation, innovation, and commercialization.

IV.10.10 Funding Strategies

Understanding the participant decision-making processes, decision situations, and how they navigated those circumstances is of critical importance to this study. To transform innovative ideas into commercially viable medical products and services, indispensable investments are required. Our findings revealed physician entrepreneurial funding strategies for requisite capital needed to support various decision-making situations for the startup venture included funding mechanisms like self-funding, family-and-friend funding, peer-to-peer investment, angel, venture capital, and variations of grant funding. Some participants provided reflective observations about their decision-making experiences and funding strategies for their new medical startups around financial investments:

First, I invested my own money in addition to time to making this device work. Like I shared, I developed the first prototypes and then connected with medical distribution companies to build the product for me. So, I guess, I next got help from friends, family, and other doctors who believed in me and what I was doing. I got some doctors to volunteer to test out the device and help me build validations. When I needed to get some investors onboard, I thought about how I was going to share my idea and how might my idea fit into the investment thesis of a venture capital investment fund. Sometimes, you have to wait for the right one. (Fergus, personal communication, September 14, 2021)

I would say, we are, the company is in, ah, series C funding- the 4th round of money. You know, the key is setting up a good cap table from the start. I knew from other business success how important this was – for the next person or new entrepreneur, this could be a deal breaker from the start. (Takoda, personal communication, September 14, 2021).

You know, we raised a little bit of money from friends and family. You know I'm involved in about 15 different health care businesses right now. OK, so we have all sorts of different models where we have. You know, some of those have raised venture funds for sure, and I'm you know, either on the board or advisor to those companies. (Mace, personal communication, October 8, 2021).

Similarities. 100% of the participating physician entrepreneurs described experiences with making wide-ranging decisions and funding strategies during points of business ambiguity as well as periods of stability during their medical startups. 100% of participants expressed

effectuating actions that led to improved decision-making for the benefit of the medical startup and the healthcare innovation delivered by the business. 100% of study participants described extensive use of their high net-worth networks of stakeholders with wide-ranging expertise to maximize the benefit of financial strategies and alternatives that supported the business needs at various stages [Crazy Quilt Principle]. 100% of physician entrepreneurs described pre-determined budget allocations of affordable losses were well-established for use by the medical startup [Affordable Loss Principle]. 100% of physician entrepreneurs shared the affordable loss budget included means: money, investments, and other financial resources that were effectuated by the entrepreneur for the benefit of the business.

Differences. For some physician entrepreneurs, financial strategies were exclusive to angel investors or venture capital investors, however, some entrepreneurs simultaneously exploited use of venture capital funding along with angel investors, peer, and family investors.

Data Interpretation. Diverse funding strategies and requisite access to capital is essential for medical startups. Among the sample, we better understand how distinct and similar strategies were exploited by physician entrepreneurs during times of uncertainty and during periods of expected volatility of funding needs.

Our data provided novel insights into the idiosyncratic and more common experiences of physician entrepreneurship that were inextricably tied across the diverse experiences of graduate medical education training, practicing as physicians, and ultimately revealed in the diversity of physician entrepreneurial experiences described in this multi-case study. Our results thus add new insights to the body of entrepreneurial knowledge accumulation and extend our findings to the phenomena of physician entrepreneurship that narrows the gap of understanding between theory and practice.

Our findings revealed 10 surprising, interesting, and multifaceted particularizations about physician entrepreneurship and medical startups that have not been previously explored, discussed, or well understood in extant literature. We found these emergent cross-case patterns of insights to be un-related to the co-occurrences of structural coding, context coding, and construct coding of the five principles of effectuation theory. The novel insights from the following 10 themes extended insight into the sophisticated experiences of physician entrepreneurship and medical startups beyond effectuation theory of entrepreneurship as follows: 1) descriptions, meaning, and definitions of a physician entrepreneur; 2) descriptive expressions of the quality of physician voices, voices of physician innovativeness, and meaning of the Hippocratic Oath; 3) the meaning and descriptions about the influences of youth and childhood on medical careers and physician entrepreneurship; 4) descriptions, meaning, and the experience of choosing medicine as a career; 5) descriptions, meaning, and the quality of lived experiences in medical school and descriptions about the future medical school; 6) descriptions, meaning, and quality of experiences during medical residency; 7) descriptions and quality of experience in medical fellowship trainings; 8) the meaning, description, definitions, and quality of business acumen development; 9) the meaning, description, and quality of experiences with ideations, innovations, and the commercialization of new medical products and services; and 10) the meaning, description, and quality of funding strategies for various functions within the medical startup business.

V CHAPTER VI. DISCUSSION, CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

V.1 Discussion

To build a bridge between academic and practitioners around the real-world and contemporary business problem of stalled healthcare innovation in the U.S., we explored rich vaults of knowledge on entrepreneurial literature and developed the purpose, motivation, and research question for our study: How do physician entrepreneurs navigate decision-making strategies for medical startups from ideation, innovation, to commercialization of new medical products and services? Guided by the research question, we designed a qualitative micro-targeted multi-case study that examined a sample of 21 cases of physician founded medical startups at the individual level of analysis where the physician entrepreneurs were the focus of our research inquiry.

We followed our research design, interview protocol, and methodology for data analysis to deliberately investigate the area of concern and to produce a paper with empirical findings that answered the research question, provided new insights and perspectives, and to underscore the voices of physician entrepreneurs. Towards that end, this study presented arguments for contributions amenable to decision-making behaviors as mechanisms exploited by physician entrepreneurs who lead medical startups and commercialize new medical products and services.

We summarized and explained the novelty, significance, importance, and implications of our key findings in field of entrepreneurial research. We focused our research on the niche of medical entrepreneurship through a first-of-its-kind qualitative multiple case study using effectuation theory to understand the micro-perspectives of decision-making and entrepreneurial processes exploited by physician entrepreneurs. The significance and importance of our data implications revealed that physicians across the United States often opt to become entrepreneurs

to solve for healthcare innovation absenteeism through iterative decision-making and exclusive industry processes influenced by prior years of honed clinical and other medical expertise.

We learned that physician entrepreneurs exploited opportunity creation (effectuation theory of entrepreneurship) and willingly took on the risks associated with new medical startup ventures in numerous ways (the five principles of effectuation). While some physicians decided to return to universities to earn additional credentials in the form of business degrees, many of the physician entrepreneurs opted to begin their medical startups by leveraging their own means in the form of medical skills, business and scientific acumen, financial resources, invested stakeholders, and other spheres of influences to build a business around their new and innovative healthcare products and services. As a result, society as a whole is the greatest benefactor of physician entrepreneurial activity and engagement.

The data suggest that our qualitative research inquiry contributed to deeper understanding about the world of physician entrepreneurship and medical startup ventures from the vantage points of micro-perspectives from 21 cases that shed new insights into an under explored and less understood phenomena. While 100% of the research participants were not informed or made aware of effectuation theory of entrepreneurship nor the five principles of effectuation, 100% of the participants' decision-making behaviors and decision mechanisms could be explained and understood through our novel application of the theoretical lens of effectuation that was used to frame our qualitative inquiry.

The data supports the theory that physician entrepreneurs have numerous anecdotal and idiosyncratic experiences that span across their childhood, youth, graduate medical education training, and professional careers as practicing physicians and physician entrepreneurs. The data indicated physician entrepreneurs have exceptional, well-established, and life-long influential

relationships with stakeholders that they can and often leverage as means, stakeholders, and partners for their medical startups.

We interpreted our results and drew emergent conclusions from our judicious analysis of rich qualitative data about the quality and meaning of the lived experiences of physician entrepreneurs and assessed the implications of our findings that answered the research question. Our findings indicated that physician entrepreneurs often begin their medical startups without external support, resources, business education, or financial training. We saw that many entrepreneurs developed their businesses by trial and error as there was little to no prior access to business skill or entrepreneurial foundational education throughout the cycles of their extensive graduate medical education or professional careers as practicing physicians. We learned that physician entrepreneurs have learned to form self-insulating peer groups to support one another including creating their own venture capital funding groups to provide financing for the development of new medical devices, products, and services to fill the gaps where no other sources previously existed.

We explored the meaning and sentiments about the lived human experiences of the 21 cases concluded that medical startups are inextricably tied to the preceding experiences, decision-making, and effectuated processes explored, exploited, and refined by each entrepreneur's niche product or service. Our data suggest that entrepreneurial education and training was important and essential for medical startups, however, data did not suggest the appropriate point to introduce business education or entrepreneurial training over the course of one's graduate medical education experience, residency, or fellowship appointments. The analysis of our data identified physician entrepreneurs as important voices and contributors to healthcare innovativeness in the United States and provided greater understandings about the

more ordinary experience of medical startups, decision-making mechanisms at various points of the business cycle, and indicated further research is needed in this niche space of medical entrepreneurship.

Data pointed to varying degrees of shared experiences, meanings, and expressions about the lived experiences of physician entrepreneurs that shaped how each case navigated their medical startups from ideation, innovation, and commercialization of new medical products and services. An overarching theme from the data indicated that effectuation theory of entrepreneurship was an available and appropriate framework from which a physician can attain physician entrepreneurship as a career and influence the profession of medical entrepreneurship. This study contributed to advancing knowledge accumulation around our area of concern, which centered around physician entrepreneurs, medical startups, and the decision-making processes to commercialize new medical products and services beyond the idea phase. The remainder of this paper's discussion specifies our research contributions made to effectuation theory of entrepreneurship, to the practice of physician entrepreneurship for medical startups & the decision-making processes required for the commercialization of new medical products and services and concludes with reflective insights about the limitations of our study and thoughts about future research.

V.2 Contributions to Theory

Our novel application of engaged scholarship constructed research inquiry specific to applying effectuation theory of entrepreneurship in the context of physician entrepreneurship. Our investigation was framed through the well-established theoretical lens of effectuation theory of entrepreneurship and the five principles of effectuation theory. Since 2000, effectuation theory of entrepreneurship has continued to gain ground as a dominating theoretical framework for understanding and explaining entrepreneurial decision-making and behaviors (Alvarez et al.,

2016). For years, traditional econometric scholars have long inferred merging physicians into massive groups of highly skilled laborers within research samplings across multiple industries without particularizations. Prior studies have centered research investigative preferences around high performing new startup ventures over the more ordinary journeys of medical entrepreneurship.

In this study, we contribute to theory by demonstrating that effectuation theory of entrepreneurship is a framework that useful to understand and explain the dexterous particularizations of physician entrepreneurship within the industry of medical entrepreneurship. Our study approach and findings confirmed effectuation theory and its five principles in the context of physician entrepreneurship. We further contribute to theory as evidence in our data extended the Crazy Quilt principle and indicated that deeply forged relationships across college and early clinical careers were intertwined within the physician and physician entrepreneurial experiences. This finding connects and extends extant literature and entrepreneurial knowledge accumulations about effectuation theory and the five principles applied to a new context of physician entrepreneurship where traditional has applied theory to context of general business and cross-industry small businesses. Evidence in our data contribute new meaning and new insights about effectuation theory and the five principles applied in a niche of medical entrepreneurship that narrows of the gaps of understanding between theory and practice about the phenomena of physician entrepreneurs and decision-making behaviors.

We contribute to effectuation theory of entrepreneurship through our fine-grained analysis of effectuation theory derived from strategic structural coding, context coding, and construct coding of the theory's five principles of effectuation in NVivo 12. Our novel research design blended multi-case study method framed through the lens of effectuation theory, a first-

of-its kind approach, was an original application of effectuation theory and 5 principles in the domain specific to understanding micro perspectives of physician entrepreneurship. The findings from our thematic and cross-case results support previous findings by (Sarasvathy, 2001; 2008; Fisher, 2012) and illuminated novel insights to using the frame of effectuation theory and the five principles to code transcribed and rich qualitative data. Our findings support that the effectuation theory of entrepreneurship was appropriately selected for understanding physician entrepreneurial experiences and decision-making behaviors as founders and leaders of medical startups. Specifically, we contribute to theory through knowledge accumulation and distribution of our findings that advance our understanding about the phenomena of physician entrepreneurship, the meaning, and quality of the lived human experiences of the 21 cases of physician entrepreneurs.

V.3 Contributions to Practice

A key assumption of this study was a belief that physicians believed and trusted in the voices and experiences of other physicians. Towards that end, our research centered on understanding physician entrepreneurship from the micro-perspectives of physician entrepreneurs. We contribute to practice through the discovery and democratization of novel insights about physician entrepreneurship as a career. We make contributions to practice by providing guidance on approaches for medical startups to commercialize new medical products and services. Knowledge production from this study provides direct and indirect insights that can be used for training in medical schools, residency, fellowship, clinical practice, medical entrepreneurship, and within the medical device industry, through which we make contributions to practice.

The knowledge accumulation and information dissemination from this study makes contributions to practice regarding the following emerged themes of lessons-learned and

experiences gained by the 21 cases of physician entrepreneurs: 1) physician entrepreneurial decision-making; 2) commercialization; 3) acumen development; 4) experience-physician entrepreneur; 5) healthcare industry and systems; 6) medical school experience; 7) the experiences of entrepreneurship; 8) the experience of a practicing physician; 8) physician entrepreneurial drive, motivation, and passion; and 10) lessons learned and experiences gained on issues related to medical startup challenges and mistakes. (See Table 8). Through the discovery of new and emergent themes listed in Table 10, we make further contributions to the practice of physician entrepreneurship through the advancement of knowledge acquisition and distribution of information about: 1) description, meaning, and definitions of a physician entrepreneur; 2) descriptive expressions of the quality of physician voices, voices of physician innovativeness, and meaning of the Hippocratic Oath, 3) meaning and descriptions about the influences of youth and childhood on medical careers and physician entrepreneurship, 4) description, meaning, and the experience of choosing medicine as a career, 5) description, meaning, and the quality of lived experiences in medical school and descriptions about the future medical school, 6) description, meaning, and quality of experiences during medical residency, 7) description and quality of experience in medical fellowship trainings, 8) meaning, description, definitions, and quality of business acumen development, 9) meaning, description, and quality of experiences with ideations, innovations, and the commercialization of new medical products and services and 10) meaning, description, and quality of funding strategies for various functions within the medical startup business.

From this research inquiry, we believe our empirical findings contribute to practice by making the profession of physician entrepreneurship within reach and influence of physicians through the amplification of the voices and real-life experiences of 21 founding and leading

physician entrepreneurs. Our findings indicated that physicians can and do often break away from the herds of clinical practice and critically ‘think out of the boxes’ to create new business opportunities as physician entrepreneurs. In our study, we uncovered lessons learned and experiences gained from the voices of founding physicians and contribute to the practice of physician entrepreneurship.

Our results contribute to practice through findings that indicate physician entrepreneurs constantly improvise and adapt to changing environments within their medical startups and the influence of prior experiences, mindsets, decision-making strategies, and behaviors are integral to becoming physician entrepreneurs. The combination of highly trained medical skills, entrepreneurial focus, and problem solving make physician entrepreneurship an example of how physicians can upskill in healthcare where medical innovativeness is traditionally absent. It takes years of medical preparations and training, resiliency, and business critical decision-making skills for physician entrepreneurs to navigate their medical startups from ideation, innovation, and commercialization. Our data provides lessons learned as prospective roadmaps for how to make enter and operate as a physician entrepreneur.

Our findings contribute to the practice of physician entrepreneurship by translating the constructs, structural codes, and context codes from empirical data from our research inquiry. From the rich collection of descriptive data, we gained new understandings about the idiosyncratic nature antecedent physician entrepreneurial experiences. Key antecedent experiences that were connected to decision-making behaviors for their medical startups included: influences of youth and childhood, choosing medicine as a career, business acumen development, ideations, innovation and commercialization of new medical products and services

and funding strategies that are intertwined with decision-making approaches and behaviors of founding physician entrepreneurs who found and lead medical startups.

Our study serves as a lessons-learned, experience gained, and as a literature resource for practice regarding physician entrepreneurial innovativeness for practicing physicians, future physician entrepreneurs, and current physician entrepreneurs experiencing various stages of their medical startup ventures. Through the lens of effectuation theory's 5 principles, physician entrepreneurs can learn, adopt, and modify approaches to making decisions on how they navigate medical startups beyond the idea phases and build business enterprises around new and innovative medical products and services that solve many of today's healthcare challenges. Our study findings are a source for physicians to draw up before they opt to become physician entrepreneurs and take on a portion of healthcare challenges by following their ideas to create, innovate, finance, and commercialize new medical products and services in today's U.S. healthcare sector. The results of this study complemented previous scholarly claims by (Ostrovsky & Barnett, 2014) that indicated U.S. academic medical centers, providers of graduate medical education that leads towards degrees in medicine, are uniquely positioned as drivers for healthcare innovation delivery reform through the introductions of disruptive innovations and entrepreneurial curriculum combined with new options for clinical-innovation career tracks in medicine.

V.4 Limitations of the Study

There were a few limitations of the study that existed and could not be overcome using the research method design to collect data or analyze data from this study. This study was conducted during the ongoing global COVID-19 pandemic. As a result, no in-person interviews were scheduled or conducted. All semi-structured in-depth participant interviews occurred through digital mediation. The use of digitally mediated interview mechanisms reduced

anonymity for research participants during the interview session, made the ability to detect the presence of any interview bias indistinguishable, constrained data collection through the digital mediums of web conference and electronic mail, and limited direct observations by the researcher beyond the visible frames of the computer screen.

The study focused on the case collection of individual self-reflections about decision-making behaviors and experiences as a physician entrepreneur during a snapshot of time over the course of a scheduled and digitally mediated interview, lasting up to 60 minutes per case participant. This did not account for data collection over a period of time, including historical and early prototype records for medical startups. Our study centered around the decision making by physician entrepreneurs across all business cycle phases their medical startups and from ideation, innovation, to commercialization of new medical products and services. Medical startups represented in this study included healthcare innovation delivery in the forms of digital clinical trials, digital healthcare platforms, healthcare information technology, healthcare workforce development, healthcare workforce staffing, legal services, medical devices, medical implants, networking platforms, solo and group physician practices, telehealth platforms, financing firms offering venture capital or angel investment to medical startups. Study results might have yielded additional information and more specific industry insights if the research further narrowed to specific business cycles phases for the medical startups and specific phases of ideation, innovation, and commercialization of the new medical products and services.

V.5 Future Research

By addressing the limitations of our research due to the COVID-19 pandemic, a future study on physician entrepreneurship should be designed to facilitate scheduled in-person interviews of physician entrepreneurs at the physical address of each case study organization. Onsite interviews might increase levels of comfort and anonymity for respondents and allow the

researcher to have direct observations of study participants. Interviews that are held onsite and in familiar work settings would foster feelings of safety and address sensitivity of participants who share greater breadths of empirical evidence. Original insight and illuminations about physician entrepreneurship that might only be elicited when participants feel secure in workplace environments.

Building upon the findings of our research, a future study design method for data collection should be facilitated through a qualitative, longitudinal multiple case study. This research design would allow for more powerful empirical data collection and deeper data analysis over a period. This approach would provide the research with opportunities to investigate, compare, and contrast specific phases of the medical startup business cycle and associated physician entrepreneurial decision-making situations. Data collection over time and different functional business structures would provide broader insights into the multifaceted series of business challenges that physician entrepreneurs encounter. Such a study design would reveal similarities, differences, and idiosyncratic experiences for cross-case analysis and understandings at a deeper level.

By re-assessing and expanding the theoretical framework and approach used in our study, future study on physician entrepreneurship can be extended to include interviews of various startup stakeholders including subordinate employees, staff members, investors, partners, clients, and suppliers to understand role-based decision-making authority and behaviors within medical startups and how those roles interact with the physician founders and impact the trajectory of the medical startup venture. Research through this approach would seek additional data insights about physician innovation and leadership from the perspectives of other organizational stakeholders beyond the founding physician entrepreneur.

By constructing future study using a similar research approach within a new context of medical entrepreneurship such as nurses and other members of the allied health field. It is likely that a future study will address other entrepreneurial challenges and issues faced by medical entrepreneurs in other geographical locations and within cultures outside of the United States. Likewise, the same research question and business problem could be addressed in different cultures and contexts beyond our approach where the physician founders were the primary sources of data collection.

A future study should aim for new objectives to understand innovations in physician entrepreneurship that extend explaining the role and impacts of machines as teammates (MaT) in medical startups and how software tools have become teammates at various functional levels of business enterprise. Such an inquiry is likely to address issues and challenges around the role of artificial intelligence as a medical device (SaMD) and how that impacts the medical startup's products and services and lead to better understanding about the increasingly prominent role that the collection of health data plays in the patient healthcare experience. Another suggestion for future research would include the use of machine learning for data analysis and interpretation and comparison to NVivo 12 data analysis and interpretation of emerged patterns and themes within transcribed interview data. In this study a comparison and contrast of the approaches would be useful for understanding new approaches to understanding the meaning and quality of rich qualitative data insights. Finally, we suggest a future study extend the data findings displayed on Table 7 on the types of physician-founded medical startups to include a comparison of each founder's medical training, undergraduate degrees, and other factors of influence in their medical startup ventures. Deeper insights into understanding the entrepreneurial mindset, cross-

medical skills, and interest could shed new insights about programs that can be developed to support the expansion of physician entrepreneurs as a career.

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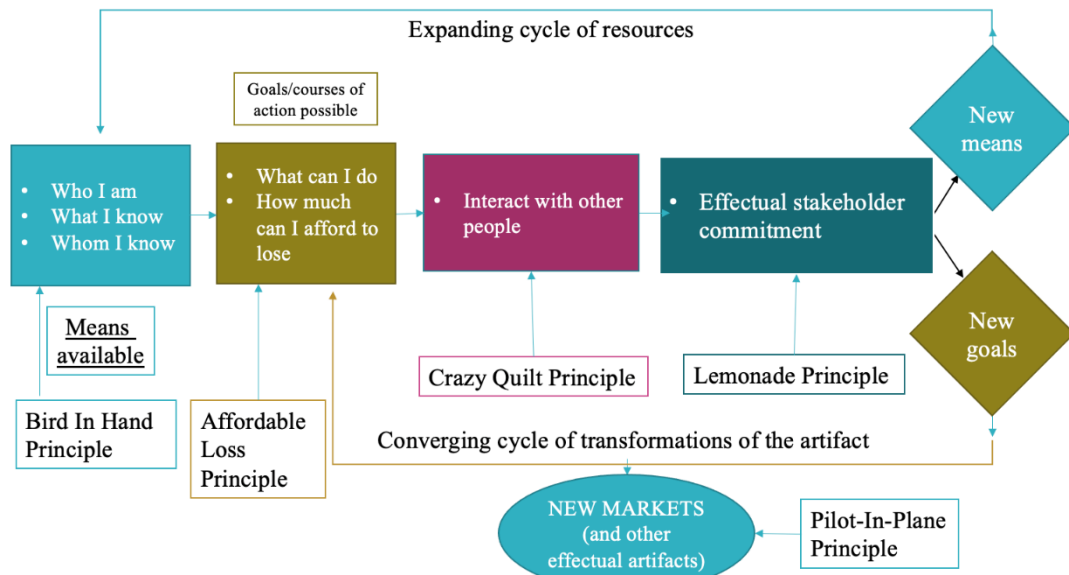
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APPENDIX

Dynamic Model of Effectuation Cycle



Source: Adapted from Sarasvathy, (2008), Figure 5.1, Dynamic model of effectuation. Effectuation: Elements of Entrepreneurial Expertise, Edward Elgar

Table B1

Five Principles of Effectuation Theory

Bird-in-Hand Principle

Bird-in-Hand starts with operationalizing entrepreneurial means. This starts with who I am, what I know and who I know and recommends entrepreneurs are guided by the means oriented towards decision making. Means plays a significant role in the trajectory of the new-venture's performance, growth, and sustainability throughout the iterative effectuation cycle. Entrepreneurs exert control over available means: personal knowledge, skills, and social networks instead of focusing on goals.

Affordable Loss Principle

This principle suggests a focus on the downside of affordable loss and leverages entrepreneurial means in creative and decisive ways to begin moving the product or service beyond the ideation phase and into the early commercialization or new markets with relatively low capital expense. Entrepreneurial decisions are made based on what the entrepreneur can afford to lose opposed to what they expect to gain.

Crazy Quilt Principle

The principle emphasizes entrepreneurial purposes of partnerships and effectuations that leverage partnerships and stakeholders through operationalizing pre-committed stakeholder input and agreements on shared risks. Such mutually beneficial partnerships should be operationalized within the new venture right from the start as a form of effectuating a method to create new business means.

Lemonade Principle

Inevitable business surprises and mistakes calls for the entrepreneur to leverage an entrepreneurial mindset and set of beliefs to the extent that contingencies are exploited and operationalized during uncertainty to the advantage of the medical startup. This is an approach to controlling emerging situations within the medical startup.

Pilot-in-the-Plane Principle

This principle posits entrepreneurs are like pilots-in-the-plane when they control their startup's future. Instead of predicting the future, the future (market value influenced by the innovation itself) is created and controlled by the entrepreneur's effectuated actions and decision-making, such as the case of introducing new products and services into new marketplaces.

Source: (Sarasvathy, 2001; 2008)

Greek Medicine

"I Swear by Apollo Physician...": Greek Medicine from the Gods to Galen

The Hippocratic Oath

The Hippocratic Oath (Ὁρκος) is perhaps the most widely known of Greek medical texts. It requires a new physician to swear upon a number of healing gods that he will uphold a number of professional ethical standards. It also strongly binds the student to his teacher and the greater community of physicians with responsibilities similar to that of a family member. In fact, the creation of the Oath may have marked the early stages of medical training to those outside the first families of Hippocratic medicine, the Asclepiads of Kos, by requiring strict loyalty.



Over the centuries, it has been rewritten often in order to suit the values of different cultures influenced by Greek medicine. Contrary to popular belief, the Hippocratic Oath is not required by most modern medical schools, although some have adopted modern versions that suit many in the profession in the 21st century. It also does not explicitly contain the phrase, "First, do no harm," which is commonly attributed to it.

Hippocratic Oath

I swear by Apollo the physician, and Asclepius, and Hygieia and Panacea and all the gods and goddesses as my witnesses, that, according to my ability and judgement, I will keep this Oath and this contract:

To hold him who taught me this art equally dear to me as my parents, to be a partner in life with him, and to fulfill his needs when required; to look upon his offspring as equals to my own siblings, and to teach them this art, if they shall wish to learn it, without fee or contract; and that by the set rules, lectures, and every other mode of instruction, I will impart a knowledge of the art to my own sons, and those of my teachers, and to students bound by this contract and having sworn this Oath to the law of medicine, but to no others.

I will use those dietary regimens which will benefit my patients according to my greatest ability and judgement, and I will do no harm or injustice to them.

I will not give a lethal drug to anyone if I am asked, nor will I advise such a plan; and similarly I will not give a woman a pessary to cause an abortion.

In purity and according to divine law will I carry out my life and my art.

I will not use the knife, even upon those suffering from stones, but I will leave this to those who are trained in this craft.

Into whatever homes I go, I will enter them for the benefit of the sick, avoiding any voluntary act of impropriety or corruption, including the seduction of women or men, whether they are free men or slaves.

Whatever I see or hear in the lives of my patients, whether in connection with my professional practice or not, which ought not to be spoken of outside, I will keep secret, as considering all such things to be private.

So long as I maintain this Oath faithfully and without corruption, may it be granted to me to partake of life fully and the practice of my art, gaining the respect of all men for all time. However, should I transgress this Oath and violate it, may the opposite be my fate.

Translated by Michael North, National Library of Medicine, 2002.

Source: National Institutes of Health. (2012, February 7). *Greek medicine - the Hippocratic oath*. U.S. National Library of Medicine. Retrieved November 21, 2021, from https://www.nlm.nih.gov/hmd/greek/greek_oath.html.

Informed Consent

Title: Physician Entrepreneurship: Understanding Medical Startups from Ideation, Innovation to IPO

Principal Investigator: J.J. Hsieh, Ph.D.

Student Principal Investigator: Charleata Battle, MBA

Introduction and Key Information

You are invited to participate in a research study that consists of an interview for about 60 minutes. The study purpose is to collect qualitative interview data to understand physician entrepreneurship, decision-making and medical startups from ideation, innovation, to commercialization of new medical products and services into the marketplace.

Voluntary Participation and Opt-Out

Participation in the study is voluntary, you can opt out at any time.

Purpose

Understand the subjective quality or meaning of experiences of physician entrepreneurs on medical startups, commercializing their idea and the use of venture capital funding.

Risks

There are no more risks or discomforts for participants beyond a typical digitally mediated interview for about 60 minutes. Only answer questions you decide.

Audio & Video Conference Recording

All data will be kept confidential. Charleata Battle, MBA will keep the digital recordings for approximately one year and then destroy them.

Contact Information

To inquire about this research study, if you have questions about your part in the study or to express concerns or complaints about the study, please contact us by the telephone numbers and email addresses listed below:

- Principal Investigator: J.J. Hsieh, Ph.D.: jjhsieh@gsu.edu or 404-413-7357.
- Student Principal Investigator: Charleata Battle, MBA: cbattle@student.gsu.edu or 770-366-9293.

The Institutional Review Board (IRB) at Georgia State University reviews all research that involves human participants. Contact the IRB: 404-413-3500 or irb@gsu.edu.

Five Effectuation Principles: Excerpts from Group Export Node

Coded at Bird-in-Hand Principle

<Files\\Paige> - § 2 references
coded [2.53% Coverage]

Reference 1 - 2.14% Coverage

Files\\Takoda> - § 4 references
coded [23.25% Coverage]

Reference 1 - 3.12% Coverage

Reference 3 - 0.73% Coverage

¶54: Well, I started out self-funded, you know. I have to say maybe I got some grant funding, NIH funding for various aspects of growing my business. I met some investor who wanted to get involved with socially responsible businesses through a colleague of mine. So, eventually, one conversation led to another, and I met with a few venture investors to discuss my plans. (Paige, personal communication, October 4, 2021).

¶38: You know there are all kinds of NIH and other grants you can apply for when trying to break into the entrepreneur role, especially as a physician. That was the initial route I took on most of these. Outside of personal investments, I had family, friends, and other doctors who believed in what I was doing. I really have to thank a buddy of mine for introducing me to the world of financing for startups. (Takoda, personal communication, September 14, 2021).

¶40: We raised \$125M seed funds and had easy other investments in later rounds of \$3M, \$5M and \$10M. (Takoda, personal communication, September 14, 2021).

Table F1

Five Effectuation Principles: Excerpts from Group Export Node

Coded at Affordable Loss Principle

<Files\\Thandi> - § 1 reference coded [3.54% Coverage]

Reference 1 - 3.54% Coverage

¶41: I learned from my husband, and we shared some of the same resources for people who helped him get his practice open, funded, and ready to receive patients. (Thandi, personal communication, October 4, 2021).

<Files\\Uberto> - § 1 reference coded [6.79% Coverage]

Reference 1 - 6.79% Coverage

¶40: I think it's important and essential to have your own money invested before asking others to put money into your idea. You have to have drive, passion, and a curiosity for identifying a problem and ensuring that your solution or idea will solve the problem. It does not have to be very complex. You can build on an existing product and enhance it in some way or create something brand new. It is about finding something that you are passionate about, something that impacts the community and improves health outcomes. I would say 90% of physicians can afford to spend at least \$20,000 to \$40,000 of their own money into developing a product prototype. (Uberto, personal communication, September 14, 2021).

Table G1

Five Effectuation Principles: Excerpts from Group Export Node

Coded at Crazy Quilt Principle

<Files\\Fabio> - § 2 references coded [4.21%

Coverage]

Reference 2 - 0.92% Coverage

<Files\\Adonnis> - § 8 references coded [5.72%
Coverage]

Reference 8 - 2.07% Coverage

<Files\\Agustin> - § 5 references coded [25.63%
Coverage]

Reference 1 - 7.00% Coverage

¶39: We initially started out with a small network of angel investors, really, some of my friends and colleague. (Fabio, personal communication, October 7, 2021).

¶123: Well, it was really, kind of a friend, through a friend that helped us with the financing. A bunch of doctors and who they knew from industry. Through this network, we heard about some investors who were looking to get into business and break into the medical industry. And we really were strapped for cash and kinda hit a roadblock at one point where we needed to move on the project. You know, to get over some of the constraints, of you know meeting and providing FDA requirements, trying different metals to make this thing work you know. (Adonnis, personal communication, September 3, 2021).

¶38: So, I have been lucky to have an extensive network of friends and mentors who started medical device companies or biopharma or solo healthcare practices over the years. You know, they have been around the block a few times with things and were willing to give me a few pointers when I needed them. Through observation and networking, I was able to connect to venture funders with experience with intricacies of medical startups. (Agustin, personal communication, September 22, 2021).

Table H1

Five Effectuation Principles: Excerpts from Group Export Node

Coded at Lemonade Principle

<Files\\Tommaso> - § 2 references coded [6.29% Coverage]

Reference 1 - 3.02% Coverage

¶63: We had to cross an interesting hurdle with the FDA and of course, deal with the patents office. Sometimes patents can take years, but we filed anyway. We started with our FDA approval back in 2018 -2019 but right now we still need data. So, we are really in the data collection, trials, and analysis phase right now before we can expand. (Tommaso, personal communication, September 22, 2021).

<Files\\Wesley> - § 2 references coded [3.09% Coverage]

Reference 2 - 2.02% Coverage

¶69: I have basically decided that I'm going to go down this path with creating my own businesses, ok, while engaging and investing in other businesses at the same time. It's not about the outcome so whether it's going to be successful or not that doesn't define me as a surgeon entrepreneur. (Wesley, personal communication, September 24, 2021).

<Files\\Tinsley> - § 7 references coded [11.02% Coverage]

Reference 1 - 1.04% Coverage

¶55: This was a medical device and that started quite a long time ago it's still not done yet, it's. It's going, it takes a long time with the FDA and everybody else to develop. We have pretty much gotten most of it done my brand-new device. (Tinsley, personal communication, September 21, 2021).

<Files\\Parker> - § 2 references coded [3.55% Coverage]

Reference 1 - 2.92% Coverage

¶74: My peers and having led the medical group of physicians, going the M&A processes, I knew what they would want to see and prepared my pitch for seed funding. I later decided, I could not find one that really aligned with my vision and the fact that I would be directly providing the consultations, I just did not go after those dollars. (Parker, personal communication, September 27, 2021).

Table II

Five Effectuation Principles: Excerpts from Group Export Node

Coded at Pilot-in-the-Plane Principle

<Files\\Agustin> - § 3 references coded [13.85% Coverage]

Reference 3 - 7.22% Coverage

¶47: I During the pandemic, I can tell you, that if your research, new medical device, or other healthcare innovation was unrelated to COVID-19, (health protection, diagnostic, treating, or monitoring the disease) or related therapeutic, the ideas were put on hold or moved to the back of the line for consideration by investors (angel or venture) and certainly with the FDA. The priority was and to some extent, still is about understanding new innovations that can move the needle on resolving COVID-19. (Agustin, personal communication, September 22, 2021).

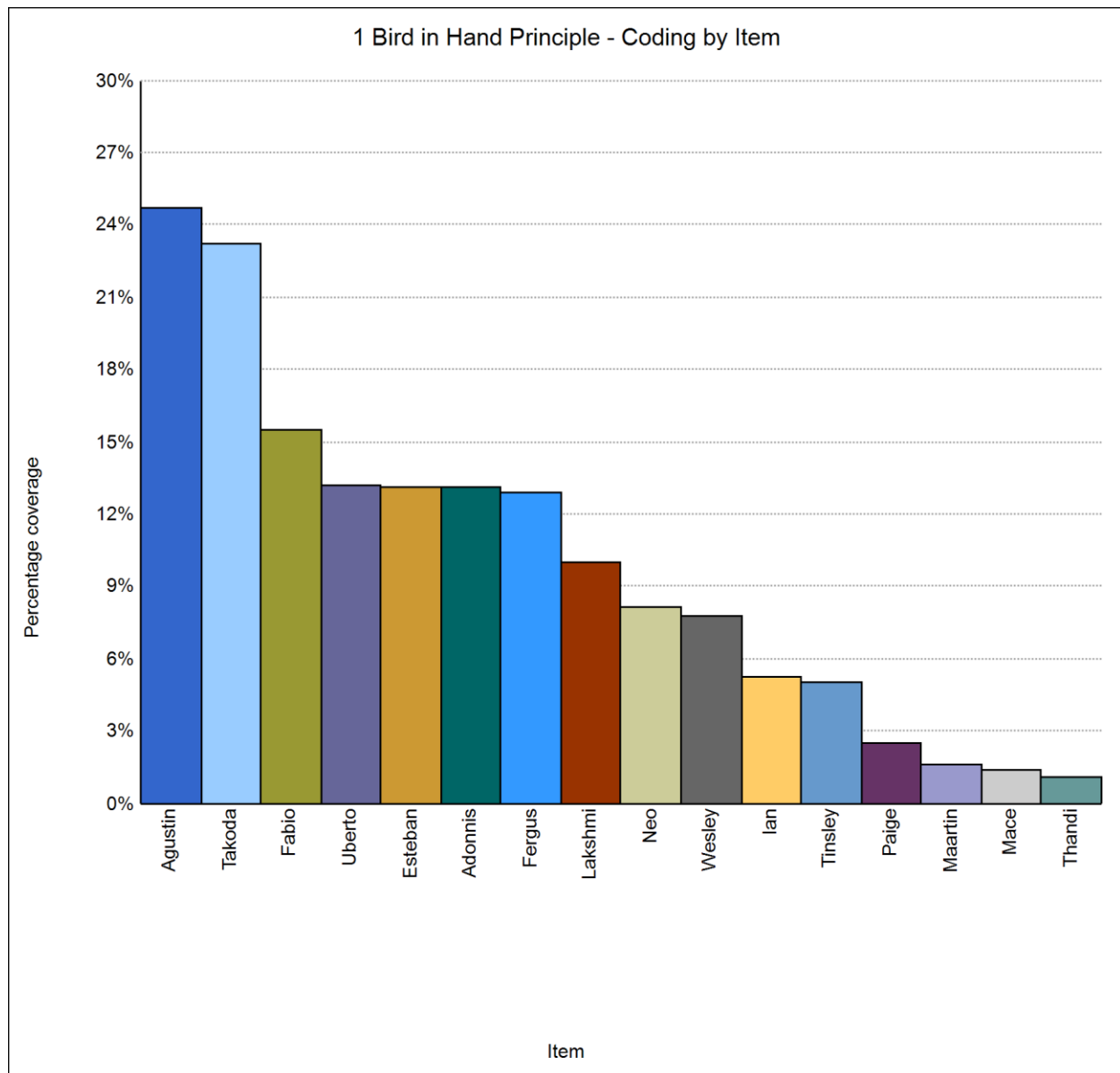
<Files\\Adonnis> - § 2 references coded [1.58% Coverage]

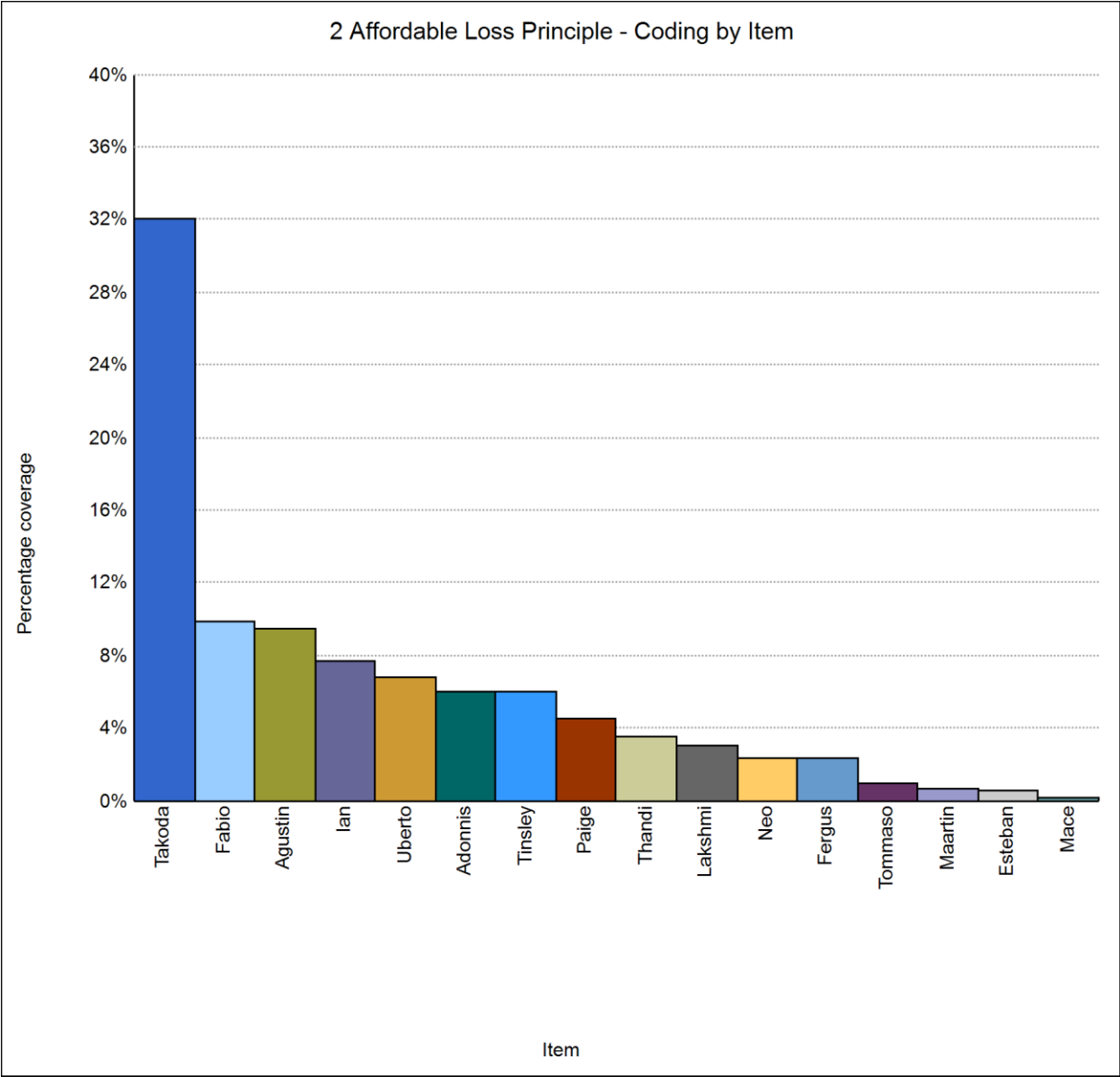
Reference 2 - 1.05% Coverage

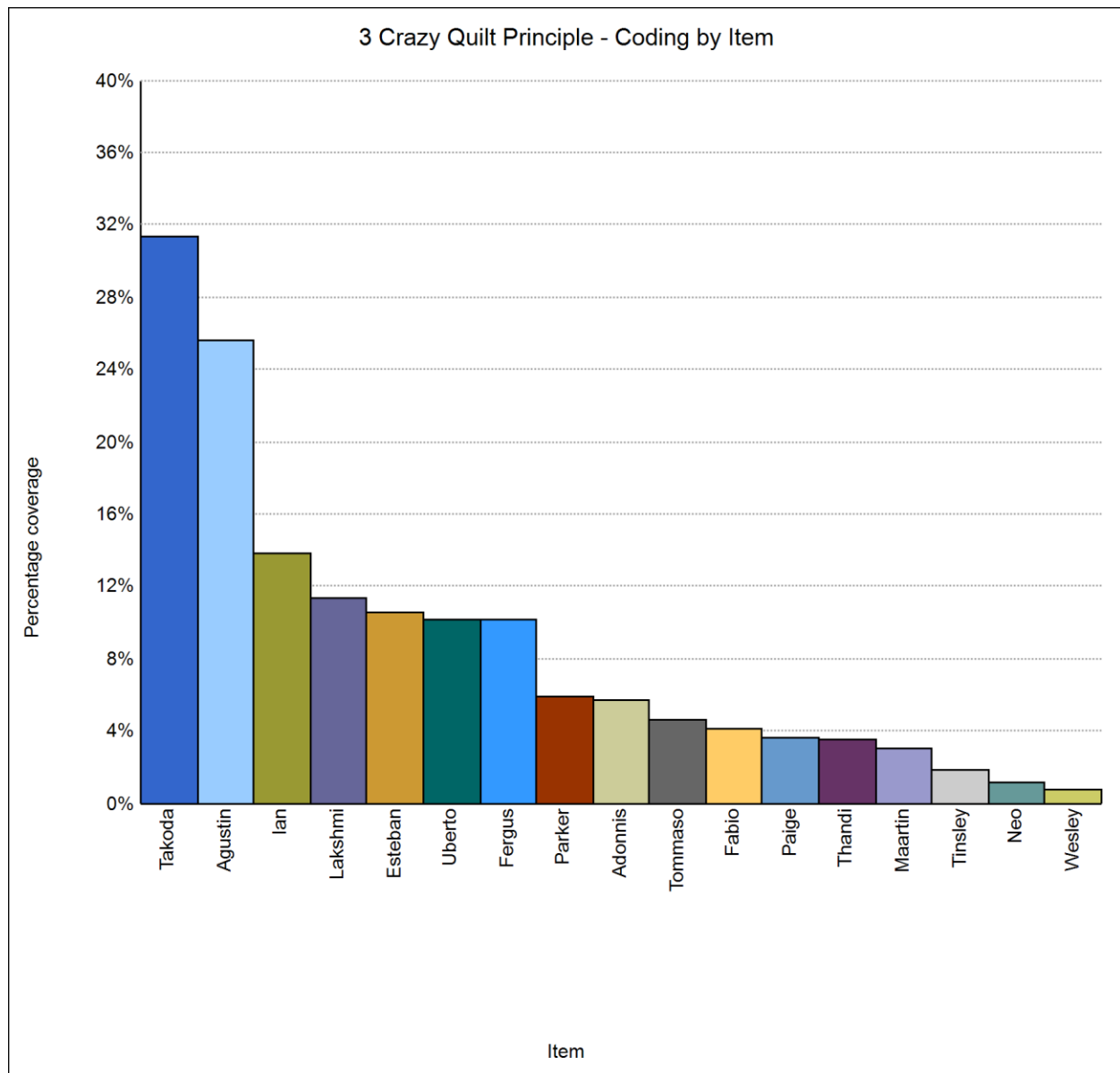
¶118: I think even when physicians change careers in medicine or become entrepreneurs, the values of the Oath are longstanding and do guide and shape how we make decisions in designing, testing, and eventually how we commercialize our medical products and services for patient use. (Adonnis, personal communication, September 3, 2021).

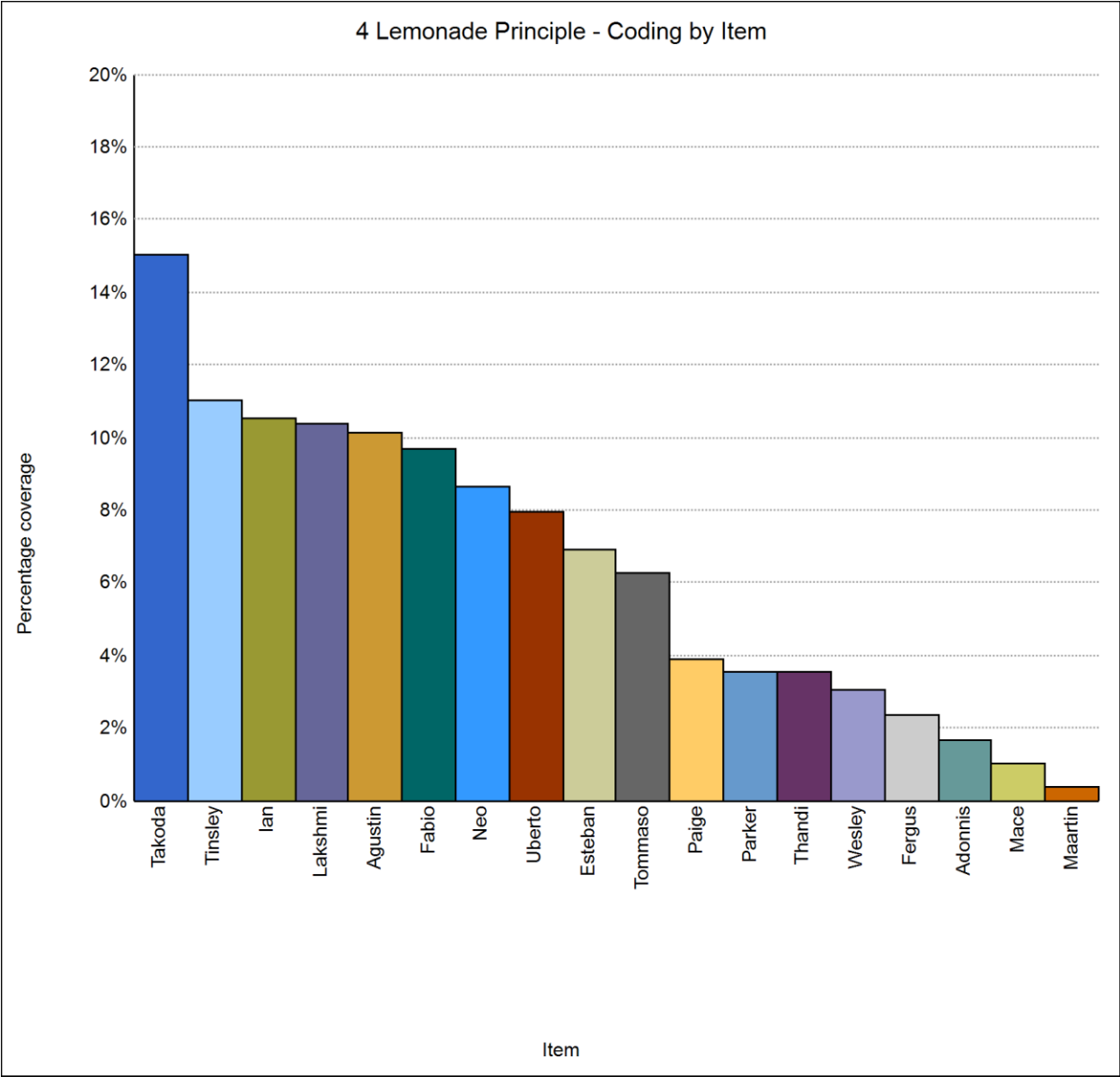
<Files\\Esteban> - § 9 references coded [9.00% Coverage]

¶75: No patient wants to be overcharged. It will be about the customer service experience in health.









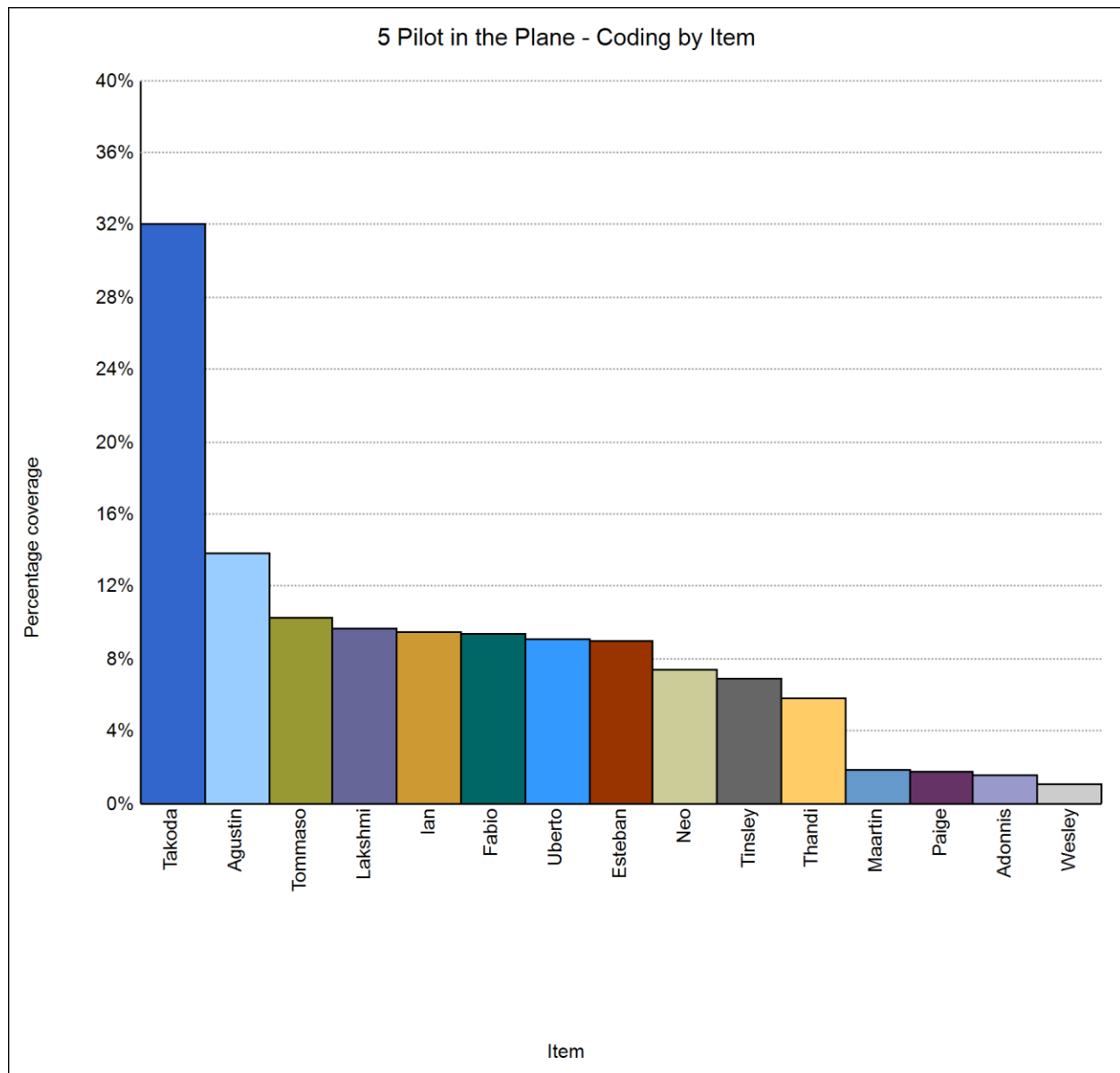


Table O1	Nodes\\Thematic Framework original nodes coded across all cases		
Name	Description	Files	References
Acumen Development	The development of business understanding about how the start-up makes and uses money	20	314
Business Acumen	Understanding how to make money in the business and to apply that knowledge to making informed business decisions for the start-up	20	300
Business Skills Acquisition	How one acquires the skills and techniques	18	114
Hire Experts	start-up hires experts in specific business areas to provide expertise needed for the company at various stages of the new venture growth.	7	9
Mindset & Entrepreneurial Spirit	Mindset is the entrepreneurial attitude, belief, and spirit that guide actions and behaviors	12	53
Negotiate Contracts	Part of the start-up process that requires legally binding terms through a written contract between the start-up venture and another party.	9	11
Additional Degrees & Formal Education	Other degrees beyond the MD degree that have been earned by the physician founders and entrepreneur for the multiple cases.	14	33
Artificial Intelligence	Computer or robotic controlled and completed tasks.	9	16
Childhood & Youth	Childhood experiences that influenced medical school or entrepreneurship intention.	15	31
Commercialization	The business processes required to bring new products and services into the existing or new market spaces.	20	547
Innovation to Mass Commercialization	The next step after ideation where the entrepreneur has a developed minimally viable product or prototype prepared for commercialization.	20	258
Ideation to Innovation	Where the entrepreneur has taken steps to operationalize their idea into a formal process for developing a minimally viable product or prototype.	20	109
New Markets	New markets with new customers where the physician entrepreneur will sell their product and/or medical services	14	86
Customers	Consumers of the new medical products and services	10	31
New Product & Service Approvals	Commercialization processes required for the physician entrepreneur to obtain the legal,	10	54

Table O1	Nodes\\Thematic Framework original nodes coded across all cases		
	medical, or other authorizations for approval to produce, market, sale, and distribute new medical products and or services for public consumption.		
FDA Approval	United States of America approval process managed by the US Food and Drug Administration (FDA). Requirements for FDA approval vary by product and service.	8	21
Validations	Confirmation that a product or service works or delivers in the way it was intended to do so. Can be formal and informal tests.	8	13
Patent Filing	Innovation filings in the United States to protect the rights of the inventor.	2	4
Physician Peer Support	Physician-led support offered to other physicians. This can be in the form of sharing information, encouragement, networking, participating in product validations, and other forms along the entrepreneur's journey.	16	55
Validations for Product, Device, Service	Peer physicians test and validate the use and outcomes of a proposed new product or service that requires proof of validations as a part of the FDA process.	7	11
Decision Making	This is an iterative and complex set of decision-making steps in a new venture. This may involve decision situations related to deciding to take action on an idea and other decision steps necessary to form a start-up, develop a product or service for commercialization, and deciding an exit strategy for the business as a future point.	21	576
Employment Status	Employed wage earner or self-employed and generating one's own income.	18	86
Salaried-Employment	Wage earner--employed by a healthcare system or organization.	13	24
Self-Employment	Status of self-employed and generating one's own income. Not employed by others.	15	62
Funding	Money required for the business use, growth, and expansion.	20	192
Angels	Private investor- individual(s).	6	11
Colleagues, Family, & Friends	A co-worker, peer, family, and/or friends who invest money in the medical start-up.	12	18
Grants	Money that does not require repayment and is used in the start-up.	4	5

Table O1	Nodes\\Thematic Framework original nodes coded across all cases		
Loans	Borrowed money that must be repaid by the start-up up.	3	4
Self-Funding	Money that is self-generated and used to fund the start-up needs. Your own money used to establish, cover operations, or start-up growth.	13	23
Venture Capital	Investor funds that are contracted for a percentage of the start-up's ownership and control of the business in exchange for providing requisite funding for the business.	18	104
Venture Stage		15	27
What Venture Capitalist Want		11	17
Medicine as a Career	Choosing a medical career over other career alternatives.	12	24
Start-up Venture	A new or young business venture; nascent firm.	17	124
Exit Strategy	Plans for selling the company in the future.	3	5
Stakeholder Alignment	Stakeholder agreement and synergies among the various stakeholder groups of a start-up business.	4	10
Drive, Motivations, & Passion	Entrepreneurial drive, motivation, and/or passions about something.	19	79
Entrepreneurship	Autonomous self-employment that involves the creation of a new business or service in existing or new markets.	16	138
Experience - Fellowship	Medical fellowship experience.	16	33
Experience - Physician Entrepreneur	Experience as a physician entrepreneur	21	240
Experience - Practicing Physician	Experience as a practicing physician	19	113
Experience - Residency	Experience as a medical resident.	18	47
Healthcare Industry & Systems	Industry that provides medical services.	20	194
Health System Priorities	Concerns that are important to health systems that employ physicians and provide medical care.	10	18
Healthcare Innovations - Future		12	29
Healthcare Innovations - Now		16	52

Table O1	Nodes\\Thematic Framework original nodes coded across all cases		
Stalled Healthcare in US		18	42
Hippocratic Oath	Influence of swearing pledges to the Oath	7	8
Hobbies		5	10
Medical School		21	174
European Medical School vs US Medical School Curriculum		1	1
Medical School - Experience		20	78
Medical School - Future		17	41
Medical School - Now		16	47
Networks & Networking		16	45
Physician Entrepreneur - Defined		21	24
Physician Work life		17	53
Prior Professions & Careers		7	13
Simultaneous Job Titles Held		20	22
Start-up Challenges & Mistakes	Start-up challenges, mistakes, lessons learned. Medical start-up hurdles- personal, professional, and economic.	18	60
Voice of the Physician	Subjective opinions, expressed attitudes - experiences in their own words.	5	9

NVivo Word Cloud: Bird-in-Hand



NVivo Word Cloud: Affordable Loss



NVivo Word Cloud: Crazy Quilt



NVivo Word Cloud: Lemonade Principle



NVivo Word Cloud: Pilot-in-the-Plane



VITA
Charleata Battle, D.B.A., M.B.A.
Assistant Professor, Management, Healthcare Management

EDUCATION

2019 - 2022 D.B.A., Georgia State University, Robinson College of Business
2010 - 2012 M.B.A., Org. Management, Georgia State University, Robinson College of Business
2004 - 2006 B.A., Management, American Intercontinental University

PUBLICATIONS

1. Battle, Charleata. Physician Entrepreneurship: Understanding Medical Startups from Ideation, Innovation to IPO (October 18, 2021). Proceedings of the Eleventh International Conference on Engaged Management Scholarship- EMS 2021, Available at SSRN: <https://ssrn.com/abstract=3944730>

Conference Presentations

1. "Doctorpreneurs: The Rise of Medical Startups." Extended Abstract. Georgia Gwinnett College Teaching, Learning, and Research Symposium. January 12-13, 2022. Georgia Gwinnett College. Co-hosted by Business, Economic, & Applied Research Center (BEAR) and Center for Teaching Excellence (CTE).
2. "Pharmaceutical Expansion into Emerging Markets: Czech Republic." Extended Abstract. Georgia Gwinnett College Teaching, Learning, and Research Symposium. January 12-13, 2022. Georgia Gwinnett College. Co-hosted by Business, Economic, & Applied Research Center (BEAR) and Center for Teaching Excellence (CTE).
3. "Navigating Institutional Voids and Institutional Structures in Emerging Markets." Extended Abstract. Georgia Gwinnett College Teaching, Learning, and Research Symposium. January 12-13, 2022. Georgia Gwinnett College. Co-hosted by Business, Economic, & Applied Research Center (BEAR) and Center for Teaching Excellence (CTE).
4. "Physician Entrepreneurship." Extended Abstract Submission, #13, Doctoral Consortium. The Conference on Engaged Management Scholarship (EMS), September 9-11, 2021. Florida International University, Miami, FL. The EMS 2021 Doctoral Consortium is a special, invitation-only session of the EMS conference where a select group of nominated DBA students and faculty from EDBAC member DBA programs around the world come together to share details about their dissertation research, receive advice and feedback about their work, and reciprocate to other students.
5. "Physician Entrepreneurship: Understanding Medical Startups from Ideation, Innovation, to IPO." Short Paper Submission, #14. The Conference on Engaged Management Scholarship (EMS), September 9-11, 2021. Florida International University, Miami, FL. The EMS 2021 Short Paper Submissions are in-progress research projects that are reviewed and approved by a select editorial board chosen by the EMS Program Chairs.

INVITED PRESENTATIONS

1. Georgia Composite Medical Board. Georgia Board of Health Care Workforce. Quarterly Board Meeting, October 21, 2021, Atlanta, GA. “Physician Entrepreneurship: Understanding Medical Startups from Ideation, Innovation, to IPO.”
2. Academy of Management, 81st Annual Conference. July 2021, virtual. “Physician Entrepreneurship: Understanding Medical Startups from Ideation, Innovation, to IPO.” Navigating Qualitative Dissertations Paper Development Workshop. Advisor, Callen Anthony, PhD, Assistant Professor, New York University, Stern School of Business, Management and Organizations Department, New York, New York.

RESEARCH INTEREST

- Entrepreneurship and hybrid healthcare management
- Business strategy and decision-making skills within organizational leadership
- Healthcare management and policy for academic medical centers and accountable care organizations
- Management cognition at the individual and firm level
- Venture capital funding strategies and investments in nascent firms

TEACHING EXPERIENCE

2021 - 2021	Master Teaching Certification, Robinson College of Business, Georgia State University
2000 - 2011	Georgia Pre-License Real Estate Instructor, Better Homes & Gardens
2000 - 2011	Georgia Pre-License Real Estate Instructor, Metro Brokers Academy of Real Estate
2000 - 2011	Georgia Pre-License Real Estate Instructor, Barney Fletcher Schools

COURSES TAUGHT

- Salesperson Pre-License, 75 hours
- Broker Pre-License, 75 hours
- Advanced Topics for New Agents, 25 hours
- Finance and Settlement Procedures, 25 hours
- Georgia Post-Licensing for Real Estate Salesperson, 25 hours
- 36-Hour Continuing Education, Course Package, 36 hours
- 18-Hour Continuing Education, Course Package, 18 hours
- 12-Hour Continuing Education, Course Package, 12 hours
- Understanding Closing Statements, 9 hours
- Commercial Sales and Exchanges, 6 hours
- Georgia License Law and Rules, 6 hours
- Property Valuation: Sales Comparison Approach, 6 hours
- Methods of Real Estate Finance, 6 hours
- Writing Contracts, 6 hours
- Real Estate Contracts, 4 hours
- ADA and Fair Housing, 3 hours

- Ethics in Real Estate: NAR Code of Ethics, 3 hours
- Real Estate Disclosures: Buyer and Seller, 3 hours

PROFESSIONAL MEMBERSHIPS

- Academy of Management
 - Healthcare Management (HCM)
 - Entrepreneurship (ENT)
 - Managerial and Organizational Cognition (MOC)
- American College of Healthcare Executives (ACHE)
- Georgia Association of Healthcare Executives (GAHE)
- Society of Physician Entrepreneurs (SoPE)
- Innovator MD
- Georgia Bio
- Executive Doctor of Business Administration Council (EDBAC)
- Georgia State University Alumni Association, Lifetime Member
- National Center for Faculty Development & Diversity (NCFDD)
- World Affairs Council (WAC)

CERTIFICATIONS

- Certified Master Teacher
- Certified Scrum Master
- Certified Scrum Product Owner
- Certified Scrum Professional
- Collaborative Institutional Training Initiative (CITI) Human Subject Research
- Federal Acquisition Contracting Officer's Representative (FAC-COR)
- Senior Professional in Supply Management (SPSM)
- Six Sigma Green Belt (SSGB)

SERVICE

- Morehouse School of Medicine, Faculty Council and Curriculum Education Committee
- Morehouse School of Medicine, Southern Association of Colleges, and Schools Commission on Colleges (SACSCOC), Reaccreditation Committee
- Morehouse School of Medicine, Liaison Committee on Medical Education (LCME), Reaccreditation Committee
- Morehouse School of Medicine, AAMC Employee Engagement Task Force Committee
- Morehouse School of Medicine, Internal Advisory Committee (IAC) for Morehouse School of Medicine Research Initiative for Scientific Enhancement (RISE) Program

PROFESSIONAL EXPERIENCE

California State University, LA, Los Angeles, CA

2022 to present

College of Business and Economic

California State University, Los Angeles (Cal State LA) is one of 23 campuses within the California State University system. The University is the premier comprehensive public university in the heart of Los Angeles. Cal State LA is ranked number one in the U.S. for the upward mobility of its students, and is dedicated to engagement, service, and the public good. The College of Business and Economics is an AACSB-accredited school with nearly 3,000 business majors across various undergraduate and graduate programs.

ASSISTANT PROFESSOR MANAGEMENT, HEALTHCARE MANAGEMENT

- Delivered an interdisciplinary approach to teaching, research, and engaged scholarship in service to the University, profession, and community
- Advised students, participated in campus and system-wide committees, and collaboratively work with colleagues in traditional academic functions
- Provided real-world experience from the U.S. healthcare system delivered through healthcare management curriculum to teach learning objectives on healthcare strategy, systems, functions, processes, and healthcare innovation at the graduate and undergraduate levels

Char Battle, Inc., Alpharetta, GA

2014 to present

Char Battle, Inc., is a professional services firm that specializes in the niche of physician entrepreneurship, medical entrepreneurship, and other entrepreneurial enterprise consulting and business services. Char Battle, Inc., is MBE and HUB certified.

CHIEF EXECUTIVE OFFICER

- Directed the delivery of healthcare strategic management consulting, policy, procedures, business, and process improvement data analysis
- Designed, developed, and implanted manageable financial and technology solutions to maximize client sales, operations, and advance market position
- Accomplished expansion of technology reseller markets for hardware, software, middleware, and custom data analytical solutions in Georgia & North Carolina

Morehouse School of Medicine & Morehouse Healthcare, Atlanta, GA

2018 to 2021

Morehouse School of Medicine, (MSM) and Morehouse Healthcare are among the nation's leading academic medical centers, educators of primary care physicians and recognized as a top institution among U.S. medical schools. Morehouse Healthcare is the clinical arm of Morehouse School of Medicine.

DIRECTOR, INFORMATION TECHNOLOGY CUSTOMER SERVICE

- Directed the enterprise information technology, 10-person, ITIL customer engagement team to enhance healthcare delivery, management, and operations at five locations
- Managed health information technology fiscal financial budgets for vendor suppliers, operations, infrastructure, cybersecurity, two-factor authentication middleware and reporting

- Coordinated healthcare technology systems' interoperability and data sharing across NIH research, finance, and data analytic initiatives for healthcare and medical records
- Advised executive leadership, faculty, and board of directors on business-critical healthcare, educational technology systems, and technology strategies
- Resolved information-intensive operational challenges for healthcare management, operations, and information technology policies related to data exchange for research and data analytics
- Project-managed new construction projects for an ambulatory clinic, gross anatomy lab, classroom wing and an executive boardroom within budget and on time
- Represented Morehouse School of Medicine and Morehouse Healthcare on the 2020-2021 SACSCOC and LCME Reaccreditation Renewal Committees as an accountable care organization: Policy Reviewer, First Reviewer, First Writer, and Second Reviewer
- Completed Graduate Medication Education, Pre-clinical Curriculum Course Review: Microbiology & Immunology. Motioned submitted and approved for a 5-year course renewal by the Pre-Clinical Curriculum Committee and adopted by the Faculty Committee
- Institutional Effectiveness Committee: AAMC Employee Engagement, Graduate Medical Education programs for 2021 SACSCOC and LCME reaccreditation

Atlanta Housing, Atlanta, GA

2016-2018

The Housing Authority of the City of Atlanta (AH), Georgia has led the forefront for providing the public with affordable housing for low-income families in the City of Atlanta.

INFORMATION TECHNOLOGY OPERATIONS MANAGER

- Delivered efficient information technology solutions and financial management across enterprise applications, infrastructure, and client services
- Contracted organizational portfolio of 136 information technology supplier contracts for hardware, software, license and maintenance agreements, middleware, and telecom
- Delivered multiple project management projects through Agile Scrum Certified Scrum Master, Product Owner, and Certified Scrum Professional
- Proactively eliminated technology service outages and managed Cisco hybrid cloud platforms, data replication, backup, endpoint, and mobility security

Atlanta Housing, Atlanta, GA

2015 - 2016

The Housing Authority of the City of Atlanta (AH), Georgia has led the forefront for providing the public with affordable housing for low-income families in the City of Atlanta.

SENIOR BUSINESS SOLUTIONS ANALYST

- Developed, monitored data quality population metrics, data variance analysis, and financial modeling across all business data sets

- Analyzed organizational data, coordinated stakeholder software needs, to support organizational growth and information technology through Agile Scrum methodology
- Developed strategic relationships with project managers, development teams, to deliver technology solutions, produced written reports, software products as Certified Scrum Master and Product Owner

Georgia State University, Atlanta, GA

2014-2015

College of Arts and Sciences

In 2021, U.S. News & World Report ranked Georgia State University: No. 1 public university in the nation for commitment to teaching, No. 2 for the most innovative college or university in the nation, and No. 11 in the nation for social mobility.

PROGRAM DEVELOPMENT OFFICER, EMPLOYEE ENGAGEMENT SPECIALIST

- Developed campus-wide workforce training curriculum that reduced workforce turnover and promoted employee engagement, diversity, and inclusion
- Delivered technical training for new employee orientation, ethics, diversity, and inclusion courses for employees

Georgia State University, Confucius Institute, Atlanta, GA

2011-2014

College of Arts & Sciences

In 2021, U.S. News & World Report ranked Georgia State University: No. 1 public university in the nation for commitment to teaching, No. 2 for the most innovative college or university in the nation, and No. 11 in the nation for social mobility.

ASSOCIATE TO DIRECTOR

- Systematized budget and financial strategies that contributed to earning the 2012 Confucius Institute of the Year for exception fiscal responsibility and program initiatives
- Designed effective budget models, financial plans, policies, analysis
- Co-directed and managed budgets and public training programs, co-authored institutional policies, and procedures for international language study
- Co-created initiatives for language, culture programs, study abroad trips, and events

Chandler Scott International., Alpharetta, GA

2000-2011

Chandler Scott International is a licensed real estate brokerage, led by a licensed broker and instructor. Firm offered real estate pre-licensing classes, real estate, and mortgage services.

LICENSED REAL ESTATE BROKER, OWNER, LICENSED INSTRUCTOR

- Taught real estate pre-license and post-license courses: Better Homes & Gardens, Metro Brokers & Barney Fletcher
- Managed business policy, technical operations, sales demand forecasting, and inventory
- Recruited, managed sales agents and brokerage contracts for real estate sales, mortgage financing options and marketing for property buyers and sellers