

Comparison of Sexual Identity in Identical Twins: A Systematic Review

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Table of Contents		
Abstract		2
INTRODUCTION		2
	Introduction to the Problem	2
	Background of the Problem	2
	Statement of the Problem	3
	Purpose of the Study	3
Research Questions		3
	Significance of the Study	3
	Assumptions	4
	Limitations	4
	Summary	4
LITERATURE REVIEW		5
	General History of the Topic	5
	Current State	5
	Nature and Genetics	5
	Disorders	6
	Nurture	6
	Shared Environments	7
	Non-Shared Environments	7
METHODOLOGY		8
	Introduction	8
Research Questions		8
	Descriptions of the Participants	8
	Instrumentation	9
	Ethical Considerations	9
RESULTS		9
	Introduction	9
	Data Collection Procedures	10
	Data Analysis	10
Results		11
	Literature Review	11
	General History and Current State	11
	Nature and Genetics	11
	Disorders	11
	Nurture	12
	Shared Environments	12
	Non-Shared Environments	12
DISCUSSION AND CONCLUSION		12
	Introduction	12
	Discussion	12
	Conclusion	13

	Exploratory Research	13
	Quantitative Analysis	13
	Methodological Improvements	13
	Integrated Collaboration	14
REFERENCES		14

Abstract

Objective: The aim and scope of this systematic review was to provide a comprehensive assessment of the impact nature and nurture have in influencing sexual identity, with a specific focus on the concordance or discordance of sexuality in identical twins.

Design: Systematic literature review.

Methods: Utilizing the National University Library, Google Scholar, Credo Reference, and National Institutes of Health (NIH), twenty-three articles were collected for review. Inclusion criteria: (a) peer-reviewed texts from 1990 to 2023; (b) quantitative and qualitative studies and educational pieces categorized: Alluded to Genetics, Alluded to Environment, Nature Versus Nurture Interplay, and Human Biology, Sexuality, Behavior and History (c) written in English; descriptive details (e.g., title, data source, sample size, type of siblings, age); and core aspects (e.g., main findings, limitations, conclusion).

Results: Strong allusion, particularly to genetics, is made regarding the origin(s) of sexual identity. However, due to its multifaceted nature, conclusive evidence has not been established. Even identical twins raised in the same environment may develop different sexual identities due to individual differences (e.g. IQ, reactions, social circles, hobbies, preferences, and beliefs).

Conclusion: Further exploratory research, quantitative analysis, methodological improvements, and integrated collaboration will provide knowledge to facilitate more impactful interventions, de-stigmatization initiatives, and policy development aimed at fostering equality and well-being for individuals of all identities (e.g., educational programs and training, human rights advocacy, community outreach, funding allocations, and support services).

Keywords: environment; gene; identical; identity; nature; nurture; sex; twins

Introduction

Introduction to the Problem

Are humans' sexual preferences and psychological orientation fixed, or is sexuality fluid and molded by environment? Studying identical twins provides a unique opportunity to explore this issue. Will those who share the same mother and father, same biological sex, same looks and usually the same environments share the same sexual identity? While some research suggests a genetic component to sexual orientation, other studies highlight the role of environmental influences, such as socialization, culture, and individual experiences. Therefore, despite sharing many similarities, identical twins may still exhibit variations in sexual identity, indicating the multifaceted nature of human sexuality.

Background of the Problem

Sexual identity involves not only the type of people one is attracted to but also encompasses how individuals choose to express their sexuality. "There is the sex the person was born with, the gender they identify as, the gender they express, the gender they are romantically attracted to, and the gender they are sexually attracted to. These are all part of a person's identity and they don't all have to align" (khanacademymedicine, 2015). When analyzing supposedly identical twins, it becomes essential to

consider the intricacies of sexual identity, recognizing that even individuals with identical genetic backgrounds may manifest differences in how they perceive and express their sexuality.

It is a point in our existence to thrive and procreate, like all other life forms. Yet, what causes some of us to lack the inclination or seek alternative avenues beyond conventional biological means? It remains a question today as to whether there is such a thing as a gay or straight gene. A biological root cause remains unnamed, yet there is neither an answer for an alternative. "Women were more likely than men to have slight to moderate homosexual feelings (scores of 1-3), and men were more likely to be nearly exclusively homosexual (scores of 5-6)" (Bailey, Dunne & Martin, 2000). This may stem from a greater social acceptance or preference, possibly related to the fetishization of relationships between women. Given that 24 years have passed since the study, one might ponder whether the findings would differ today. Could it be that these studies were inaccurate in the past due to apprehensions about potential criticism?

Studies show that when it comes to sexuality, therapy and treatment cannot persuade your character. Does this mean you were born with a fate already pre-determined? However, simultaneously, it has been strongly suggested that factors such as social and

cultural influences play a role in shaping the spectrum of sexual identity. “Our study provides physiological evidence confirming twins’ discordant sexual orientations, thereby supporting the importance of the non-shared environment for the development of sexual orientation and sexual arousal” (Watts et al., 2018). Non-shared environments encompass factors that affect twins differently, including unique social circles, teachers, coworkers, and other external influences, contrasting with shared environments characterized by commonalities such as home, school, family members, and religious affiliations.

Statement of the Problem

The problem is the absence of a definitive scientific fact regarding whether sexual identity is shaped solely by nature, nurture, or a combination of both environmental factors and inherent traits.

Purpose of the Study

Establishing whether identical twins share the same sexual identity or not could serve as a solid benchmark for future research studies. “You can’t bake the same cake twice. Despite having both identical genomes and a shared family environment, monozygotic (MZ) twins do not have identical values for psychological traits” (Mitchell, 2018). Though the similarity is higher than unidentical twins and siblings, the result is still not statistically significant. No matter the effort in trying to replicate something, even down to the smallest cell, achieving exact duplication remains unattainable. For the time being, identical twin studies represent the closest approximation for comparing “identical” subject at this time.

Scientific discoveries have the potential to diminish social stigmas, then increasing individual self-confidence. However, suggesting a reveal of sexuality can either make someone feel validated or exposed. These studies can serve as valuable reference points for discussions on human rights and a deeper understanding of biology, psychology, and behavior. Ultimately, the discoveries regarding sexual identities in twins will significantly enhance insight in diverse fields of medicine.

The aim of this study is to provoke meaningful changes by addressing and potentially contributing to the resolution of pertinent social issues. “The continued genetic study of male sexual orientation should help open a gateway to other studies focusing on genetic and environmental mechanisms of sexual orientation and development” (Sanders et al., 2017).

Continuous study of the XY chromosomes and their connection to sexuality have the potential to broaden inclusivity across all identities, due to the societal influence of masculinity. “There is no rational stopping rule; the world-physical, biological, and social-is a seamless whole and the task of science is to work out the links at every level, not declare domains “off limits”” (Bouchard & McGue, 2003) The world, both physically and socially, is interconnected and a researcher’s role is to establish connections at all levels. The pursuit of scientific understanding should exclude no domain from investigation.

Research Questions

The research questions will be studied by using both quantitative and qualitative resources. This study is documented solely as qualitative. These questions could ultimately aid this study’s problem statement.

Do identical twins who share almost 100% of their DNA also share the same sexual identity?

What role do genetic and environmental factors play in determining sexual identity concordance among identical twins?

Are twins born into their sexual preferences and psychological orientation, or is sexuality fluid and molded by our environment?

Significance of the Study

Genetic conditions affecting hormones and physical appearance can significantly impact the identity and experiences of an individual. “Sometimes, genetic conditions affecting hormones can lead to a discordance between chromosomes and a person’s physical appearance” (Strong Medicine, 2017). In the event that twins are affected by a condition like this, it would make the probability of their identities aligning even more unlikely. This is often referred to as a Discordance in Sex Development (DSD), impacting each twin differently, if at all. Body image may play a role in how we identify, and who we feel we are supposed to be attracted to.

Addressing the challenges faced by DSD can influence a positive impression on one’s sense of self, relationships, and overall well-being.

In utero is a pivotal time, as it marks the formation of a child’s tissues and organs. “In the theory of “fetal programming,” it is stated that during fetal growth and development, the various tissues of the body grow during different critical periods of rapid cell division” (Jacobs et al., 2001). Environmental factors affecting the mother, such as malnutrition, can cause

significant defects in the baby's development. The brain, being our most complex organ, plays a role in all mental and physical functions. Thus, ensuring quality maternal health and mitigation of hostile environmental effects during pregnancy are essential in providing a healthy fetal development.

Placentas are intricate organs that develop within the womb, serving as a vital resource in supplying the fetus(es) with oxygen and nutrients via the umbilical cord, while simultaneously expelling waste or toxins from the developing baby(ies). More than seventy percent of identical twins share a placenta during gestation. Sharing the same placenta exposes twins to shared nutritional factors during the critical stages of early body and organ development. "Taken together, this study suggests that default-mode functional connectivity is influenced by genetic factors as an entire network..." (Jansen et al., 2015). This suggests that identical twins, undergoing similar developmental processes, may exhibit the same traits. In essence, twin studies provide valuable insight into the heritability of traits and diseases and environmental influences in shaping human characteristics. By comparing the similarities of twins raised together versus those raised apart and identifying genetic factors underlying cancer, cardiovascular, psychiatric, and neurodevelopmental disorders and conditions, researchers can obtain knowledge of disease risk, progression, and prevention. Learning about psychological, personality, cognitive, and mental health traits and disorders assists recognition of risk and protective measures associated with these vulnerabilities. Shared environmental and genetic influences in identical twins can lead to parallel development trajectories.

Assumptions

The study population will be inherently limited compared to others, primarily due to the rarity of identical twins and associated topic stigmas. Additionally, the literature search on the direct research questions will be sparse, reflecting the absence of confirmed factors underlying sexual identity. References selected for this study are more likely to originate from societies a greater acceptance of sexual diversity. Societal norms often oversimplify sexual identity by categorizing it into binary terms, for example, heterosexual versus homosexual, disregarding the complexity inherent in the sexual orientation and gender identity spectrum. The reviewed literature may assume that sexual identity remains fixed over time, ignoring the possibility of

fluidity and shifts in identity over one's lifespan. An assumption can be made that identical twin findings can be generalized to the wider population, overlooking potential biases in twin studies and the uniqueness of the twin relationship. On the contrary, findings in individual studies (non- family studies), may be used to provide context in understanding twin research findings.

Limitations

A significant challenge for this study lies in the absence of a definitive determinant of sexual identity, leaving only speculative theories available. The nature versus nurture debate surrounding this topic has persisted over time, highlighting the intricacy of these influences. The existence of a scientifically proven answer to this discussion would greatly enhance the resources available for more thorough research. Additionally, an inherent limitation lies in our inability to inhabit another individual's body, being unable to experience their emotions and thoughts firsthand. Consequently, a challenge persists in being unable to determine whether our perceptions align with those of others. Hence, the reliability and sincerity of findings may forever remain in doubt. Under the presumption that sexuality is fluid, individuals may undergo shifts in their personalities and preferences over time. Therefore, further studies may be necessary to establish whether twins maintain the same sexual identities and if a change occurs, if it occurs concordantly.

Summary

As of the 20th century, the origins of sexual identity remain unknown, yet encompasses a vaster array of subcategories than ever. Ongoing research in psychology, biology and sociology is needed to unravel the complexity of sexuality. Globally, we have made progress in identifying and discarding factors that are not influential in shaping sexual identity, while remaining mindful of those that are significant. While resources addressing the specific research questions at hand may be limited, attention can still be directed towards literature exploring broader topics related to sexuality. This approach enables an exploration of diverse perspectives and fosters the emergence of new ideas. The literature review will focus on the concept of "nature" within the context of the nature versus nurture debate. Subsections of this chapter will delve into genetic factors, including DSD and gender dysphoria, and explore the probability of twins sharing such conditions. This chapter will also shed

light on the role of “nurture,” clarifying the distinction between shared and non-shared environments.

Literature Review

General History of the Topic

Sexual identity overcasts a large variety of subcategories that we are still learning about today. There has been a long-standing question on whether some personality traits and thoughts stem from genetics (nature) or a person’s environment (nurture). “From the 18th century the body came to be understood as a machine, not a sentient entity” (Hawkes & Dune, 2013).

Sexuality does not only involve reproducing; humans perceive and feel things, and these feelings may not be limited towards a person of the opposite biological sex. “This has been a subject of endless debate for literally thousands of years, with various prominent thinkers, from Aristotle and Plato to Pinker and Chomsky, lining up to argue for either innate differences between people or for everyone starting out with a blank slate and our psychology being shaped by experience alone” (Mitchell, 2018). The advancement in fields such as genetics and psychology are allowing us to adopt a more nuanced understanding of sexuality in all realms.

Current State

“The topics of sex, gender and sexual orientation are highly politicized here in the U.S.” (Strong Medicine, 2017). Approximately 3% of the population today publicly identifies as LGBTQ+. “Since Darwin's day, we've been told that sexual monogamy comes naturally to our species. But this narrative is collapsing” (Ryan etc., 2010). Marrying one’s first love and understanding preferences is rare at a young age. “The stereotype norm for people in our society is straight” (khanacademy, 2015). It is essential for us to explore sexuality and discover our likes and dislikes over time. Daily, we see same sex marriages and gender transformations. With this, social stigmas have lessened but are still showing to be a challenge. “Discrimination and stigma based on gender identity, gender expression, and sexual orientation create stressors and trauma for LGBTQIA+ people. These stressors can produce depression, anxiety, and post-traumatic stress disorder, which are associated with eating disorders” (Goldhammer, 2023). The intersectionality of these stressors, compounded by factors such as race, ethnicity, economic status, and

disability underscore the importance of creating inclusive and supportive environments to mitigate the adverse effects of discrimination on both mental and physical well-being. Addressing these obstacles are crucial to bolster inclusivity and mitigate obstacles.

A logical approach by scientists is used to investigate, acquire knowledge, and develop deeper understandings of natural occurrences in the world. “But in the early years of the 20th century, the study of the scientific method crystallized into an academic discipline in its own right, known as philosophy of science, which flourishes today. Contemporary practitioners typically have a training in both philosophy and science, and in some cases straddle them” (Okasha, 2019). Observations, inquiries, experiments, data collection, analyses and communication is essential to construct conclusions and identify the best optimal courses of action medically and socially.

Nature and nurture interactions may vary across different dimensions of sexual orientation, including attraction, behavior, and identity. “Male sexual orientation is moderately heritable (30~40%), but is multifactorial, with evidence of multiple genetic and environmental contributions, via family studies, twin studies and segregation analyses” (Sanders et al., 2017). The examination of patterns within families further explores the genetic mechanisms contributing to a trait. Segregation analyses is a statistical method used in genetics to investigate pattern inheritance, which then discerns whether there are genetic components that contribute to said patterns. “Genetically identical twins can differ in their self-reported sexual orientations.

However, whether the twins’ subjective reports reflect valid differences in their sexual orientations is unknown” (Watts et al., 2018). Variations in self-reported sexual identities exist, but the accuracy of these disclosures remain questionable due to uncertainty in the statement’s reliability. It is impossible to understand the true thoughts and feelings of another individual. Therefore, the veracity of reports to researchers is uncertain.

Nature and Genetics

“Similarity in genes” refers to the degree of resemblance or likeness between the genetic composition of species. It indicates how closely related or similar two or more sets of genes are to each other. “...If genes are involved in homosexuality, then the more closely related two siblings are genetically, the more likely they should be concordant for sexual

orientation. Indeed, for both men and women this holds true: identical twins exhibit the most concordance, followed by fraternal twins, and finally adopted siblings.” (Viii. homosexuality and transsexuality, 2002). To no surprise, studies have consistently found a higher resemblance rate in sexual orientation among identical twins compared to other types of sibling pairs. “However, in only about half of the identical twins are both homosexuals; in the other half they are discordant for sexual orientation, suggesting that genes alone do not determine sexual orientation” (Viii. homosexuality and transsexuality, 2002). This means that even though identical twins share almost all of their identical makeup, only about half of them both identify as gay or lesbian.

Examining family history generates an approximation on the likeliness of inheriting a particular trait. “...‘Heritability analysis’. This involves studying relatives in order to produce a numerical estimate of a trait’s heritability, defined as the fraction of the trait’s variation that is due to genetic variation. To illustrate the logic, suppose that two identical twins, separated at birth, are found to be much more similar, in respect of some trait, than two randomly chosen population members. Since the twins grew up in different environments, we can infer that their similarity is probably due to shared genes, that is, the trait has a high heritability” (Okasha, 2019). It can be assumed that similarity in twins, regardless of environment separation, is likely attributed to shared genes. Heritability analysis allows scientists and other researchers to gauge the genetic contribution in trait variation and understand the interaction and collaboration between genetic and environmental factors.

Disorders

Identical twins share almost all of their genetic material; this makes them most ideal for investigation of the influence of genes versus the influence of environment in the display of disorders and personality traits. Past research will suggest a genetic component in the development of disorders such as eating disorders and DSD. “Transgender and gender diverse (TGD) youth may engage in disordered eating in order to prevent puberty or to attain a body shape more associated with their gender identity. For example, a TGD person assigned female sex at birth may restrict eating to prevent breast growth and menses. Some TGD people may overeat or restrict eating to attain a more traditionally masculine, feminine, or androgynous body shape (e.g., “I’ll limit

eating until I have no curves”)” (Goldhammer, 2023). If one identical twin has a disorder or trait, the other is at a higher risk than anyone else in the population. “On multiple measures of personality and temperament, occupational and leisure-time interests, and social attitudes, monozygotic twins reared apart are about as similar as are monozygotic twins reared together.” (Bouchard et al., 1990) Geographically separated twins show almost the same measurement of similarity as those who may have matured together. This is a big statement to be a coincidence. If their environment wasn’t shared, how do they remain so similar?

Gender dysphoria is distress due to a conflict with an individual’s assigned sex at birth and their gender identity. “...Gender dysphoria is most likely a highly heritable trait, although heretofore unidentified environmental conditions may contribute to its expression” (Coolidge & Stillman, 2020). This statement highlights the uncertainty and lack of fact in cause of sexual identity and related disorders. “The etiology of gender dysphoria is unknown, yet the reported prevalence has been increasing, with most estimates suggesting that as many as 521 in 100,000 males and 265 in 100,000 females experience gender dysphoria” (Foreman et al., 2019). The reported prevalence may be increasing due to the warming of social acceptance.

The distress some individuals experience due to conflict between their gender identity and assigned sex at birth may influence their relationship with their body and their body image. To understand the collaboration between genetic and environmental factors is key in identifying the associated risk factors. Genes alone do not determine the development of eating disorders; environmental factors, such as societal pressures, family dynamics, and personal experiences also contribute significantly. Traditional treatment settings may not be inclusive and sensitive to unique needs of transgender and gender-diverse individuals. Then, making it challenging to seek out and receive appropriate care.

Nurture

Can our observation of another’s sexuality and behavior influence our own, and is it possible for someone else to alter our sexual identity? Non-genetic influences can include environmental, social, cultural, or psychological factors. “Initial theories about non-genetic influences on sexual orientation were based on social learning theories, stating that non- heterosexual individuals are “recruited” by

existing non-heterosexual individuals, or that they learn non-heterosexual behavior from non-heterosexual parents or relatives” (Oginni et al., 2023). In essence, a study on childhood gender nonconformity and early-life adversity, suggests that sexuality can be influenced by social interactions and environmental factors rather than solely by genetic or biological factors.

Heightened vulnerability can develop from social pressures, discrimination, health concerns, and lack of support. Approaching these issues with necessary knowledge and expertise is crucial in providing support acknowledging the connection between sexuality, self-identity, and mental health. “Our brains come prewired, but they are not hardwired” (Mitchell, 2018).

Though there are certain things we cannot change about ourselves, we are not rigidly fixed, and with effort and “molding” there is a degree of flexibility within our brains functioning that allows us to learn and adapt with experiences over time. “In fact, you could say that the brain’s main job is to change itself—that is how it reacts to the environment and how it stores memories of experiences, tracking the statistical patterns in the world, mapping out causes and effects, tagging outcomes as good or bad for future reference” (Mitchell, 2018). The brain is a dynamic and resilient organ, constantly undergoing changes to better comprehend and respond to the complexities of the environment.

There is a prevailing assumption that the family environment is uniform and equally shared amongst children. This assumption implies that children will experience the exact same relationships and obtain knowledge in a comparable manner within the family structure. “Such research underlines the assumption within consumer research that the family environment is homogenous and shared equally by all children (i.e. that siblings will be socialized by their parents and learn about consumption within their family in a similar manner)” (Kerrane et al., 2013). It is noteworthy to acknowledge that this theory may oversimplify the complexities of family dynamics and individual experiences within a shared environment. Etiological explanations aim to uncover the relationships between factors and the explanation of a cause, specifically in medicine or biology “The environment in this context refers to all non-genetic etiological influences on sexual orientation” (Oginni et al., 2023). These influences could include work, relationships, geographics, social circles, culture,

education, economic status, household, etc. “Many researchers believe that sexual identity is shaped for most people at an early age through complex interactions among biological, psychological, and social factors” (Longe, 2016). For instance, being raised in a supportive and accepting environment can nurture self-acceptance and encourage healthy sexual exploration, whereas experiencing stigma or discrimination may result in the suppression or confusion of one’s identity.

Shared Environments

Monozygotic twins, commonly known as identical twins, possess nearly identical genetic compositions as they originate from a single fertilized egg that splits into two embryos.

Throughout their development, these twins will share numerous other environmental influences and life experiences. Shared environments encompass the non-genetic factors that are common among two or more individuals. These may include aspects such as culture, economic status, city, and school. The most common shared environments occur within households, particularly when twins are raised together and share the same caregivers. In such cases, they may experience identical family dynamics, parenting styles, and the overall atmosphere of their home environment. Additionally, identical twins growing up within the same community and culture are likely to be influenced by similar societal norms and commonly comparable economic circumstances. When residing in not only the same community, but same homes, it’s probable that twins will attend the same schools. As a result, they will have access to uniform educational resources and be exposed to the same peer groups and teachers if they share classes. Residing in the same household suggests that siblings frequently share access to similar nutrition and daily routines as well as experience family milestones and crises together. Collectively, these factors shape their shared perspectives and behaviors. While shared environments hold significance, it’s essential to recognize that individual experiences will still occur, and each twin may react differently to the same environment.

Non-Shared Environments

Non-shared environments are also referred to as “unique environments” or “individual-specific environments.” These are the environmental aspects of a twin’s environment that are distinct from their siblings. Some of these factors include friends,

romantic encounters, media exposure and life events. “Children are treated in different ways by both their parents and siblings. The siblings created different and multiple sibling micro-environments within each family, and these varied from contentious/confrontational (dispassionate sibling micro-environments) to collaborative/cooperative (supportive sibling micro-environments)” (Kerrane, 2013). Sibling dynamics and their individual experiences shape diverse developmental environments, even within the same familial context. The significance of an individual-specific environment plays a crucial role in shaping individual differences within families, highlighting factors beyond genetics and shared environments that contribute to the diversity among siblings. “Within families are substantial sibling differences in temperament and personality factors, cognitive and achievement skills, and many other individual difference attributes arising from genetic and nongenetic influences” (Deater-Deckard, 2011). The various developmental trajectories witnessed among siblings stem from their discordance in respective non-shared environments. Further examples of non-shared environments include exposure to different teachers, hobby engagement and pursuit of individual aspirations.

These distinct experiences and interactions contribute to shaping social skills, cultivating interests, and developing in a path unique of their siblings. “The present study suggests that identical twins with discordant self-reported sexual orientations differ in their patterns of physiological sexual arousal in a manner similar to unrelated heterosexual and homosexual individuals. These findings support the validity of identical twins’ self-reported discordance in sexual orientation” (Watts et al., 2018). Distinctiveness observed in the sexual orientation of identical twins supports the idea that non-shared environments bolster diverse experiences.

Methodology

Introduction

The age-old question of “Nature vs. Nurture” has long been questioned. “The relative contributions of genetic and environmental factors to the development of gender identity have been debated” (Diamond, 2013). Understanding the interaction between genetics and the environment in shaping an individual’s characteristics is complex, especially in

the broad subject of sexuality. While some studies have alluded to one or the other, the root of sexual identity is still unanswered. “Twin research on psychological characteristics falls within the field known as behavioral genetics, but twin research has also informed our understanding of the genetic contribution to other human attributes, such as body mass and medical disease” (Yoon, 2017).

By comparing and contrasting traits between twins using a systematic literature review, researchers can hypothesize, by identifying patterns, the genetic and environmental contributions to specific attributes.

Individuals within the same family might share hereditary predispositions toward homosexuality or be influenced by similar upbringings, or a combination of both, contributing to a pattern. “...A family pattern of homosexuality could be caused by a similarity in genes and/or shared home environment” (Viii. homosexuality and transsexuality, 2002). The subtopics of this study are nature and genetics, disorders, nurture, shared environments, and non-shared environments. Therefore, to achieve the most precise results and comprehensively depict the background of human sexuality, it is crucial to embrace a diverse selection of participants and studies. Doing so will not only encompass broader themes regarding sexuality, but also dive into specific realms such as concordance of sexual identity in identical twins. It is essential to recognize the complexity of the study and the limitations in research methodologies.

Research Questions

The proposed research questions for the review are:
Do identical twins who share almost 100% of their DNA also share the same sexual identity?

What role do genetic and environmental factors play in determining sexual identity concordance among identical twins?

Are twins born into their sexual preferences and psychological orientation, or is sexuality fluid and molded by our environment?

Description of the Participants

This is not a hands-on human research project; therefore, a systematic review has been conducted. Peer-reviewed literature has been retrieved through the National University Library and other sources such as Google Scholar, Credo Reference, and the National Institutes of Health (NIH). These publications embraced the perspectives of different authors on genetic and environmental effects towards

sexuality. Information spanning various time periods was analyzed to track the evolution and progress of social acceptance in the world and advancement of discoveries related to the origin(s) of sexuality. Twin research studies were targeted, but due to lack of specific research, studies on other siblings, family members, and sexuality in general, were considered. Selecting twins, specifically identical twins, provides a distinctive opportunity to conduct a natural experiment aimed at investigating how genetics and environments impact various aspects of life in similar individuals.

Literature chosen to address the research questions are both qualitative and quantitative.

In one NIH study, a sample size of 451 same sexed twin pairs were chosen for further quantitative development across a diverse range of age groups, including children, adults, and the elderly. The “Sexual Arousal Patterns of Identical Twins with Discordant Sexual Orientations” study examined physical responses in six pairs of male twins and nine pairs of female twins who reported differing sexual orientations. In the “Australian Twin Sample” study, researchers efficiently recruited twins from the Australian Twin Registry to investigate their sexual orientation in relation to childhood gender nonconformity and continuous gender identity.

Scientific Reports conducted a genome-wide association study on male sexual orientation using a predominantly European ancestry sample, which included 1,077 self-reported homosexual men and 1,231 self-reported heterosexual men.

Instrumentation

Reputable data from journals, books and articles worldwide have been thoroughly examined to gain information from surveys, interviews, observations, and psychometric tests. “Sexual identity may or may not be reflected by the individual in his or her behavior because feelings of attraction may be repressed or ignored for any number of reasons” (Longe, 2016). In the reviewed studies, surveys like the Sexual Orientation Questionnaire (SOQ) were utilized to gauge participants’ self-reported sexual orientation. Questions and responses created for this survey were vague, with answers such as “male or female” and “gay, straight or bisexual.” Follow up interviews conducted in person were also carried out to inquire about upbringing, exposure, relationships, and other pertinent matters. Stigma may lead to a lack of dishonesty in participants; therefore, information

pulled from this questionnaire was cautiously considered.

Thanks to advancements in scientific methods and medical technology, less subjective measures can be performed by researchers with greater precision and reliability. For example, Intelligence Quotient (IQ) testing, Magnetic Resonance Imaging (MRI) brain scans, genetic testing, and observations of genital arousal and pupil dilation were performed. MRI brain scans enable examiners to view brain design and uncover any neurological underpinnings in the subjects under review. Genetic testing conducted using blood and saliva samples provided valuable insights into the biological influences that may contribute to an individual’s behaviors and traits. Observations of genital arousal and pupil dilation offered indicators of physiological responses, shedding light on subconscious reactions that may not be apparent through self-reporting alone. By utilizing a range of diverse approaches, the studies sought to offer a comprehensive understanding of the genetic and environmental factors influencing the concordance or discordance of sexual identity among identical twins.

Ethical Considerations

All information provided was voluntary, and researchers obtained informed consent either in writing or verbally from participants. It is important for the participants to not be incapacitated and fully understand their rights and the nature, objectives, and risks of the study. “While bias and discrimination against those who do not fit the norm still exists, in modern times, sexual identity is discussed more openly” (Longe, 2016). Participants should not be subjected to coercion or pressure as this could result in undue stress and harm and may lead to inaccurate disclosure of information. Those who conducted these experiments had to exercise sensitivity towards the volunteers, using appropriate language and minimizing the risk of potential mental and physical harm. Ensuring the comfort of participants who may experience distress and providing appropriate support and resources is essential. All information obtained and released to the public was kept anonymous and stored securely.

Results

Introduction

Through studies and observational analyses between identical twins and other family members,

investigation of the origin(s) of sexual identity and determination of whether such identity traits are mirrored in those so alike, can transpire. Examples of instrumentation utilized in the literature assimilated in this study consisted of SOQ's, interviews, and less biased measures such as IQ tests, MRI brain scans, genetic testing, and observations of genital arousal and pupil dilation. Past research incorporated in this study sourced volunteers for genetic and behavioral studies via public outreach, registries, databases, and literature platforms. Data collection procedures, analysis, and results from past and present research enforces anonymity. The following section describes the methods and procedures used to conduct, obtain, and examine data pertinent to this study.

Data Collection Procedures

Sourcing was performed with a commitment to maintain the integrity and reliability of the study while assessing diverse perspectives. An abundance of studies and information exist on the perspectives, rights, education, and spectrum of human sexuality. However, resources addressing the specific research questions at hand, were come across less frequently. Therefore, selected terms, or combination thereof, were input to narrow down relevant articles. Examples of terms: twins, similarity, identical, shared, siblings, nature, nurture, sexual, genetic, environment, influence, and identity. Literature populating under these categories elaborated on heritability and the uniqueness of the shared and non-shared environment. Determining suitability of literature used in this study was accomplished by confirming the text is in English, evaluating the backing of claims made, assessing topic relevance, and verifying the information has been peer-reviewed. Furthermore, it is essential to ensure proper reference, citation, and acknowledgement of any previous data is given.

Minimizing risks and implementing ethical methodology was imperative in studies that included human subjects. For example, in the Genome-Wide Association Study of Male Sexual Orientation, approval was needed to access European ancestry. "We obtained institutional review board approval from NorthShore University Health System, and after a study description all enrolled subjects gave informed consent" (Sanders et al., 2017). The research cohort of "Sexual Arousal Patterns of Identical Twins with Discordant Sexual Orientations" obtained approval for genital measurement through the University of Essex's Ethics Committee and followed federal

regulations. "The research followed the approved procedures, and all participants gave informed consent" (Watts et al., 2018). Another example was portrayed in a study investigating genetic and environmental influences on sexual orientation. The study sample consisted of twin pairs identified from the Central Population Registry of Finland. 5,000 monozygotic and dizygotic twin pairs from this registry were mailed questionnaires consisting of questions about sexuality-related themes. "Ethical approval was obtained from the Ethics Committee of the Department of Psychology, Abo Akademi, Finland and informed consent was obtained from all participants" (Oginni et al., 2023). The data collection and analysis system adhered to protocols and standards that ensured accuracy, reliability, and reproducibility of information.

Data Analysis

Thematic analysis was used to review qualitative information presented in included literature, recognizing any recurring patterns, topics, or emerging concepts. The genetic and environmental themes will be analyzed by examining the instrumentation and results of studies across categories such as race, gender, economic status, lived experiences, relationships, education, brain structure, IQ scores, and more. If a study suggests that sexual identity is influenced by nature, what biological factor does it originate from? Alternatively, if a study suggests it is influenced by nurture, what aspects of the environment are highlighted? Qualitative data offers an insightful understanding of human experiences and responses. Through documentation of themes such as the participants' social interactions, emotional responses, perceptions, beliefs, interpretations, experiences, and narratives, the intricacies of human behaviors and attitudes enriched the comprehensive exploration of the research questions.

Quantitative data obtained through surveys, experiments and observational studies portrayed sample size, response rates, and psychometric and biometric test results. This data enables significant correlation or association between variables in the dataset and potential relationships or dependencies to be measured. If studies were to confirm that a particular genome influenced sexual identity, it would suggest that identical twins would indeed share the same sexual identity. Contrarily, if it were proven that environment alone molded sexual identity, the concordance of sexual identity among twins might

vary depending on whether they experienced similar environments or not. Following the systematic literature review, the information proving to be most significant was scrutinized and prioritized, considering the recurrence of themes and the reliability of concepts utilized in the studies.

Results

Literature Review

Twenty-three peer reviewed publications were selected for inclusion in this systematic review following meticulous data collection procedures and a thorough review of abstracts and titles to ensure relevance to this study. Twenty-six articles were initially retrieved from search engines, but three did not meet inclusion criteria established for this study. These texts were omitted on account of bias, a misleading title, or irrelevancy upon material review. The literature that withstood data analysis standards produced dependable data for this study and introduced nuanced perspectives. These perspectives were indexed into four categories to facilitate discussion points and classified as follows: Alluded to Genetics (n=10), Alluded to Environment (n=5), Nature Versus Nature Interplay (n=3), and Human Biology, Sexuality, Behavior and History (n=5). Out of the twenty-three data sources spanning 1990 to 2023, twelve either directly studied or referenced identical twins. The remaining eleven were utilized to draw speculative insights from other human sexuality studies.

General History and Current State

The concept of sexual identity is evolving with society and scientific advancement. The understanding of human sexuality from ancient civilizations to modern societies have varied considerably. However, in more recent years, milestones have been met worldwide to provide valuable insight into this puzzle. "Evolving biometric techniques coupled with existence of large-scale, longitudinal twin registries across the globe can help clarify and strengthen the results derived from twin studies" (Yoon, 2017). Innovative research methodology and varying registration rosters have contributed to a deeper understanding of genetic and environmental influence in forming one's sexuality. Despite moving forward, social stigma still exists, emphasizing the need for ongoing evidence-based procedures to recognize and validate diverse sexual identities.

Nature and Genetics

In a study investigating the concordance of transsexuality between twins, 112 twin pairs either concordant or discordant for transsexuality, were analyzed on transition, upbringing, and sexual practices. "Combining data from the present survey with those from past-published reports, 20% of all male and female monozygotic twin pairs were found concordant for transsexual identity. This was more frequently the case for males (33%) than for females (23%). The responses of our twins relative to their rearing, along with our findings regarding some of their experiences during childhood and adolescence show their identity was much more influenced by their genetics than their rearing" (Diamond, 2013). The variance in the prevalence of transsexuality between men and women hints at a potentially greater impact of the DNA contributions from the "Y" chromosome on transsexualism.

The relationship between prenatal hormone exposure and identity development is an ongoing area of research in the field of psychology and neuroscience. Some studies suggest that exposure to atypical levels of sex hormones during fetal development may play a role in shaping thoughts and behavior. For example, exposure to higher levels of androgens, such as testosterone, in utero has been hypothesized to influence the development of gender dysphoria or transgender identity in some individuals. Concordant transsexuality among identical twins is often presented as evidence to support the idea of biological reasoning for gender identity. While prenatal hormone exposure is one potential factor to human sexuality, it is unlikely to be the sole determinant.

Disorders

Recent research, such as 'Genetic Link Between Gender Dysphoria and Sex Hormone Signaling,' have uncovered a considerable connection between DSD's and specific genetic markers. "A significant association was identified between gender dysphoria and ER α , SRD5A2, and STS alleles, as well as ER α and SULT2A1 genotypes" (Foreman et al, 2019). This supports the notion that gender dysphoria is not simply a psychological condition but has biological roots as well. Such discoveries not only contribute to a deeper understanding of DSD's, but also have the potential to address more targeted approaches to treatment, for example, hormone therapy regimens, and support for individuals experiencing gender dysphoria and other sex related disorders.

Nurture

The physical form of the brain has a much higher study rate than mental due to its feasibility. “Compared to brain structure, twin studies of brain function are scarce, and show much lower heritability estimates (~40%)” (Jansen et al., 2015). While genetic factors play a substantial role in shaping brain structure, their influence on brain function may be less pronounced. This emphasizes the need to clarify the specific genetic mechanisms underlying cognitive processes and neurological functions.

Shared Environments

Within a shared environment, one can still develop a distinct relationship within it. “It is proposed that children inhabit a unique position, or micro-environment, within their family setting” (Kerrane & Hogg, 2013). While children may share a household with their family, they have a separate connection with each family member. Micro-environments imply that within the same physical setting, the experiences, development, and accompanying beliefs and behaviors of two individuals may still diverge.

Non-Shared Environments

In a study on Alcohol Use Disorder (AUD), it was unveiled that almost half of the disorder’s elements can be attributed to genetics. “The results revealed a converging heritability estimate of .49, with the remaining estimate being primarily due to nonshared environmental influences” (Yoon, 2017). While genetics contribute significantly to susceptibility, non-shared environmental influences also play a crucial role in shaping an individual's risk for developing AUD and other non-physical traits. This highlights the importance of considering both genetic and environmental factors in understanding and addressing AUD and other substance use disorders. Additionally, it emphasizes the potential for targeted interventions and preventive strategies that address both genetic vulnerabilities and environmental risk factors to reduce the burden of AUD.

Discussion And Conclusion

Introduction

This section provides implications for the research questions: Do identical twins who share almost 100% of their DNA also share the same sexual identity? What role do genetic and environmental factors play in determining sexual identity concordance among identical twins? Are humans born into their sexual preferences and psychological orientation, or is

sexuality fluid and molded by our environment? These questions were explored within twenty-three articles, alluding to either gene origination, environmental influence, nature versus nurture interplay, and human biology, sexuality, behavior, and historical overview. The following discussion and conclusion will denote the significance of the systematic review and provide recommendations for further studies.

Discussion

By examining past studies and societal norms, insight can be offered based on the success of the techniques used. The inferences and effects of previous and proposed research questions are significant for wider communities of interest, including scientific and social spheres. This study’s research questions dove into the complex interplay between genetics, environment, and their relationship to human sexuality. The scientific community may find these questions necessary in advancing knowledge of the elements influencing sexual identity formation and human biology and behavior. Previous literature has explored various theories and methods related to nature and nurture influences on sexuality in the general population. However, the current research questions prompt a more direct investigation into the specifics of how identical twins, who share nearly identical genetic makeup, may or may not share their sexual identity.

The refined research questions can also provide profound implications for societal and cultural attitudes towards human sexuality. Comprehending matters of sexual identity provides the opportunity to persuade social acceptance, rights, and healthcare policies for LGBTQ+ individuals amongst more. Previously, study results have shown the ability to influence public perception and sex rights, but still, ongoing, and updated research and discussions around these questions can contribute to more informed and inclusive societal actions and beliefs. Reflection on the way sexual identity is perceived, as fixed or fluid, can challenge assumptions and promote greater cultural sensitivity. Identical twins provide a natural experiment to investigate the human sex further, promoting conversation amongst researchers, policymakers, and the broader public, leading to a more rounded understanding. Ultimately, empowering individuals to make informed decisions about their health, relationships, and life choices.

Conclusion

Given the knowledge retrieved from the research material cited in this Capstone report, it is reasonable to presume that identical twins will not always share uniform sexual identities. The likelihood of experiencing exact and uniform circumstances every moment of their lives is minuscule. Even identical twins raised in the same environment may develop different sexual identities due to individual differences and experiences in personality, IQ, emotional responses, communication styles, social circles, hobbies, preferences, and beliefs. A majority of the literature in this review assumed that biology, more so development before birth, had a higher effect on one's sexuality. However, these were only hypotheses, and no proof was provided. The populated weight of biology-focused research may have stemmed from the phrasing of the research questions. Therefore, it may be wise to consider rewording inquiries, acquiring alternative data, examining, and comparing it through a fresh perspective.

While this study may have focused on identical twins, it is important to acknowledge that each twin remains a unique individual despite their genetic similarities. To deepen our understanding of human sexuality, not only researchers, but the public can explore a variety of supportive and educational avenues. By evaluating both effective and ineffective strategies, we can determine the most optimal solutions or identify alternatives we have yet to explore. Precise categories of recommendations for further studies on human sexuality are as follows: Exploratory Research, Quantitative Analysis, Methodological Improvements, and Integrative Collaboration.

Exploratory Research

Conducting research to understand and address the impact of stigma and sex related disorders on an individual's ability to access therapy and mental health support can significantly enhance service quality and delivery methods. To advance mental health equity, awareness programs aimed at education of the sexuality spectrum should be developed and implemented. Qualitative exploratory research interviews with individuals from varied backgrounds must be conducted prior to course development to recognize social interactions, experiences, trends, risks, and perceptions within communities. Such initiatives can inspire individuals to seek care,

support, and diminish stigma associated with diverse identities.

As a result, personalized medicinal strategies for individual health would optimize treatment outcomes by considering everyone's genetic makeup, lifestyle, economic stature, experiences, personal preferences, and beliefs when issuing any necessary policies, treatments, or pharmaceuticals. Addressing and prioritizing mental health concerns before they escalate can help identify disparities in care early to reduce the need for more intensive and costly interventions later. Empowering individuals, empowers communities, and these communities are encouraged to advocate for their health and foster a support network that provides necessary care and needed outcomes.

Quantitative Analysis

Taking on longitudinal studies enable researchers to track an individual's life experiences and health over time, then highlighting how these factors compound and interact over their lifespan. Individuals open to being part of a longitudinal study will allow the researcher to gain insight on sexuality and its fluidity. Does one determine themselves when young, or do their preferences and image flex over the years? The researcher will gather demographic information and qualitative responses from the volunteers, which will then be quantified for statistical analysis.

Continued neuroimaging is encouraged to evaluate brain structure and its potential correlation with sexual identity using MRI brain scans. Neuroimaging provides a platform for brain activity to be associated with specific mental health conditions, guiding treatment selection and monitoring. Prolonging studies of fraternal twins, identical twins, and non-twin siblings is ideal for controlled comparisons as well as generalizability of applicable findings to the greater population. Controlled and cross-cultural comparisons give researchers the opportunity to play with a variation of gene similarity levels and disentangle the nature versus nurture collation.

Findings from these comparisons can shed light on how cultural factors influence sexual image and expression across diverse societies. Furthermore, these findings encompass a variety of genetic relatedness commonly observed in families.

Methodological Improvements

Improving methodology designs in a nature versus nature study on sexuality involves several key considerations. A recommendation is to ensure that

the sample consists of a diverse range of twin pairs, considering factors such as age, cultural background, economic status, and education level. Limitations identified in this study was the absence of resources originating in the United States, a primary focus on biological men, and a narrow age range limited to children, middle-aged individuals, or the elderly. In-depth phenotyping in any instrumentation should incorporate questions that remain relevant over time. This entails ensuring that questionnaires or interviews encompass a thorough assessment of sexuality across multiple areas, including sexual attraction, behavior, and orientation. This approach captures a more detailed depiction, facilitating extensive studies.

To clarify the impact of environmental factors on human sexuality, robust methods should be used to assess various aspects such as family dynamics, peer relationships, societal attitudes, and cultural influences. Given the sensitivity of this topic, it is imperative to prioritize privacy and confidentiality throughout the research process. Today's technology offers platforms for self-reporting with varying degrees of anonymity, intending to minimize potential bias and facilitate the reporting of crucial data that may have been absent in previous research. Receiving Institutional Review Board (IRB) approval before conducting any research involving human subjects, personally identifiable information (PII), or data collection and presentation of results is imperative to ensure ethical standards are upheld.

Integrative Collaboration

Efforts towards diversity and inclusion (D&I) are essential to ensure representation of broader perspectives in discussions surrounding sexuality. This involves fostering collaboration among researchers from diverse genetic, psychological, sociological, and neuroscience fields. By bringing together experts with varied expertise and geographical locations, a more inclusive understanding of sexuality can be achieved. Through this interdisciplinary collaboration, an array of methodological backgrounds and approaches can be utilized.

Achieving results is supported by the continued advancement and integration of data sourced from diverse outlets. This includes biological, psychological, and environmental measures, providing a collective image of the interplay between nature and nurture and the intricate relationships within the dataset. Ultimately, embracing diversity in

research and harnessing interdisciplinary expertise facilitates the development of a more nuanced understanding. This, in turn, will provide information used in more effective interventions, destigmatization efforts, and policies aimed at fostering equity and well-being for individuals of all identities.

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