

Identity Development During Adolescence in Individuals with Pectus Excavatum

by

Michael Mihuc

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Science

Approved March 2023 by the
Graduate Supervisory Committee:

Jane Maienschein, Chair
Karin Ellison
Rachel Gur-Arie

ARIZONA STATE UNIVERSITY

May 2023

ABSTRACT

For my graduate thesis, I present an annotated bibliography that evaluates and summarizes a list of resources available for use in future research. The resources focus on how pectus excavatum, a congenital birth anomaly affecting the thoracic wall, may impact identity formation and subsequent behavior during a period characterized by significant physical and psychological development, from the ages 12 to 18, known as adolescence. I examine resources that specifically look at congenital birth anomalies, pectus excavatum, developmental psychology, psychoanalysis, and identity crises. The following provides background and an annotated bibliography to establish whether there is a causal relationship between individuals born with congenital birth anomalies, specifically pectus excavatum (PE), and the impact it has to identity development during adolescence. This work is important to me because I was born with pectus excavatum, and I believe a causal relationship does exist. While I claim the causal relationship does exist, I should note this is conjecture and anecdotally based on 7 years of interacting with patients in both a clinical and personal setting. The conversations are reflective of discussions that have taken place about having been born with pectus excavatum and how the condition has impacted our lives.

DEDICATION

This thesis is dedicated to anyone who is suffering, or has suffered, with developing an identity. More specifically, this work is dedicated to anyone who was born, or will be born, with pectus excavatum, and endured, or will endure, the challenges that come with being different than those around you. I would also like to dedicate this thesis to those in the medical and academic community for not giving up on their patients and students while working tirelessly to ensure their success in life.

ACKNOWLEDGMENTS

First, I would like to thank my parents Mark and Mary Ann for the support they have provided, words are not enough to describe the appreciation I have for you both and I look forward to the next chapter of life together.

In the same way, I want to thank my girlfriend Beth for coming into my life and providing support, patience, words of encouragement, and unconditional love. I look forward to strengthening our relationship and spending the rest of our lives together.

Next, I would like to thank my family and friends who have been an instrumental part of my life and for the support they have also provided along this journey. Specifically, I would like to thank my sister Caren and her husband Ernie, along with my niece and nephew Elizabeth and Benjamin. In an equivalent manner, I would like to offer a debt of gratitude to Michelle and John Yurcak, Pat and Jim Aldridge, Steven and Sophia Campeau, and Amer Zahr.

Equally important, I would like to acknowledge Dr. Dawn Jaroszewski, Dr. Lisa McMahon, Dr. David Notrica, Dr. Donald Nuss, Dr. Robert Obermeyer, and Jackie Hurley for the work they have done in the medical community. Your dedication to improving those with pectus is immeasurable. I simply cannot find the words to express how much each of you have meant to me and those with pectus; therefore, please know that your work has changed, and will continue to change, lives for the better. Of course, I must acknowledge Dr. Dawn Jaroszewski for all that she has done. There are no words to describe what you have given me; however, I can tell you it is the reason I am here today. Therefore, please accept that I am eternally grateful for everything you have done.

Identically, I would like to acknowledge Arizona State University and Barrett, The Honors College for providing an environment that allowed me to become unified between the person I was when I entered the University to the person I desired to be today. None of this would not have been possible without the support of everyone who stood by me with every step I took as a student and employee. Specifically, I would like to thank Professor Jane Maienschein for her patience, support, and countless interactions that always left me wanting to become a better prepared student and person. There simply is not enough space to articulate the gratitude I have for you. Therefore, please know that I look forward to passing along everything you have given me to whomever I cross paths with in the future.

Lastly, I want to thank the countless number of patients and families that have confided in me about their journey with pectus. The courage, vulnerability, and discussions we shared have been a motivating factor for this thesis.

TABLE OF CONTENTS

	Page
CHAPTER	
1. BACKGROUND	1
2. QUESTION... ..	8
3. METHODS	8
4. FINDINGS.....	10
5. CONCLUSION	38
REFERENCES	42

BACKGROUND

Congenital malformations, also known as anomalies or deformations, are defined as abnormalities of body structure or function, including metabolic disorders, which are present at birth and are of prenatal origin. In the simplest terms, congenital refers to the existence at or before birth. Regardless of definition, congenital malformations can cause abortions and stillbirths. They are a significant, but underrecognized cause of mortality and disability among infants and children under the age of five. They can be life-threatening, result in long-term disability, and negatively affect individuals, families, health-care systems, and societies (World Health Organization, 2010).

For example, pectus excavatum (PE) is the most common congenital anterior chest-wall deformity. The condition occurs in as many as 1-in-350 births with a three-to-one male to female ratio (Shamberger, 1996). While PE is more likely to occur in males than females, it may be underdiagnosed in females because breast tissue could disguise the defect (Jaroszewski, et al., 2015). It can present at birth or may develop, and worsen, during childhood and adolescence. The chest-wall deformity, or sternum depression, produces a concave, or caved-in, appearance. Many patients are not brought to the attention of a pediatrician until the patient and family notice such changes (Steinmann et al., 2011). Primary health concerns for the patient center on the physiological and psychological effects created by PE.

The physiological cause of PE may originate from an unbalanced overgrowth in the costochondral thoracic region. Studies show that patients with asymmetric PE have shorter ribs on the more severely depressed side of the defect (Obermeyer, 2010). Up to 43% of patients with PE have a family history of the condition (Kelly, R., 2007). Pectus

excavatum is thought to be of multifactorial inheritance, but the genetic markers implicated are currently unknown (Creswick, HA. 2006).

Furthermore, PE can be associated with scoliosis and connective tissue disorders such as Marfan syndrome, Ehlers-Danlos syndrome, and Noonan syndrome; one study found scoliosis incidence as high as 21% in patients with PE (Kelly, RE., 2010). Patients with PE often encounter an increased occurrence of cardiopulmonary restriction such as decreased blood flow, decreased lung volume, and thus leading to the possibility of decreased exercise activity. (Crump, 1992). In fact, a multicenter study found that PE can decrease cardiac function both at rest and during exercise; even so, it has been demonstrated that surgical correction of PE can improve cardiac function (Kelly, et al., 2013).

Notably, cardiac function is the performance of the human heart from the ending of one heartbeat to the beginning of the next. In other words, cardiac output is a term used in cardiac physiology within the cardiac cycle that describes the volume of blood being pumped by the heart, per unit time.

Specifically, stroke volume is the volume of blood pumped from the left, and right, ventricle per beat. The term stroke volume can apply to each the right and left ventricles of the heart, although it usually refers to the left ventricle into the aorta, or right ventricle into the pulmonary artery; and stroke volumes for each ventricle, in a healthy person, are equal. Stroke volume is calculated using measurements of the ventricle volumes from an echocardiogram and subtracting the volume of blood in the ventricle at the end of a beat (end-systolic volume) from the volume of blood just prior to the beat (end-diastolic volume), (Maceira, et al., 2006). Stroke volume is an important

determinant of cardiac output (function), which is the product of stroke volume and heart rate, and is also used to calculate ejection fraction, which is stroke volume divided by end-diastolic volume. Because stroke volume decreases in certain conditions and disease states, namely PE, stroke volume itself correlates with cardiac function. Males, on average, have higher stroke volumes than females due to the larger size of their hearts (Rutkowski et al., 2020). Finally, factors affecting stroke volume and heart rate also affect cardiac output.

As an illustration, cardiac output (CO) is the product of the heart rate (HR), or the number of heart beats per minute, and the stroke volume (SV), which is the volume of blood pumped from the left or right ventricle per beat; thus,

$$CO = HR * SV$$

Cardiac output is denoted as L/min . For a healthy person weighing 70kg, the cardiac output at rest averages $5L/min$, assuming a heart rate of 70 bpm; therefore, the stroke volume would be $\sim 70mL$.

For the simple reason that cardiac output is related to the quantity of blood delivered to various parts of the body, its relevance is an important indicator of how efficiently the heart can meet the body's demands for perfusion, which is the passage of blood through the circulatory system to an organ or tissue. Namely, Zhao, et al. (1999) posit that physical activity requires a higher-than-normal level of oxygen to support increased muscle activity, where, in the case of heart failure, actual cardiac output may be insufficient to support even simple activities of daily living; nor can it increase sufficiently to meet the higher metabolic demands stemming from even moderate exercise.

Subsequently, some evidence supports the hypothesis that cardiac function in patients with PE may be limited because of compression by the displaced sternum on the right ventricle. For instance, Zhao, et al. (1999) concluded that cardiac function is reduced because of compression by the displaced sternum on the right heart chambers caused by PE, thereby lowering cardiac output by limiting augmentation of stroke volume during exercise. Compared to the right ventricle, the left ventricle is located more posteriorly and is a thicker muscular structure which protects it from the compression effects of the displaced sternum (Obermeyer et al., 2018). Accordingly, Sigalet, et al. (2003) noticed an increase in post-operative cardiac output, respectively.

Table 1. Cardiac function after repair of pectus excavatum

	Preoperative	Postoperative (3 mo.)	Postoperative (21 mo.)	Post Bar Removal
n	48	41	22	11
Stroke volume (mL)	69.9 ± 3.6	77.4 ± 4.4	79.0 ± 5.2	85.9 ± 7.0
Cardiac output (L/min)	4.79 ± 0.19	5.64 ± 0.32	5.32 ± 0.32	5.56 ± 0.28

Evaluating PE from a patient's physiological presentation requires a thorough workup to determine treatment options. A workup is indicated in a patient with symptoms, history, and physical examination. Additionally, thoracic imaging, electrocardiography, echocardiography, blood chemistry analysis, cardiopulmonary exercise testing, and pulmonary function will qualify a patient for corrective procedures.

To conclude, a significant amount is known about the degree to which patients suffer from the physiological impacts of PE. Presently, several studies validate the surgical treatment options and outcomes for PE patients (Nuss, et al., 1998).

Conversely, while PE is well understood from a physiological perspective, the psychological concerns related to this disease may introduce a decrease in self-esteem and quality of life for patients that is much less well understood. The World Health Organization (WHO) defines quality of life as a patient's perception of his or her position in life relative to the culture and value systems in which he or she lives. Additionally, quality-of-life is self-assessed relative to his or her goals, expectations, standards, and concerns (World Health Organization, 1994).

Even though several studies validate the impact PE has on an individual's quality-of-life, those studies use quality-of-life as a relative measure that focuses on a broad set of indicators biased toward the study of the development, structure, and function of human society. Whereas the psychological concerns are focused on the identity, role, function, and behavior of an individual; and more importantly how an individual's identity, role, function, and behavior can be impacted due to a congenital birth anomaly.

For example, Steinmann et al. (2011) note that PE often coincides with a vulnerable life phase of puberty, a period characterized by significant physical, social, and emotional development. The appearance of the chest can be very disturbing to patients. Problems with self-esteem and body image perception are frequently reported in adolescent patients. Psychological disturbances are not unusual as individuals with PE progress through the lifespan. Equally important, my position as Executive Director of the 503(c) non-profit Pectus Awareness Support Foundation has allowed me to meet with

PE patients, both men and women, from around the world. The discussions that have followed point to there being a significant amount of concern about their outward appearance being a major issue, and those who have PE felt that they may be put at a disadvantage, having to come to terms with their looks while facing risk of harassment by peers. While my research infers the following, my anecdotal discussions with patients often demonstrate the fact that individuals experience feelings of shame and try to hide their chest; and because of this, individuals may become introverted and withdraw from social activities and sports. Also, this behavior can be reflected in their posture, choice of clothing, and unusual behavior.

Under these circumstances, there can be substantial impact to social interactions in the form of stigmatization, societal withdrawal, and suboptimal social behavior. Additionally, as patients mature, they may become increasingly concerned about sexuality and intimacy. This is acknowledged by a self-awareness that their deformity is not considered attractive, and some regard it as an obstacle in future relationships, both personally and professionally. As a result, reduced self-confidence and self-esteem appear to be common characteristics of PE patients.

To illustrate, the health and wellness of a child's self-esteem can be attributed to many factors. However, taking into consideration the degree that a child's social development is impacted by school and its related childhood interactions, it is important to accept the impact that exposure has on a child's self-esteem. School-age bullying has gained national attention as a very real and destructive presence in our school systems, leading to reports of clinical depression and, unfortunately, suicides. An increasing number of students, 30% in 2010 for example, report having been bullied during the

school year. Of those, half were harassed because of their looks and body shape (Davis, S., Nixon, C., 2010).

Davis and Nixon (2010) debate whether low self-esteem contributes to one becoming bullied or is a result of being bullied; regardless, at stake is a child's self-esteem and identity development. However, if low self-esteem may put a child at greater risk of being a victim, then there is evidence to support that treatment related to the impact on quality of life caused by PE can contribute to a child's sense of self-worth and self-esteem by improving body self-esteem.

Unfortunately, little is known about the degree to which adolescent patients prior to and after surgical correction suffer from the psychological impact of PE; and presently, only a few studies have attempted to describe the psychological strain. Sarwer et al. (1998) argue that the psychology of these studies often seeks to validate the surgical outcome. Given the quality-of-life implications of both its psychological and physiologic effects, pectus excavatum represents a type of disease in need of thorough investigation into its impact on an individual's behavior, development, functional role, and identity.

Therefore, given the idea that PE can impact an individual's behavior and identity formation, utilizing the work of Erik Erikson could offer practical utility for further research. Erikson, a developmental psychologist, and psychoanalyst known for his theory on identity crisis posits there are eight stages during the lifespan, with the most critical stage, psychosocial development, occurring during adolescence. It is at this stage during the lifespan that adolescents encounter physical growth, sexual maturity, and the construction of ideas about themselves and what others think of them. Therefore, a crisis begins as individuals seek to define their identity, and adolescents form their self-image

while enduring the task of resolving the crisis. According to Erikson, a myriad of issues (i.e., trust, autonomy, and initiative) from a previous stage, in this case childhood, are central to resolving this crisis. It should be noted that Erikson thought of crisis not as an impending disaster, but as a time when an individual must make an important or difficult decision. Lastly, Erikson notes that individuals going through an identity crisis exhibit confusion, and if not resolved it can lead to confusion about their appropriate roles in subsequent stages.

QUESTION

Given that congenital birth anomalies are acknowledged within the medical community, it would make sense to focus specifically on how an individual's behavior may be related to such anomalies, especially at a specific time within the life span. Therefore, I ask: What resources are available to help formulate and support future research that would seek to establish whether there is a causal relationship between individuals born with pectus excavatum and their behavior during adolescence?

METHODS

To answer this question, I provide an annotated bibliography that will evaluate and summarize a comprehensive collection of relevant sources. Each source is separated and arranged in alphabetical order. Additionally, each source includes a short paragraph with a summary explaining its credibility and relevancy. Lastly, the form of annotated bibliography is evaluative and assesses the source's strengths and weaknesses; states why the source is interesting or helpful; lists what kind of, and how much, information is

given; considers objectivity and bias; and evaluates the source's usefulness relative to future research.

To begin, I examine selected works in psychology starting with Erik Erikson who laid the groundwork for psychosocial scholarship in *Identity and The Life Cycle* (1959) and *Identity, Youth and Crisis* (1968). He posits that adolescence is a critical time in the lifespan that is concerned with how individuals appear to others and asks the existential question: Who Am I and What Can I Be?

Next, I review journals from the American Psychological Association (APA). The APA is the largest scientific organization of psychologists in the United States and publishes over eighty journals, including the *Journal of Developmental Psychology*, which covers the scientific study of how and why human beings change their behavior over the course of their life. Another source that I will examine is the *Journal of Educational Psychologist*, which covers the area of psychology concerned with the scientific study of human learning.

Additionally, I examine the *Journal of Personality and Social Psychology*, which aims to show how people are individually different due to psychological forces. The *Journal of Personality and Social Psychology* also reviews the scientific study of how the thoughts, feelings, and behaviors of individuals are influenced by the presence of others as well as the internalized social norms that humans are influenced by, even when alone.

Finally, I examine literature from *The Journal of Cardiothoracic Surgery* and *The Annals of Thoracic Surgery* to discuss how chest wall anomalies and pectus excavatum can create deleterious effects that can occur from birth to adolescence, ranging from life-threatening conditions to psychosocial cosmetic concerns.

FINDINGS

Arnett, J. J. (2000). "Emerging adulthood: A theory of development from the late teens through the twenties." *American Psychologist*, 55(5), 469–480.

<https://doi.org/10.1037/0003-066X.55.5.469>

In this article, Arnett proposes a new concept of identity development called emerging adulthood. He puts forth a theory that emerging adulthood is a distinct period after adolescence that is utilized for identity exploration.

From previous research, as put forth by Erik Erikson's work on identity, Arnett acknowledges adolescence as a crucial time in the lifespan, which occurs from ages 12-18, but before young adulthood, which takes place during the age range between the late twenties to early thirties. While Arnett, does not provide a specific age range for young adulthood, he does characterize the period to be marked by subjective events, with supporting research, focused on individualistic qualities of character.

Specifically, his research shows that the top two criteria for entering young adulthood are accepting responsibility and making independent decisions. A third criterion that is also individualistic but more tangible, is financial independence.

Additionally, while Arnett notes the importance of Erikson's work on identity development during adolescence, he draws distinctions in several key areas as to why a new period of identity research is needed, especially during the ages of 18-25; and it should be noted that Arnett does not reject previous research on adolescence and its importance on identity development.

On the contrary, what Arnett is attempting to accomplish is to draw a distinction between the time in history that previous research on identity took place, while putting

forth new demographic and cultural data relative to the social changes that have occurred since. As a result, this article is important because it reinforces the concept of how identity is formed and can change during the lifespan, especially relative to demographic and social changes in industrialized societies.

In closing, the author uses Erik Erikson's theory on identity, and other primary sources, as a precursor to put forth a new concept on the development of identity formation during the lifespan with a focus on the ages of 18-25 known as emerging adulthood.

In the final analysis, this article is of significance because it focuses on the changing demographic and social landscape, in industrialized nations, which could influence an individual's identity. While the author concedes these are subjective and normative measures, he does offer research that quantifies how identity formation, during the ages of 18-25, could be influenced by life events that include marriage, career, and worldview. I find this author's article to be of importance because he posits the need to better understand identity formation relative to normative influences in an individual's life but does not include how those with congenital birth anomalies may have their identity influenced by those same normative standards. For example, Erikson's concepts were developed during a period where the normative, and subjective, social markers for the formation of an identity, such as marriage and career, took place at differing times and under different context in the lifespan than they do now. Notably, the starting of a family and career occurs later in the lifespan than they did in the 1950's.

Côté, J.E. (2009). "Identity Formation and Self-Development in Adolescence." In *Handbook of Adolescent Psychology* (eds R.M. Lerner and L. Steinberg).

<https://doi.org/10.1002/9780470479193.adlpsy001010>

In chapter 9, of the *Handbook on Adolescent Psychology*, James E. Côté discusses the concepts of self and identity during a time in the lifespan known as adolescence. He notes that, because these concepts have been approached from a variety of disciplinary and epistemological perspectives, often producing different empirical measures, the resulting studies have been characterized by academic enclaves leading to the same terminology being used for clearly different phenomena.

Given this outcome, Côté acknowledges that the higher-order abstractions of the psychological and social process of self and identity development make it a formidable task to define, both operationally and theoretically.

Because both concepts are multidimensional and have no single or simple definition, Côté provides an architectural framework for each concept, starting with identity. He separates the concepts because each has a distinct research tradition with different theoretical roots, notably self being associated with Freudian theory and identity with Eriksonian theory. Côté posits that a definitional checklist that specifies taxonomy of the processes, structures, and contents of each concept will normalize the discussion, offer coherence, and establish the difference in each concept's literature. As a result, Côté's work in chapter 9 of the *Handbook on Adolescent Psychology* provides a starting point for those seeking clarity on how the concepts of self and identity formation during adolescence can be used in operational or theoretical studies.

In closing, Côté's work has been cited regularly when discussing identity formation in adolescence as it relates to Eriksonian theory; and he regularly contributes to three fields of research: sociology of youth, identity formation, and higher education studies.

In the final analysis, this chapter is of significance because the author acknowledges the formidable task in studying identity formation, especially during adolescence and cross culturally. Furthermore, and perhaps of more importance, the author provides a type of architectural framework that could normalize future work on identity, especially in empirical studies. I posit that this is of utmost importance when considering the impact on behavior and identity formation in those who were born with pectus excavatum. I argue this because there is a lack of discussion in research articles published on the topic of PE and its impact on an individual's psychology. Especially, since several articles I have reviewed regarding the impact PE may have in an individual's life focuses more on quality-of-life instead of identity development and formation.

Côté, J. E. (2018). The enduring usefulness of Erikson's concept of the identity crisis in the 21st century: An analysis of student mental health concerns. *Identity: An International Journal of Theory and Research*, 18(4), 251–263.

<https://doi.org/10.1080/15283488.2018.1524328>

In this article, Côté examines the usefulness of Erikson's concepts on identity crisis relative to 21st century concerns on student mental health. In Côté's analysis of student mental health concerns, he draws parallels between classic and neo-Eriksonian

frameworks on identity and those from a psychiatric model that can inappropriately label certain behaviors as disorders.

For example, Côté's argues that identity, Erikson's legacy, is undisputed, has profoundly reshaped views on human development, and is a value-neutral interdisciplinary term. However, through primary sources, Côté concedes that while some observers question the need for Erikson's identity concept, they do so in a manner that is not consistent with the fact that the concept of identity endures today in thousands of theoretical and empirical publications.

Furthermore, he argues that the concept of identity, and its associated identity crisis, helps us to better understand experiences during the transition to adulthood, especially related to person–context adjustments and mental health.

As an illustration, Côté discusses the numerous ways an identity crisis can manifest itself in today's contemporary students; and as a result, problematic person–context fits create identity confusion especially among students who are not well prepared emotionally and academically for the rigors of higher education. In a more formal context, Côté notes the remarks of Erikson in 1956 to the audience of delegates at the First International Conference on Student Mental Health:

“Identity-Confusion should be discussed a great deal by this conference, not because we want to emphasize the pathological, but because we should be aware of the fact even healthy and functioning young people function only through the (often costly) struggle with identity-confusion. While the cost of this struggle is not always mental disorder by any means, it can lead to a vastly limited use of inner resources and outer opportunities.

But we must understand that confusion can also presage a new order, a fact which should

prevent us from rushing with psychiatric terms into crises which are not only necessary, but desirable.”

Côté provides context to Erikson’s remarks via several published studies. For example, as recently as 2016, the American College Health Association found that personal appearance created trauma in 30% of its respondents. The ACHA-National College Health Assessment (NCHA) is a nationally recognized research survey that assists in collecting precise data about students’ health habits, behaviors, and perceptions. While critically assessing these surveys, he goes on to note the absence of questions that explore how well students feel they were prepared academically, or how much they reveled in mastering challenges, a key indicator of ego strength and success in mastering an identity crisis.

As a result, Côté’s article on the usefulness of Erikson’s concepts in the 21st century is important because it provides applied examples of Eriksonian identity theory with firsthand accounts of the potential to misdiagnose students as they transition into adulthood.

In closing, the author uses primary sources to introduce the reader to what can be considered, a time in which student mental health crisis is of utmost concern. However, he does so in a way that acknowledges, through the work of Erik Erikson, that identity confusion will be common and should not be viewed as abnormal and certainly not as a disorder. Finally, summarizing that adolescence transition into adulthood is a period providing time during which an identity crisis can be experienced in a safe manner and optimally resolved in a fashion that sets the stage for a positive adulthood.

In the final analysis, this article is of significance because it explores identity, and the concept of identity crisis, in an operational context. More importantly, it uses a relative comparison involving pathological diagnosis' as an alternative consideration, and its associated consequences. Because the article acknowledges the complexity of this stage in the lifespan, and how appearance can create either an identity crisis or a pathological diagnosis, I posit that pectus excavatum, a congenital birth anomaly, could create an unresolved identity, or mental health, crisis that one has not been given the tools to solve on his or her own. However, it could also be said that society needs the tools to address the potential issue just as well. For example, medical students, according to reports, will only see about 4 hours of training on the topic of PE. The training they do receive, from my understanding, is to address the pathology of PE. Nonetheless, the tools that an individual could use could find some utility include an understanding how to cope with PE, especially regarding how it may impact them in various subjective social settings, in academics and sports, for example. One example I can provide includes my inability to run long distances. Had I been told I may not be able to run 1-mile at the same time as my peers then the feeling of inadequacy may have been reduced had I understood that I had a compromised pulmonary system due to PE.

Kroger, J., Marcia, J.E. (2011). "The Identity Statuses: Origins, Meanings, and Interpretations." In: Schwartz, S., Luyckx, K., Vignoles, V. (eds) *Handbook of Identity Theory and Research*. Springer, New York, NY. <https://doi.org/10.1007/978-1-4419-7988-92>

In this chapter, Kroger and Marcia examine the history and development of Erik Erikson's theory on psychosocial development as it relates to identity. Additionally, they discuss the theoretical origins of the identity construct while exploring its consequences.

It is important to realize, as the authors note, that the theoretical origins of identity arose from Sigmund Freud's development and concept of ego functions. Freud distinguished the ego into three phases, with all three being self-oriented. However, subsequent work by Alfred Adler who was an Austrian medical doctor, psychotherapist, and founder of the school of individual psychology, put forth that the realms of interpersonal relations, and the influences of society, influenced the ego. Consequently, it was at this time that Erikson systemized all these developments into a coherent theory on psychosocial development with the central tenet being identity crisis.

Both Marcia and Kroger have been key figures in building on Eriksonian theory in its original form, with Marcia practicing as a clinical and developmental psychologist and teaching at Simon Fraser University in British Columbia, Canada, and the State University of New York at Buffalo. It is important to note, as the authors also articulate, that identity researchers who are not psychoanalytically oriented, or concerned with classic psychoanalytic theory, do little to advance Erikson's original theory.

For example, Marcia begins with framework for the validation and measurement of the identity construct. In addition, Kroger interprets the various statuses of identity by reviewing over 40 years of research related to the identity model. Although Marcia claims, along with the implications of Erikson's own writings, that the identity construct can be enumerated into four statuses, he concedes that the problem for empirical research is that identity is not something that can be seen.

As a result, what can be seen, and measured, are behavior references that can determine whether an identity has or has not been formed. Under those circumstances, Marcia's psychoanalytic approach in developing the identity status model validates his work and the identity construct itself. Together with Marcia, Kroger also validates the identity construct by reviewing meta-analytic findings from the past 40 years. Her examination found that developmental patterns of change in the identity-formation process, in both adolescents and young adults, have occurred.

Consequently, Kroger notes that when the identity construct is used as an intervention technique, and for it to be effective, it must be particularly targeted for the intervention itself. In effect, what Marcia and Kroger have written in this chapter of the *Handbook of Identity Theory and Research* offers support for the validity of the identity construct. Notably, this chapter by academics utilizing a psychoanalytical approach to their research, and subsequent work, reinforces the driving question in my thesis. This is achieved, primarily, through the authors' approach in developing the identity status model and construct itself relative to today's social markers that Erikson formulated in his original concepts.

In closing, both authors are frequently cited in both the theoretical and operational applications of the identity construct providing ample evidence that their work, and the identity construct, can be validated.

In the final analysis, this chapter in the *Handbook of Identity Theory and Research* is the most comprehensive overview on the origins, meanings, and interpretations of the identity statuses, and construct itself. The authors offer various perspectives related to the implications, and consequences, of the construct put forth by

Erikson, and how the statuses arose from his initial work. Lastly, because I make the claim there is an impact to an individual's behavior during a critical time in the lifespan, and there is a causal link driven by a congenital birth anomaly, the personality, behavioral, relational, and developmental variables that have been examined in this chapter are relevant to applying the identity construct to my work.

Maree, Jacobus G. (2021) "The psychosocial development theory of Erik Erikson: critical overview," *Early Child Development and Care*, 191:7-8, 1107-1121, DOI: 10.1080/03004430.2020.1845163

In this article, Maree reflects on the life and work of Erik Erikson while offering a critical overview of Erikson's theory on psychosocial development. To accomplish this task the author discusses Erikson's biographical details, academic background, and the influence they had on his work as a developmental psychologist and psychoanalyst related to human development.

Because Erikson played a key role in articulating new theories for early child development in the twentieth century, Maree provides a general orientation for the broad framework put forth by Erikson. Much of what Maree writes, relative to Erikson's biographical and academic background, reflects Erikson's own identity crisis experienced early in his life and career. Maree notes the identity crisis Erikson experienced was foundational to the origins of his theories and later work. These experiences are summarized by Maree and offer insight into Erikson's proposed theory on psychosocial development and how they differed from existing theories proposed before him by noted psychoanalyst Sigmund Freud. As a result, this article is important because it provides

insight, and orientation, to Erikson's psychosocial development theory, its origins, and the key development tasks that occur during an individual's lifespan.

In closing, the author uses primary sources to discuss developmental psychology, Eriksonian theory, and their practice in self-construction.

This article is of significance because it calls attention to the influence of Eriksonian theory and how, in Erikson's view, every stage of a person's life relates to a different and specific psychological struggle that constitutes a key facet of their personality. I posit that pectus excavatum creates psychological struggle during adolescence, a time during the lifespan that Erikson stated requires an adequate sense of self, and therefore if not resolved can create an identity crisis in individuals.

Sokol, Justin T. (2009) "Identity Development Throughout the Lifetime: An Examination of Eriksonian Theory," *Graduate Journal of Counseling Psychology* Vol. 1: Iss. 2, Article 14

In this article, Sokol examines Eriksonian Theory on identity development across the lifespan. The article describes the different developmental stages, the associated conflicts, and research from empirical studies as part of the conclusion. As an illustration, the article discusses the impact Erikson's psychosocial theories have had on the social sciences, and the numerous research studies they have inspired.

Additionally, the article points to Erikson's focus on psychosocial analysis across the lifespan noting that most of his work focused on identity formation during the period that represents an optimal time for identity development due to a variety of physical, cognitive, and social factors called adolescence.

This article is important because it provides an elementary introduction to the concept of Eriksonian Theory on identity, an essential feature of psychosocial development. In closing, the author uses primary sources to convey the importance of Erikson's theories and the complexity involved in applying them to future work.

In the final analysis, this article is of significance because it places emphasis on how Erikson's theories apply to identity development at a critical time in the lifespan called adolescence. The author recognizes Erikson's work, especially related to the influence of culture and society, on an individual's identity development. I posit those who have pectus excavatum will have their identity development impacted because cultural norms, like body image, play a role in developing how an individual may see themselves relative to their peers.

Kelly, R. E., Jr. (2008). "Pectus excavatum: historical background, clinical picture, preoperative evaluation and criteria for operation." In *Seminars in Pediatric Surgery* (Vol. 17, Issue 3, pp. 181–193). Elsevier BV.

<https://doi.org/10.1053/j.sempedsurg.2008.03.002>

In the publication, *Seminars in Pediatric Surgery*, Dr. Robert Kelly Jr discusses the historical background, clinical picture, preoperative evaluation, and criteria for surgical treatment related to pectus excavatum (PE). Dr. Kelly, a Professor of Clinical Surgery and Pediatrics at the Children's Hospital of The King's Daughters, describes PE from an anatomical perspective by calling attention to sternal and costal cartilage depression which may present at birth, or more commonly during the adolescent growth spurt marked by puberty. Because of these anomalies, he also discusses symptoms; they

present as a lack of endurance, shortness of breath with exercise, chest pain, and body image issues.

From a historical perspective, Kelly notes that the earliest reported cases of PE appear to originate from a report of 176 excavated graves in Hungary dated from the 10th to 16th centuries. He also discusses that is PE found not only in humans, but also in animals with published reports of successful surgical treatment on cats and dogs. It has also been postulated that otters are thought to develop PE by cracking open shellfish on their chest while floating in the sea.

Together with the historical perspective and natural history, Kelly discusses consideration of embryology as a factor in the development of PE. As an illustration, Kelly's research uncovers how the sternum begins as a uniform population of undifferentiated mesenchymal cells which condense to become its anlage, or basic form. The sternum's relationship with the clavicle and seven costal cartilages, together with the synovial joints, are responsible for the articulation of the sternum up to 20,000 times per day by breathing. Expanding on this, he notes the process that takes place after sternal anlage with chondrification following and the cartilage being replaced by bone only after birth. As a side note, chondrification is the growth or formation of the skeletal system. It is the process of tissue being converted into tissue and bone. While Kelly continues to offer empirical evidence about the formation of the sternum, he does not conclude how exactly the formation, construction, and articulation, of the sternum and its associated anatomical parts, especially during the embryonic stage, after birth, and during the lifespan are responsible for PE.

Even knowing that embryology can be a factor, the full etiology of PE is also unknown, though the mechanical forces previously discussed in the development stages are thought to contribute to its development. Kelly discusses other congenital issues as a cause for PE and based on published research he discusses Marfan's syndrome, scoliosis, spinal muscular atrophy, and Ehlers-Danlos as an explanation; however, he declares that subsequent research shows that these causative factors have been widely disregarded.

Alongside the pathology, Kelly discusses the clinical features of PE. Noting that PE presents at birth, he discusses findings of numerous studies that have produced results showing that only one-third of patients had PE during infancy. Also noted, most patients are not cognitively aware of their PE until a pubertal growth spurt occurs.

From a morphological point-of-view, Kelly notes that most cases involve the lower sternum, and after careful review of pre-operative photographs, and CT scans, these images show that most patients also present with a long furrow or a thoracic trench with asymmetry that implies sternal torsion. For female patients, Kelly notes the presence of markedly asymmetric breast projection. The takeaway from Kelly's focus demonstrates the importance of understanding, and documenting, how morphological features are a critical component of discussing surgical treatment and health outcomes with patients.

Kelly discusses, thus far, numerous domains that focus on the timeline of PE, and he continues to do so by discussing preoperative evaluation and criteria for operation. He notes the use of radiographic tools for anatomic assessment and documentation of dimensions of the chest. While some practitioners will use a chest radiograph, because it is inexpensive, readily available, and allows measurement of severity, Kelly notes that

the advantages of a CT scan are compelling. His argument is that CT offers the deformity of the bony and cartilaginous skeleton in three dimensions. Additionally, it offers insight into cardiac compression and displacement. Additional benefits from the CT include assessing the Haller Index, which is calculated by dividing the transverse diameter of the chest by the anterior-posterior distance on CT of the chest on the axial slice that demonstrates the smallest distance between the anterior surface of the vertebral body and the posterior surface of the sternum. The reason for the Haller Index was simply to develop a baseline for insurance purposes and it is widely dismissed as having any significance regarding the severity or implications that PE may have on an individual. The result from the Haller Index simply tells the patient and physician the distance between the back of the sternum and the front of the vertebrae. Lastly, he argues that the CT offers insight about selecting the best possible surgical technique. The reason this is important is because it provides insight into the positioning of the heart and lungs prior to selecting a surgical technique.

Because PE may impact the cardiopulmonary system, Kelly discusses the limitation patients may have related to exercise. Based on a computer-assisted search of literature, his team identified seventeen studies that evaluated a total of 169 patients. In the assessed studies, parameters such as total exercise time, VO_{2max} (maximum oxygen uptake), power output, maximal heart rate, percent predicted work performed, oxygen pulse, anaerobic index, and various cardiac indices were computed. Kelly notes that the findings show an average cardiovascular function increase by one half standard deviation (SD) following surgical repair. The importance of this increase cannot be underestimated since the purpose of the cardiovascular system is to provide adequate circulation of blood

through the body; and pulmonary circulation allows for the oxygenation of the blood, and systemic circulation provides for oxygenated blood and nutrients to reach the rest of the body (Chaudhry, 2022).

Due to the nature of the exercise limitations identified, Kelly further assesses the pulmonary function for those with PE. Specifically, he looks at pulmonary function at rest, including through spirometry and plethysmography. Expanding on spirometry, which measures air flow out of the chest on exhalation at rest, Kelly noted that patients with PE are 10-20% below the expected average population without PE. Continuing, plethysmography which measures how much air you can hold in your lungs, Kelly noted that lung volumes are modestly decreased and consistent with the sternal depression proportional to the thoracic volume displaced by PE. He concludes, after presenting data on over eight hundred patients presenting with PE, that the only rational physiological explanation for the decreased exercise limitation is the chest wall malformation caused by PE.

Another critical point that Kelly discusses concerns the fact that cardiology evaluation is significant because some patients will have findings of right atrial and ventricular compression or mitral valve prolapse. Because of this, cardiac output is compromised and can manifest into exercise-related symptoms, including chest pain. Kelly goes on to note that these findings are significant because in some patients' cardiovascular surgery is a prerequisite before repair of PE itself. Through his own extensive research, and by referencing existing research, Kelly discusses the hemodynamic effects of PE relative to the shape of the chest. One such study indicated that work capacity was correlated to the severity of pectus depression. In another 16-

patient study, patients who had a shorter distance from the sternum to the vertebrae had a 20% or greater decrease in physical work capacity from the spine to sitting position. Also notable was the difference in stroke volume from changing the same positions. In normal subjects, Kelly notes a 51% increase with only 18.5% increase in those with PE. Kelly summarizes by noting the narrower the chest in the anteroposterior direction, the more the heart is apt to be squeezed between the sternum and spine. In summary, his work shows that compression of the right heart leads to diminished stroke volume. This, combined with a modest decrease in movement of air in and out of the chest leads to diminished cardiopulmonary capacity in severe cases.

A point often overlooked with PE is related to body image. Kelly addresses these concerns by drawing attention to the appearance of the chest and how it prompts some, if not most, patients to pursue surgical correction. His research notes that a significant percentage of PE patients are self-conscious about their chests, leading to interpersonal difficulties. In his own practice, Kelly discusses the attempts of suicide in response to depression precipitated in part by concern of patients with PE.

Particularly concerning are Kelly's findings related to the interaction of PE patients with pediatricians. He notes that patients with PE are often dismissed as having an inconsequential problem and pediatricians often tell patients, and parents, that their chest wall deformity is only cosmetic. In summation, Kelly notes that during adolescence body image is of great importance as it is a time when the person is establishing an independent identity, choosing a profession, and beginning involvement with the opposite sex; and because of PE an individual is afflicted with a deformity that reduces his or her capacity to do those things. Kelly notes that physicians support other surgical treatments

for revisions of burn scars, syndactyly, and other conditions in which the justification for operative risk is anatomic abnormality.

Given these points, Kelly discusses criteria for surgical repair of PE. In his own practice, he notes most patients come only after significant evaluation and that only half of the patients presenting for PE are offered surgical correction. By establishing selection criteria, Kelly offers surgical treatment if two or more of the following symptoms are demonstrated: history of progression of the deformity, paradoxical movement of the chest wall with deep inspirations, a chest CT scan with Haller Index greater than 3.25, cardiac compression, displacement or pulmonary compression identified on echocardiogram or CT, abnormal pulmonary function studies showing significant restrictive disease, mitral valve prolapse, bundle branch block or other cardiac pathology secondary compression of the heart, history of failed previous repair(s), and significant body image disturbance.

In closing, Dr. Robert Kelly offers a comprehensive integration of existing literature together with his own research on the assessment and treatment of pectus excavatum. From a theoretical and operational perspective, his work has been cited regularly.

This article is of significance when discussing PE because it covers the physiological and psychological domains related to the historical background, clinical picture, preoperative evaluation, and criteria for surgical treatment. Furthermore, and perhaps of most importance, Kelly identifies and acknowledges the importance of body image and identity formation in those individuals with pectus excavatum and how the manifestation of a patient's self-conscious behavior during a critical time in the lifespan known as adolescence may be impacted.

Jaroszewski, D.E., Obermeyer, R.J. (2018). “The physiologic impact of pectus excavatum repair.” *Seminars in Pediatric Surgery* (Vol. 27, pp. 127-132). Elsevier BV.

<https://doi.org/10.1053/j.sempedsurg.2018.05.005>

In the publication, *Seminars in Pediatric Surgery*, Dr. Dawn Jaroszewski and Dr, Robert Obermeyer discuss the adverse physiologic effects of pectus excavatum (PE) and the possible resolution following surgical correction with the minimally invasive repair of pectus excavatum (MIRPE) using the Nuss procedure. [it would help to have a brief explanation of what this is, since you discuss it more in this article] While the authors note subjective improvements, as reported by patients, in exercise tolerance after surgery, they concede to the elusiveness of clear and consistent objective data from well-defined study methodologies. Because PE is present in both pediatric and adult patients, the discussion is divided into two parts representing each group of patients separately. In this analysis, I report on the pediatric discussion only.

To start with, Jaroszewski and Obermeyer discuss pectus excavatum (PE) pathology and demographic information. Since the article is focused on the physiological effects of PE, and the lack of information to substantiate objective improvements post-surgery, the authors report on the available literature that discuss validated questionnaires related to statistically significant perceived improvements in exercise tolerance as reported by both patients and parents.

Because Dr. Jaroszewski and Dr. Obermeyer work at institutions that perform surgical correction of PE using the Nuss procedure, they also discuss their findings by querying internal databases using a defined period of 33 years and 10 years, respectively.

In the case of Dr. Obermeyer, who is a practicing pediatric cardiothoracic surgeon specializing in the surgical correction of PE, at Children's Hospital of The King's Daughters in Norfolk, VA, internal database findings also demonstrate statistically significant perceived improvements in exercise tolerance from validated questionnaires like those used in existing literature. The findings, which included 1270 patients, revealed that approximately 95% of patients no longer reported exercise intolerance after the MIRPE Nuss procedure.

In comparison, the authors also examine external findings from the previous decade where smaller studies using a different surgical technique, called the Ravitch procedure, found evidence to support improved cardiovascular function. While this is noteworthy, because the Ravitch procedure is a higher-risk surgery that has been practiced longer than the Nuss procedure, the authors declare the purpose of this specific article is to review data from literature on pediatric patients undergoing the MIRPE using the Nuss procedure.

Given these points, the authors conclude that contemporary literature demonstrates improvements, after surgical correction, in key areas including pulmonary function, chest wall mechanics, cardiac function, and cardiopulmonary exercise tolerance.

Regarding pulmonary function, the authors note that while pulmonary function tests (PFTs) are not the optimal way to evaluate patients complaining of exercise intolerance, they have strength of being reported against a normal distribution. Moreover, the authors provide insight from existing literature that any improvement in pulmonary function after surgical correction is attributable to an improvement in respiratory

mechanics. As the article notes, this is due to the diaphragm initiating most of the inspiratory effort during exercise and that more thoracic excursion is required to generate higher lung volumes, at which time the sternum and costochondral cartilage become more important for efficient respiration. The authors close on this topic by noting that because the Nuss procedure remodels the costochondral cartilage it thus may improve respiratory mechanics such that patients are able to expel air faster.

Another key point discussed by the authors, chest wall mechanics, is presented through existing literature. Jaroszewski and Obermeyer report that when examining chest wall mechanics, Redlinger et al. (2011) employed Optoelectronic Plethysmography (OEP) to demonstrate regional chest and abdominal wall motion dysfunction in pectus excavatum patients. What Jaroszewski and Obermeyer uncovered was that during deep breathing the movement of the upper and lower sternum was decreased by 28-51% and the abdominal wall motion was increased by 147% in PE patients compared to matched controls. The authors hypothesized the significant increase in abdominal wall motion was a compensatory reaction to a fixed sternum during forceful breathing. The same analysis, from Redlinger et al., (2011), was completed one year post-operatively and there was a resolution of the paradoxical movement of the sternum and abdominal wall during forceful respiration. The findings from this analysis provide a possible biomechanical explanation for the noted increase in forced expiratory volume (FEV), which measures how much air a person can exhale during a forced breath.

This article also focused on resting cardiac function. When examining contemporary literature, the authors found that analogous to PFTs (pulmonary function tests), cardiac studies performed during rest may not provide a clear physiologic

explanation for improved exercise tolerance. For example, literature from Jeong et al. was discussed as having a statistically significant resolution of cardiac compression, namely on the right ventricle, after MIRPE Nuss procedure. However, Jaroszewski and Obermeyer contend that supine imaging may underestimate the severity of cardiac compression when a patient is in the upright position. While the authors discuss quantifiable ways to measure resting cardiac function, they conclude with the fact that the left ventricle is located more posteriorly and is a thicker muscular structure. Therefore, the left ventricle is comparatively protected from the compressive effects of the sternum and explains the diminutive changes in resting cardiac output/index demonstrated after surgical repair of an individual's PE.

Lastly, Jaroszewski and Obermeyer examine cardiopulmonary exercise testing as an accepted and reliable method to measure functional aerobic exercise capacity. An important metric of this test is quantified using the peak oxygen uptake. This metric represents the maximum ability of a patient to inspire, transport, and consume oxygen in the peripheral tissue. Another important feature of cardiopulmonary exercise tests (CPET) is the integrative assessment of the interplay between the cardiac, pulmonary, musculoskeletal, hematopoietic, and neuropsychological systems. The authors argue that in PE patients the compression on the right ventricle is even more pronounced during forceful breathing; and because of this phenomenon, the authors posit that there is significant improvement in cardiac output during exercise, than rest, after MIRPE Nuss procedure.

In closing, Dr. Dawn Jaroszewski and Dr. Robert Obermeyer demonstrate the subjective experience that patients may endure when pursuing clinical improvement of

MIRPE Nuss procedure. While the authors concede that the physiological effects are difficult to assess, primarily because of inconsistent testing methodologies and lack-of-data, they summarize the benefits are multifactorial with improvements in respiratory mechanics and increased stroke volume due to relief of right ventricular compression. They make a final statement that calls for future studies to focus on cardiopulmonary exercise testing (CPET) with consistent methodologies using control groups to provide a more objective evaluation of the physiological impact after surgical repair.

In the final analysis, this article is significant because it demonstrates that there is a physiologic impact in individuals with PE. While I concede that the article may prove inconclusive for the reasons the authors note, I can recall for my entire life, until surgical correction of my PE, I had performance related issues with my cardiopulmonary system. For example, prior to surgery I could not hike to the top of Camelback Mountain in Phoenix, AZ. Nearly 5 years after surgery I have reached the top of Camelback Mountain, not only once, but twice in the same day. While I concede this example is anecdotal, there are many examples like this I have experienced since surgical correction of my PE.

Jaroszewski, D., Notrica, D., McMahon, L., Steidley, D. E., & Deschamps, C. (2010). Current management of Pectus Excavatum: A review and update of therapy and treatment recommendations. *The Journal of the American Board of Family Medicine*, 23(2), 230–239. <https://doi.org/10.3122/jabfm.2010.02.090234>

In the publication, *The Journal of the American Board of Family Medicine*, Dr. Dawn Jaroszewski, Professor in the Department of Cardiothoracic Surgery at Mayo

Clinic and director of the Mayo Clinic Chest Wall and Thoracic Surgery Program, examines the current management of pectus excavatum (PE) and its associated therapy and treatment recommendations. In Jaroszewski's examination, she discusses the characteristics of PE, the consequences of patient physician interactions, and the associated physiological symptoms. Lastly, she offers suggestions for critical evaluation of PE, criteria for surgical referral, and surgical treatment.

To begin, Jaroszewski remarks that PE is responsible for greater than 90% of chest wall deformities and occurs in approximately one out-of-every four hundred white male births with men being afflicted five times more than women. Because 40% of patients with PE have a family member who also have deformities, she proposes a genetic link as being responsible for PE, noting however that none has been identified.

Because PE develops in the thoracic region of the body, Jaroszewski suspects that the pathogenesis of PE is caused by disturbances in the growth of the sternum and costal arches as well as biomechanical factors. While there is a significant occurrence of abnormalities with the costochondral cartilage, she suggests that PE is often associated with connective tissue disorders, such as Marfan syndrome. Marfan syndrome is an inherited disorder that affects connective tissue. The connective tissue, according to Mayo Clinic, can be thought of as the fibers that support and anchor your organs and other structures in your body.

From a developmental perspective, Jaroszewski details how PE can be present at birth but is most frequently recognized during adolescence. During this period there is rapid growth, and many patients experience a marked increase in the severity of the depression until full skeletal maturity is achieved.

Under those circumstances, Jaroszewski emphasizes that in these severe cases there is a possibility for the depression created by PE to directly impinge the right ventricle of the heart; and because of this, she argues that PE is more than a cosmetic deformity. Because patients do not undergo surgical repair during childhood, many experience a progressive worsening of symptoms and cardiopulmonary function with increasing age.

To demonstrate, Jaroszewski discusses the clinical features of PE. She lists the most frequent symptoms of PE noted by patients as dyspnea with mild exercise, progressive loss of endurance, inability to keep up with peers, chest pain with activity, worsening fatigue, palpitations, tachycardia, exercise induced wheezing, frequent upper respiratory infections, easy fatigue, fainting/dizziness, chest pain without exercise, and exercise intolerance.

Consequently, even though PE can present with many different symptoms, they do not always correlate with the severity of the defect. Jaroszewski notes that while many patients are asymptomatic at a younger age, they do experience symptoms as they enter their teens. Although this may be true, and despite multiple studies evaluating cardiac and pulmonary function, there has been no conclusive or consistent demonstration of physiologic impact correlating with PE. However, Jaroszewski concedes that anatomic abnormalities, including decreased thoracic volume and cardiac compression, are thought to explain the physiologic effects noted by patients.

Jaroszewski remarks that the increased work of breathing from a partially restricted chest wall with impaired oxygen delivery to working muscles as the result of decreased venous return to the right heart may also play a role. For example, sternal

compression is suspected to decrease thoracic volume, which can reduce the SVO₂, exercise tolerance, tidal volume, and vital capacity causing dyspnea and a decrease in endurance with compensatory tachypnea during exercise. As a note, SVO₂ is a measurement of the mixed venous oxygen saturation or the amount of oxygen returning to the right side of the heart (percentage bound to hemoglobin). This reflects the amount of oxygen "left over" after the tissues remove what they need.

Together with the physiological concerns, Jaroszewski also discusses the psychosocial issues surrounding body image among teenagers. She notes they can be significant, life-altering, and occasionally life-threatening. Expanding on this topic, she discusses previous research and notes that poor body image and impaired psychosocial function are often important concerns for surgical repair. Lastly, she summarizes that previous psychological research shows that patients with disfigurements confirm disturbance of the body schema and alterations of the individual's self-representation.

Beyond the clinical features and symptoms, Jaroszewski expands on evaluating PE and the various methods that should be considered when doing so. The following tests provide the physician and patient with a thorough workup to assess the significance of the defect, and they include, but are not limited to, radiographic evaluation including a computerized tomographic (CT) scan, electrocardiogram, and pulmonary function tests. Jaroszewski offers the following criteria for surgical referral, and they include being symptomatic, progression of the deformity, paradoxical movement of the chest wall with deep inspiration, computed tomography with severity index greater than 3.0, cardiac compression or displacement, pulmonary compression, abnormal pulmonary function, mitral valve prolapse, and significant body image disturbance. The results derived from

these physiological tests are necessary to determine whether individuals should be referred to a surgeon for a discussion of repair options, Jaroszewski concludes.

In closing, Dr. Jaroszewski concludes by discussing the pathology of PE and its progression relative to the availability of more data and treatment experience.

Additionally, she notes the patient physician interaction is focused more on PE being a cosmetic diagnosis; however, it has become less commonplace but recommendations for surgery are still based on limited and preconceived knowledge. Because of this, the primary care physician continues to play a critical role in the diagnosis and referral of these patients.

In the final analysis, this article is of significance when discussing the physiological and psychological impacts PE can have on an individual. Additionally, the article demonstrates how PE is currently managed in a clinical environment and its associated challenges when a patient is presenting for surgical correction. Jaroszewski's findings also reveal demographics and historical information of PE, associated therapy and treatment recommendations, and perspective on patient physician interaction.

Kelly, R. E., Jr, Cash, T. F., Shamberger, R. C., Mitchell, K. K., Mellins, R. B., Lawson, M. L., Oldham, K., Azizkhan, R. G., Hebra, A. V., Nuss, D., Goretsky, M. J., Sharp, R. J., Holcomb, G. W., 3rd, Shim, W. K., Megison, S. M., Moss, R. L., Fecteau, A. H., Colombani, P. M., Bagley, T., Quinn, A., ... Moskowitz, A. B. (2008). Surgical repair of pectus excavatum markedly improves body image and perceived ability for physical

activity: multicenter study. *Pediatrics*, 122(6), 1218–1222.

<https://doi.org/10.1542/peds.2007-2723>

In this article, Robert Kelly et al. examine surgical repair of pectus excavatum (PE), its impact on body image, and perceived ability for increased physical activity. The article specifically evaluates changes in both the physical and psychosocial quality of life reported by the parent and child after surgical repair of PE.

Furthermore, the article discusses methods from a multicenter study utilizing a previously validated tool called the Pectus Excavatum Evaluation Questionnaire. The questionnaire was administered by a research coordinator, via telephone, to parents and patients between the ages of 8-21 before and one year after surgery. Eleven North American children's hospitals participated; and from 2001 to 2006, 264 patients and 291 parents completed the initial questionnaire. Participants were recorded using a Likert-type scale of 1 to 4, reflecting the frequency of a particular experience with higher values equaling less-desirable experiences. As a result, parents and patients reported significant positive post-operative changes, including improvements to both physical and psychosocial functioning, including less social self-consciousness and a more favorable body image.

This article is of significance because it demonstrates that patient populations with pectus excavatum can experience significant anxiety and self-consciousness due to body image distress. Furthermore, Kelly provides evidence based on existing psychological research that reveals how a visible, or potentially visible, part of the body can often cause disturbances of the body schema and alter an individual's self-representation. I hypothesize that based on Carl Rogers construct of self-concept, how an

individual with PE encompasses themselves through self-representation, which is the way people depict themselves either to themselves or to others, can manifest into what Erik Erikson considers an identity crisis. Finally, I find this article of significance because of what Kelly notes regarding the interaction patients and parents have with pediatricians, and that is in most cases patients with pectus excavatum are told they have an inconsequential problem. Pediatricians often tell patients that the chest wall deformity is only cosmetic, and for this reason, they are often denied the opportunity for surgical correction of the problem.

CONCLUSION

I conclude by summarizing the key research findings in relation to the driving question, while additionally discussing the value and contribution of those findings. I will reiterate key points of my work including a personal reflection related to various experiences as they are motivating factors for establishing the need for future work. Lastly, I will discuss the limitations of my work and propose opportunities for improvement in future research.

I have argued throughout this work that identity development during adolescence in individuals with pectus excavatum can be impacted, delayed, or not resolved. I use Erik Erikson's concept of psychosocial development, which is a comprehensive psychoanalytic theory that identifies a series of eight stages that a healthy developing individual should pass through from infancy to late adulthood. While Erikson's theory covers the entire lifespan, I examine the stage he considered the most important, and where an identity crisis can occur, during the approximate age of 11-19 years.

Because Erikson's writing was limited, not well documented, and established during a different era, my argument incorporates analysis of journal articles from academics who are best known for their extensive research and writings on psychological development, with specific attention focused on adolescent lifespan identity development as originally constructed by Erikson.

My central argument is also supported by analysis I perform on journal articles published by the medical community, specifically cardiothoracic surgeons who specialize in the surgical correction of pectus excavatum. The articles quantitatively assess the impact that pectus excavatum can create physiologically while examining the possible psychological effects an individual may encounter. While I argue pectus excavatum is well understood from a physiological perspective, the psychological concerns related to it are not, at least in the medical community and especially at the general practitioner level. Therefore, the journal articles selected, and the subsequent analysis are selectively represented to draw attention to the psychological concerns that surgeons recognize within their patient population during clinical evaluation of pectus excavatum.

I explore how Dr. Dawn Jaroszewski, Dr. Robert Obermeyer, and Dr. Robert Kelly assess the clinical features of pectus excavatum. Additionally, I provide analysis of the various techniques they utilize for measuring the impact pectus excavatum may have on an individual's cardiopulmonary system. While work by Dr. Kelly establishes the historical background, clinical picture, preoperative evaluation, and criteria for operation, Dr's Jaroszewski and Obermeyer provide findings that help strengthen my argument that pectus excavatum, if severe enough and left untreated, can become a lifelong consequence both physiologically and psychologically.

Because the physiological health of an individual with pectus excavatum is of primary concern among medical doctors, I discuss the utility of Eriksonian theory and how it can be synthesized with the diagnosis of pectus excavatum to address the possible trauma that can occur in patients. To strengthen my argument, I analyze the works of James Côté, Ph.D., a professor of Sociology at the University of Western Ontario, and James Marcia, Ph.D., a clinical and developmental psychologist at State University of New York at Buffalo.

In my analysis of Marcia, I note his published framework attempting to validate and measure the identity construct originally put forth by Erikson. My analysis describes Marcia's interpretation of identity, which he substantiates by reviewing over 40 years of research related to the identity model. Although Marcia claims, along with the implications of Erikson's own writings, that the identity construct can be enumerated, the weakness in my argument and the identity construct itself is that empirical research on identity is not something that can be seen. While I do concede in my analysis of Marcia that identity is a social construct, what can be seen, and measured, are behavior references that can determine whether an identity has or has not been formed.

In my analysis of Côté, I argue that he provides enough evidence to draw parallels between classic and neo-Eriksonian frameworks on identity and how those from a psychiatric model can inappropriately label certain behaviors as disorders. The reason of calling attention to the inappropriately labeling of certain behaviors as disorders is of primary importance because Erikson felt that identity development during adolescence could presage an identity crisis, and that the crisis that ensues is a moratorium where important decisions about who one is, and what they are capable of, need to be made.

Comparatively speaking, what Erikson posits is that the word crisis has been misappropriated as an impending disaster that requires immediate attention and hence the focus on the pathological.

My work is important because there is not a method with low discrepancy to determine whether identity development during adolescence in individuals with pectus excavatum is impacted, delayed, or never accomplished. While evidence illustrates surgical treatment can address quality-of-life concerns, some studies use quality-of-life as a relative measure focusing on a broad set of indicators biased toward the study of the development, structure, and function of human society.

While these quality-of-life indicators have utility, I posit what is more important, and of primary concern, is the focus on the identity, role, function, and behavior of an individual; and more importantly how an individual's identity, role, function, and behavior can be impacted due to pectus excavatum. Even though I do not argue for it in my work, I put forward the argument that there is an equal amount of responsibility for the individual and the society they are a part of to have a reciprocating effect on what each are and can do for each other. The strength of this statement is reinforced when my work considers that importance of Erikson's original concepts and how they focused on biological and environmental factors that impact an individual's identity formation during adolescence.

REFERENCES

- Abid, I., Ewais, M. M., Marranca, J., & Jaroszewski, D. E. (2017). Pectus Excavatum: A Review of Diagnosis and Current Treatment Options. *The Journal of the American Osteopathic Association*, 117(2), 106–113.
<https://doi.org/10.7556/jaoa.2017.021>
- Arnett, J. J. (2000). “Emerging adulthood: A theory of development from the late teens through the twenties.” *American Psychologist*, 55(5), 469–480.
<https://doi.org/10.1037/0003-066X.55.5.469>
- Côté, J.E. (2009). “Identity Formation and Self-Development in Adolescence.” In *Handbook of Adolescent Psychology* (eds R.M. Lerner and L. Steinberg).
<https://doi.org/10.1002/9780470479193.adlpsy001010>
- Côté, J. E. (2018). The enduring usefulness of Erikson’s concept of the identity crisis in the 21st century: An analysis of student mental health concerns. *Identity: An International Journal of Theory and Research*, 18(4), 251–263.
<https://doi.org/10.1080/15283488.2018.1524328>
- Creswick, H. A., Stacey, M. W., Kelly, R. E., Jr, Gustin, T., Nuss, D., Harvey, H., Goretsky, M. J., Vasser, E., Welch, J. C., Mitchell, K., & Proud, V. K. (2006). Family study of the inheritance of pectus excavatum. *Journal of pediatric surgery*, 41(10), 1699–1703. <https://doi.org/10.1016/j.jpedsurg.2006.05.071>
- Davus, S., & Nixon, C. (2010). The Youth Voice Project. Retrieved November 30, 2019, from http://www.fmptic.org/download/the_youth_voice_project.pdf.
- Erikson, E. H. (1968). *Identity and the life cycle: Selected papers*. International Universities Press
- Erikson, E. H. (1968). *Identity, youth and crisis*. W.W. Norton.
- Hardin, A. P., Hackell, J. M., & COMMITTEE ON PRACTICE AND AMBULATORY MEDICINE (2017). Age Limit of Pediatrics. *Pediatrics*, 140(3), e20172151.
<https://doi.org/10.1542/peds.2017-2151>
- Jaroszewski, D., Notrica, D., McMahon, L., Steidley, D. E., & Deschamps, C. (2010). Current management of pectus excavatum: a review and update of therapy and treatment recommendations. *Journal of the American Board of Family Medicine: JABFM*, 23(2), 230–239. <https://doi.org/10.3122/jabfm.2010.02.090234>
- Kelly, R. E., Jr, Cash, T. F., Shamberger, R. C., Mitchell, K. K., Mellins, R. B., Lawson, M. L., Oldham, K., Azizkhan, R. G., Hebra, A. V., Nuss, D., Goretsky, M. J., Sharp, R. J., Holcomb, G. W., 3rd, Shim, W. K., Megison, S. M., Moss, R. L.,

- Fecteau, A. H., Colombani, P. M., Bagley, T., Quinn, A., ... Moskowitz, A. B. (2008). Surgical repair of pectus excavatum markedly improves body image and perceived ability for physical activity: multicenter study. *Pediatrics*, 122(6), 1218–1222. <https://doi.org/10.1542/peds.2007-2723>
- Kelly R. E., Jr (2008). Pectus excavatum: historical background, clinical picture, preoperative evaluation and criteria for operation. *Seminars in pediatric surgery*, 17(3), 181–193. <https://doi.org/10.1053/j.sempedsurg.2008.03.002>
- Kelly, R. E., Jr, Shamberger, R. C., Mellins, R. B., Mitchell, K. K., Lawson, M. L., Oldham, K., Azizkhan, R. G., Hebra, A. V., Nuss, D., Goretsky, M. J., Sharp, R. J., Holcomb, G. W., 3rd, Shim, W. K., Megison, S. M., Moss, R. L., Fecteau, A. H., Colombani, P. M., Bagley, T. C., & Moskowitz, A. B. (2007). Prospective multicenter study of surgical correction of pectus excavatum: design, perioperative complications, pain, and baseline pulmonary function facilitated by internet-based data collection. *Journal of the American College of Surgeons*, 205(2), 205–216. <https://doi.org/10.1016/j.jamcollsurg.2007.03.027>
- Kroger, J., Marcia, J.E. (2011). “The Identity Statuses: Origins, Meanings, and Interpretations.” In: Schwartz, S., Luyckx, K., Vignoles, V. (eds) *Handbook of Identity Theory and Research*. Springer, New York, NY. <https://doi.org/10.1007/978-1-4419-7988-92>
- Maree, Jacobus G. (2021) “The psychosocial development theory of Erik Erikson: critical overview,” *Early Child Development and Care*, 191:7-8, 1107-1121, DOI: 10.1080/03004430.2020.1845163
- Obermeyer, R. J., Cohen, N. S., & Jaroszewski, D. E. (2018). The physiologic impact of pectus excavatum repair. *Seminars in pediatric surgery*, 27(3), 127–132. <https://doi.org/10.1053/j.sempedsurg.2018.05.005>
- Shamberger R. C. (1996). Congenital chest wall deformities. *Current problems in surgery*, 33(6), 469–542. [https://doi.org/10.1016/s0011-3840\(96\)80005-0](https://doi.org/10.1016/s0011-3840(96)80005-0)
- Sokol, Justin T. (2009) “Identity Development Throughout the Lifetime: An Examination of Eriksonian Theory,” *Graduate Journal of Counseling Psychology* Vol. 1: Iss. 2, Article 14
- Steinmann, C., Krille, S., Mueller, A., Weber, P., Reingruber, B., & Martin, A. (2011). Pectus excavatum and pectus carinatum patients suffer from lower quality of life and impaired body image: a control group comparison of psychological characteristics prior to surgical correction. *European journal of cardio-thoracic surgery: official journal of the European Association for Cardio-thoracic Surgery*, 40(5), 1138–1145. <https://doi.org/10.1016/j.ejcts.2011.02.019>

The World Health Organization Quality of Life assessment (WHOQOL): position paper from the World Health Organization. (1995). *Social science & medicine* (1982), 41(10), 1403–1409. [https://doi.org/10.1016/0277-9536\(95\)00112-k](https://doi.org/10.1016/0277-9536(95)00112-k)