



Understanding the Market for Gender Confirmation Surgery in the Adult Transgender Community in the United States: Evolution of Treatment, Market Potential, and Unique Patient Characteristics

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Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School

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Scholarly Report Title: UNDERSTANDING THE MARKET FOR GENDER CONFIRMATION SURGERY IN THE ADULT TRANSGENDER COMMUNITY IN THE UNITED STATES: EVOLUTION OF TREATMENT, MARKET POTENTIAL, AND UNIQUE PATIENT CHARACTERISTICS

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TITLE: Understanding the market for gender confirmation surgery in the adult transgender community in the United States: Evolution of treatment, market potential, and unique patient characteristics

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Purpose: Estimate the size of the market for gender confirmation surgery and identify regions of the United States where the transgender population is underserved by surgical providers. Additionally, inform new surgeons who seek to contribute to gender confirmation about the unique patient characteristics of the transgender population.

Methods: To estimate the size of the gender confirmation surgery market, we used the best available data in national LGBTQ surveys and literature to estimate the prevalence of transgender people in the United States, the demand for various types of gender confirmation procedures, and a range of prices for two major groups of procedures, “top-surgery” and “bottom-surgery.” Regional saturation of surgeons who advertise gender confirmation procedures was triangulated from the aforementioned estimates as well as provider supply estimates from an online aggregator of surgeons who advertise transgender surgical services.

Results: The market size for top- and bottom-surgery is between \$11 and \$20 billion dollars, with top-surgery representing \$2 to \$5 billion and bottom-surgery \$9 to \$15 billion. The Midwest boasts the largest absolute market for all surgeries at about 240,000 patients as well as the lowest average providers per available patient (2.00 per 10,000). Nationally, bottom-surgery in both male-to-female and female-to-male patients are the least developed markets for transgender surgery with provider saturation of 1.06 and 1.18 providers per 10,000 patients, respectively.

Conclusions: The Midwest region in the United States is likely the most underserved gender confirmation surgery market with the largest available patient pool and lowest surgeon saturation rate. New providers in the gender confirmation surgery market should have an appreciation for the financial and social barriers that transgender people face in achieving surgical transition.

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Definition of Terms

Cisgender: The opposite of a *transgender* person; a person whose natal identity (sex) matches their expressed gender identity.

Cross-dress (transvestitism): A person who expresses themselves outside of their natal sex through clothing, jewelry, accessories, and/or makeup typically associated with another gender.

Facial Feminization: A range of procedures that transform the male facial structures into the measurements and proportions typical of the female facial aesthetic. Procedures can include forehead recontouring, brow lift, rhinoplasty, malar implants, lip lift, lip filling, and chin or jaw contouring.

Facial Masculinization: A range of procedures that transform the female facial structures into the measurements and proportions typical of the male facial aesthetic. Procedures can include forehead recontouring, brow lift, rhinoplasty, malar implants, lip lift, lip filling, and chin or jaw contouring.

Female-to-male (FTM or FtM): A transgender person whose sex was identified as female at birth, but has made behavioral or physical changes to express themselves as male.

Masculinizing Top-Surgery: Surgical procedure that involves the removal of breast tissue (mastectomy) with or without repositioning of the nipple-areola complex to reconstruct a typical male chest. Also known as chest contouring.

Feminizing Bottom Surgery: A range of procedures that transform the male genitalia into various structural and functional forms of the female genitalia. These procedures can include the removal of the external male genitalia (penectomy), removal of the testicles (orchietomy), construction of a vaginal canal (vaginoplasty), or labia (labiaplasty).

Gender: The self-categorization of a person as a male, female, or something outside of societal expectations.

Gender Confirmation Surgery: A set of surgical procedures that aligns the physical appearance of a transgender person with their intrinsic sense of gender, which may be distinct from their natal identity. Also referred to as *gender transformation surgery*, *sex reassignment surgery*, or *sex change surgery/operation*.

Intersex: A group of medical disorders where the external sexual organ is incongruent with the internal sexual organ.

Male-to-female (MTF or MtF): A transgender person whose sex was identified as male at birth, but has made behavioral or physical changes to express themselves as female.

Masculinizing Bottom Surgery: A range of procedures that transform the female genitalia into various structural and functional forms of the male genitalia. These procedures can include

metoidioplasty (release of the suspensory ligaments of the clitoris and removal of the attachments of the clitoris to the labia minora), phalloplasty (reconstruction of a penile shaft from local or distant autologous tissue, such as the forearm or thigh), penile implants, scrotoplasty (reconstruction of a scrotum from the labia), implantation of testicular prostheses, or urethroplasty (creation of a functional conduit for urine through a neophallus).

Feminizing Top Surgery: Surgical procedure that involves the insertion of alloplastic material, (breast implants), or autologous fat grafts in the male chest to reconstruct a typical female breast mound. Also known as mammoplasty.

Tracheal reduction: Reshaping of the thyroid cartilage, typically through surgical shaving, to reduce the size of the “Adam’s apple” typical of the male anatomy. Also known as chondroaryngoplasty or tracheal/thyroid shave.

Sex: The categorization of a person as either male, female, or something in between as determined by genetics and/or genitalia of a person. The sex of a person at birth is known as their *natal identity*.

Transgender: A person whose gender identity is different than societal norms for their natal sex and is outside of the gender roles typically assigned to cisgender people. Also referred to as *trans* people or persons.

Transsexual: A person who expresses themselves outside of their natal identity through feminizing or masculinizing hormones and/or surgery.

Abbreviations

ACA – Patient Protection and Affordable Care Act
ACO – Accountable Care Organization
APA – American Psychiatric Association
CMS – Centers for Medicare and Medicaid Services
DSM – Diagnostic and Statistical Manual
HHS – Department of Health and Human Services
FtM – Female-to-male
MtF – Male-to-Female
NCD – National Coverage Determination
NTDS – National Transgender Discrimination Survey
SOC – Standards of Care
WPATH – World Professional Association of Transgender Health

Introduction

Globally, there has been an increase in the number of people seeking treatment for gender incongruence or “gender dysphoria,” as it is defined by the psychiatric community (De Cuypere, 2007). Current literature suggests that the prevalence of transgender people in the United States is about 1 in 330 or approximately 1 million persons in 2015 (Gates, 2011). Hormonal and surgical treatment has evolved rapidly over the past century, yet surgery remains out of reach for many individuals who seek to align their internal gender identity with their outward gender expression (Institute of Medicine, 2011). Cultural differences between and among nations creates a highly variable environment for the support of individuals to publically transition from one gender to another. An evolution of surgical treatment and the rise of popular figures who have undergone gender confirmation surgery has increased the visibility of transgender health issues in the public eye.

Surgical services for the transgender population are delivered through a mix of multi-disciplinary health centers in large academic medical centers and private practice surgeons. Many of these services are rendered on a cash basis due to the lack of universal insurance coverage of transgender treatment. However, in the last five years, legislation at both the federal and state level has extended insurance reimbursement to transgender health care services, which has increased the financial accessibility of gender confirmation surgery for some.

As new surgeons enter this field to cater to the increasing demand and growing insurance coverage of gender confirmation surgery, there is a lack of understanding of where their services can best serve the transgender community. In order to establish a successful practice in this space, the new generation of surgeons also needs to appreciate the unique characteristics of the transgender patient and how they approach a surgical transition. With a deep understanding of the challenges that a trans person faces in achieving gender congruency, surgeons can become a powerful force in reshaping the legal and financial framework to increase healthcare access for transgender people.

This paper seeks to educate the surgical community about the evolution of adult gender confirmation surgery in the United States and inspire an appreciation for the unique

characteristics of this vulnerable patient population. Using the best available data, we also estimate the size of the opportunity in entering the market for transgender surgery and identify regions of the United States that may be underserved by surgeons offering transgender services. Lastly, we describe the special considerations that a new surgeon in this field should appreciate as he or she builds a practice in gender conformation surgery.

Gender Identity in Modern Psychiatry

In 1952, the American Psychiatric Association (APA) published the *Diagnostic and Statistical Manual* (DSM-I) in attempt to unify the nomenclature for psychiatric illnesses and the clinical criteria in diagnosing them. In this first edition, homosexuality was classified as a “sociopathic personality disturbance” (1st ed.; DSM; American Psychiatric Association, 1952). As stated, homosexuality was presented as a pathological state that could be treated. Transgender identity was not included in the first two versions of the diagnostic manual, which some surmise was an opposition by the medical community towards gender confirmation therapy and surgery, confusion of homosexuality as the root cause of gender incongruence, or simply indifference (Drescher, 2010).

With the release of DSM-III in 1980, two psychiatric diagnoses related to gender identity made their first appearance. The first was gender identity disorder of childhood (GIDC), which manifested before puberty with the following criteria (all inclusive):

...(1) a persistent and intense distress about assigned sex, ...(2) a desire to be (or insistence that one is) of the other sex. ...(3) a persistent preoccupation with the dress and activities of the opposite sex and (4) repudiation of the individual's own sex. (3rd ed.; DSM; American Psychiatric Association, 1980)

The diagnosis of transsexualism was reserved for adolescents and adults. Diagnostic criteria for transsexualism were shorter than GIDC and included only: “(1) Persistent discomfort and sense of inappropriateness about one's assigned sex [...] (2) The person has reached puberty” (3rd ed.; DSM; American Psychiatric Association, 1980). By the release of DSM-IV in 1994, all gender identity related diagnoses were combined into gender identity disorder (GID), with specific criteria for pre-pubertal and post-pubertal individuals (4th ed.; American Psychiatric Association, 1994).

Inclusion of gender identity in psychiatric nosology was received with mixed review from the transgender community and its allies. Assigning these diagnoses provided a legitimate framework for third-party reimbursement for the costs associated with psychiatric, medical, and

surgical therapies. As Nichols posited, “Psychiatric classification can initially increase public empathy for people who are seen as suffering from a ‘disease’ and can even enable oppressed groups to be treated more humanely” (Nichols, 2008). On the other hand, all transgender individuals were now labeled by the medical community as having a disorder or disease, which can come “at the cost of reinforcing the belief that certain behaviors are deviant, subnormal, or pathological, and therefore less deserving of genuinely equal rights” (Nichols, 2008). Ironically, lawmakers drew from the expanded recognition and standardized labeling of non-traditional gender identities to exclude transsexuals, as defined in the DSM-III, from enjoying protection under the Americans with Disability Act of 1990 (Drescher, 2010). The result is that the federal government does not protect trans people from discrimination in employment, compensation, or benefits (Americans with Disabilities Act, §12,211, 1990).

One of the largest advocates for transgender healthcare issues is the World Professional Association for Transgender Health (WPATH, <http://www.wpath.org>), formerly known as the Harry Benjamin International Gender Dysphoria Association. They called upon the APA to make many changes to the DSM-IV criteria for gender disorders, including a replacement of “disorder” with “dysphoria” and an “exit clause” to allow individuals who have resolved their gender incongruence to drop the stigma of being labeled with a mental disorder (WPATH, 2010). In the newest version of the DSM (V), released in 2013, the APA obliged and changed “gender disorder” to “gender dysphoria” (5th ed.; American Psychiatric Association, 2013). In a public statement about the changes, the APA acknowledged the tradeoff that psychiatric labeling can create: “Persons experiencing gender dysphoria need a diagnostic term that protects their access to care and won’t be used against them in social, occupational, or legal areas” (American Psychiatric Association, 2013). The language in DSM-V was a big step in depathologizing gender fluidity, but more importantly, the processes of collaboration with transgender special-interest groups promised an evolution of thought around solving for access without enabling social injustice.

Evolution of Medical and Surgical Treatment

The etiology and presentation of cross-gender expression varies amongst children, adolescents, and adults. Treatment for each of these groups has evolved within distinct therapeutic, legal, and financial environs. This paper will only address those medical issues related to gender dysphoria in adults.

Magnus Hirschfeld, physician and sexologist, is credited with performing the first gender conformation surgery at his Institute for Sexual Science in Germany. The patient was Dorchen Richter, a natal male who identified as a female since her youth. In 1922, Hirschfeld performed an orchiectomy to reduce her testosterone levels, which would reduce some of her male secondary sex characteristics.¹ Nine years later, Ms. Richter underwent a penectomy and vaginoplasty to allow for penetrative sexual intercourse. Hirschfeld's most famed patient was Einar Wegener, who was also a natal male that desired to undergo the male-to-female transition to become Lili Elbe. In addition to orchiectomy, penectomy, and construction of a neo-vagina, Hirschfeld attempted to further enhance her female secondary sex characteristics² by transplanting ovaries from a human donor into her abdomen. Hirschfeld experimented even further with Elbe by attempting to surgically create a neo-uterus. The patient passed away in 1931 from cardiac issues, possibly related to the stress of the transplanted ovaries or the repeated surgeries. A friend of Elbe posthumously published her experience in *A Man Changes His Sex* (1932, Hoyer). The Institute of Sexual Science was destroyed in 1933 amongst rising Nazi sentiment and Hirschfeld, a Jew, fled to France only to pass away two years later.

At about the same time, endocrinologists had made significant findings in the science of sex hormones. The first was a new understanding that estrogen and testosterone exist simultaneously in both sexes, which increased confidence in the safety of exogenously increasing the levels of estrogen in a natal male or testosterone in a natal female (Rubin, 2006). The first commercially

¹ Typical male secondary sex characteristics include thick and diffuse body hair, facial hair, deep voice, male patterned baldness, increased muscle tone, and reduced body fat percentage.

² Typical female secondary sex characteristics include enlarged mammary glands, female pattern pubic hair, increased fat deposits around buttocks/thighs/hips, and softer skin with thin body hair.

available oral estrogen was created at Collip and Ayerst Laboratories from the urine of pregnant Canadian women. By 1938, British scientists had synthesized an oral female sex hormone known as diethylstilbestrol (DES). After DES was approved by the FDA in 1941, estrogen hormone therapy was widely available, considered safe, and relatively inexpensive.

German biochemist Adolf Butenandt is credited with elucidating the structure of testosterone. By 1935, Butenandt and Leopold Ruzicka had independently synthesized testosterone from cholesterol (Butenandt, 1935 & Ruzicka, 1935). Injectable male steroids (testosterone propionate) and oral steroids (methyltestosterone) were available for clinical research by 1937 (Hoberman, 1995). The first natal female on record to take synthetic steroids for gender transformation was Michael Dillon in Britain (Kennedy, 2007). He began taking testosterone in 1939 and later elected to undergo a double mastectomy in 1942. By 1946, he sought to complete the transition by undergoing several phalloplasties. These attempts to surgically create a penis were the first female-to-male genital reassignment surgeries performed in a non-intersex person (Kennedy, 2007).

In the United States, gender confirmation surgery came to the forefront of national attention when George Jorgensen, a former US soldier, went to Denmark and returned in 1952 as Christine Jorgensen (Jorgensen, 1967). Beginning in 1950, endocrinologist Christian Hamburger treated Christine with high doses of estrogen, performed a penectomy, and reshaped the scrotum into labia (labioplasty), which he documented in an article published in the *Journal of the American Medical Association* (Hamburger, 1953). Media coverage began in 1952 with the headline “Ex-GI Becomes Blonde Beauty,” published in the *New York Daily News*. The public’s fascination with Jorgensen’s story was partly born out of a growing admiration of science and medicine during the time period but also the the evolving dialogue about homosexuality and gender fluidity. As Beemyn recalls:

Through the publicity given to her transition, she brought the concept of “sex change” into everyday conversations in the United States, served as a role model for many other transsexual individuals to understand themselves and pursue medical treatment, and transformed the debate about the efficacy of providing hormones and gender-affirming

surgeries to individuals who identified as a gender different from the one assigned to them at birth. (Erickson-Schroth, ed. Beemyn, 2014).

Although Jorgensen's story undoubtedly inspired a dormant trans population and provided a success story of a gender transformation through scientific advances, the medical community remained critical of gender confirmation surgery in adults. Driven by expertise in the psychiatric community, most physicians believed that hormone therapy and gender confirmation surgery were improper treatment methods for a disorder that was "either a severe neurotic or psychotic, delusional condition in need of psychotherapy" (Drescher, 2010). In 1969, Green et al. published a survey of 400 physicians across medical and surgical specialties that asked them to analyze a hypothetical case of a self-identified "transsexual" person. The majority of respondents did not support gender reassignment for this patient, even when "the patient was judged nonpsychotic by a psychiatrist, had undergone two years of psychotherapy, had convinced the treating psychiatrist of the indications for surgery, and would probably commit suicide if denied sex reassignment" (Green, 1969).

Harry Benjamin was a physician and author who published *The Transsexual Phenomenon* in 1966. He refuted the idea that gender incongruence was a psychiatric problem, but instead felt that trans people had a medical necessity to "adjust the body to the mind" (Benjamin, 1966). At a time when anti-transgender sentiment was high, he openly accepted transgender patients seeking hormonal therapy and referred them to surgeons abroad for surgery. Reportedly, by 1972 he had "diagnosed, treated, and befriended at least a thousand of the ten thousand Americans known to be transsexual" (Person, 2008). He was able to achieve this impact outside of the politics of an academic medical center.

In the latter half of the 20th century, political action groups, popular culture, and the media challenged binary gender roles and inspired a growing acceptance of trans people as a normal variant. Transgender autobiographies, such as Jane Morris' *Conundrum* (1974), Canary Conn's *Canary* (1974), Mario Martino's *Emergence: A Transsexual Autobiography* (1977), and Renée Richard's *Second Serve* (1983), provided a humanistic narrative to the struggle of living with an internal gender identity that is incongruent with one's natal gender identity. Stories such as these

started to expand the public's understanding of the spectrum of non-pathological, non-deviant human experiences. As a consequence, more trans people were inspired to publically identify themselves and seek out treatment (Reed, 2009 & Zucker, 2008).

One of the most important steps in creating the structural support for individual physicians and institutions to participate in transgender healthcare was the development of standards of care (SOC). Much like the DSM in psychiatry, SOC are intended to create clinical guidance to medical professionals in their attempt to diagnose, treat, and ultimately improve patient quality of life. The most widely accepted SOC in transgender health are published by WPATH. The document was first published in 1979 by the Harry Benjamin International Gender Dysphoria Association, the predecessor of WPATH, and the 7th edition became available in 2011. The document draws upon expert opinion and evidence-based medicine to highlight the range of medical and surgical options available to provide “gender non-conforming people with safe and effective pathways to achieving lasting personal comfort with their gendered selves....” (WPATH, 2011). The work of WPATH, the increasing visibility of transgender issues, and the growing body of evidence to support transgender surgery has compelled many medical associations³ to denounce transgender discrimination in healthcare and support treatment options (Lambda Legal, 2011). Despite this call for action, the transgender community remains marginalized in the healthcare system; hesitance to disclose gender identity out of fear of discrimination, lack of provider experience, structural barriers, and financial barriers make it difficult for transgender people to secure affordable, effective healthcare (Roberts, 2014).

³ Examples of professional organizations that support equality for transgender people in healthcare: American Medical Association, American Psychiatric Association, and the American College of Obstetricians and Gynecologists (Lambda Legal, 2011)

Reimbursement Trends in Gender Confirmation Surgery

Not all trans people desire surgery and some only seek hormonal treatment or opt out of medical interventions altogether. For those that desire surgery, they see it as a necessary part of permanently aligning their inward and outward gender identities in order to achieve professional and personal success. As stated in the WPATH Standards of Care, transgender surgery “can help patients feel more at ease in the presence of sex partners or in venues such as physicians’ offices, swimming pools, or health clubs” (WPATH, 2011). Gender confirmation procedures can be categorized into those pertaining to the female-to-male (FtM) or male-to-female (MtF) populations. Beyond that, gender confirmation surgery does not have one defining set of procedures. There are three anatomical areas with a range of available procedures within each category: (1) breast/chest, (2) genital, and (3) non-breast/chest, non-genital (**Table 1**).

The Centers for Medicare and Medicaid Services (CMS) under the Department of Health and Human Services (HHS) is responsible for determining the spectrum of reimbursable diagnoses and treatments for the two government-funded health plans, Medicare and Medicaid. Medicare was established to insure the elderly and disabled populations, whereas Medicaid insures citizens in the lowest socioeconomic classes well below the poverty line. The remainder of the population is typically covered by a private plan, which they can purchase directly from insurance companies or receive as a benefit paid for by their employer.

In 1981, CMS issued a National Coverage Determination (NCD) that denied Medicare coverage for gender confirmation surgery. Under section “140.3, Transsexual Surgery,” the original policy elaborates on the rationale:

Transsexual surgery for sex reassignment of transsexuals is controversial. Because of the lack of well controlled, long-term studies of the safety and effectiveness of the surgical procedures and attendant therapies for transsexualism, the treatment is considered experimental. Moreover, there is a high rate of serious complications for these surgical procedures. For these reasons, transsexual surgery is not covered. (Department of Health and Human Services, 2014)

Although a majority of Americans are not covered under the two federal programs, private insurance companies tend to set their coverage policies and reimbursement rates based on the policies set by CMS. Without a federal precedent for recognizing the value of gender confirmation surgery, coverage of these procedures was up to the discretion of private insurers and employers, who generally seek to maintain costs by limiting the scope of insured care within legal bounds. Both federal and state-level legislation can set standards for health insurance, so while the NCD was discouraging, the future of reimbursement for transgender health remained uncertain and regionally variable.

Since 1981, there has been a growing body of evidence to suggest that gender confirmation surgery can be performed safely and result in a significant improvement in subjective well-being, aesthetics, and sexual function (**Appendix A**). The transgender community and its allies, such as WPATH and The Human Rights Campaign, have also gained popular support and political influence since the initial NCD decision. The American Medical Association adopted a policy in 2008 that called for insurance companies to cover transgender treatment, including surgical procedures, when it is deemed necessary by the patient's physician (American Medical Association House of Delegates, 2008). In 2012, Oregon became the first state to mandate that private insurers cover surgical procedures for gender dysphoria. Four other states and three municipalities (California, Vermont, Colorado, Connecticut, Washington D.C., San Francisco, and Rochester NY) followed suit.

The Patient Protection and Affordable Care Act (ACA), effective January 1, 2014, was a monumental reform that sought to increase insurance coverage, reduce healthcare spending, and eliminate disparities in the insurance market. The law defines a limited set of variables by which an insurance company can discriminate on price and policy offers (i.e. location, age, tobacco use), and gender is not one of these (Patient Protection and Affordable Care Act § 1557).

Washington State and Massachusetts used this non-discrimination clause in the ACA to extend coverage for gender confirmation surgery to their government employees and eventually their privately insured citizens. In a landmark decision in May 2014, the Department of Health and Human Services (HHS) reversed the original NCD that restricted Medicare recipients from achieving gender confirmation surgery. HHS cited the overwhelming evidence in support of the

efficacy and safety of surgical interventions for gender dysphoria (Department of Health and Human Services, 2014). This decision only directly affected Medicare recipients, but states would retain the right to make regional coverage decisions as it related to Medicaid.

Unfortunately, more than 80% of the approximately 50 million Medicare beneficiaries are greater than 65 years old (American Association of Retired Persons, 2012), which may be beyond the average age of first consultation for gender confirmation surgery.⁴

Today, there are nine states that ban insurance companies, including their respective Medicaid programs, from excluding gender confirmation surgery and other treatments related to gender transition (Washington, Oregon, California, Colorado, Illinois, New York, Connecticut, Massachusetts, and Vermont), which encompasses 31% of the estimated general population of the United States in 2015 (United States Census Bureau, 2015). Seven of these states also extend the same transgender health benefits to their state employees (California, Connecticut, Massachusetts, New York, Oregon, Washington, and Vermont), and an additional two states that only extend them to their state employees but have not banned insurance exclusions in their general populations (Minnesota and Maryland) (**Figure 1**).⁵

While there have been rapid changes in both federal and state legislation to reduce health insurance discrimination against the transgender community, the Society for Human Resource Management reported in 2015 that only 5% of private employers offer healthcare policies that reimburse gender confirmation surgery (Taylor, 2015). Even with the changing political and social environment, this estimate is down from 7% in the previous year. Because trans people are four times more likely to make less than \$10,000 per year than cisgender people (Grant, 2011), Medicaid is an important safety net amongst this vulnerable community. However, as outlined above, less than a third of the general population reside in states that universally reimburse for gender conformation surgery.

⁴ In one cohort of 321 Belgian people who underwent gender confirmation surgery, the mean age at first consultation was 31.56, ranging from 14 to 71 (De Cuypere, 2007).

⁵ As of 2014, there were 5.343 million state and local government employees in the United States. Approximately 1.416 million employees, or 27% of the total, were affected by legislation that extended transgender surgery benefits (United States Census Bureau, 2014).

Prior to the recent legislative changes, the 2011 National Transgender Discrimination Survey (NTDS) found that: “Nineteen percent (19%) of the sample lacked any health insurance compared to 17% of the general population. Fifty-one percent (51%) had employer-based coverage compared to 58% of the general population” (Grant, 2011). With insurance exchanges and the individual insurance mandate rolling out through the Affordable Care Act, the percentage of covered transgender persons should be on the rise. Specifically, it is hard to estimate the extent of the trans population that has insurance coverage for gender confirmation surgery, because of the state-to-state variation in public and private health insurance policies.

Market Size and Characteristics

The global prevalence and incidence of trans people have not been agreed upon, and there is likely a true difference across borders because of the varied cultural contexts that may suppress or promote gender fluid behavior. Epidemiological studies within this community have mostly been limited to estimating the prevalence of trans people by enumerating patients with gender dysphoria who present to the medical community for medical or surgical transition.⁶ De Cuypere et al. reviewed twelve of these studies from around the world and found wide variation in the reported prevalence of transsexuals, both throughout time and between countries. Excluding two outliers⁷, they found that the reported prevalence of MtF people ranged from 1:11,900 to 1:45,000 and 1:30,400 to 1:200,000 for FtM people (De Cuypere, 2007). Oyslager and Conway (2007) presented new data on the incidence of transsexualism and used an enhanced mathematical model to suggest a prevalence as high as 1:500 (Oyslager, 2007).

Drawing upon data from three state-level surveys conducted between 2003 and 2009, Gates estimates that the prevalence of transgenderism in the United States is 0.3% or about 1:330 (Gates, 2011). According to data from the Census Bureau, the estimated population of the United States in 2015 was 321 million (United States Census Bureau, 2015). Using Gates' prevalence estimate, there are approximately 1 million people in the United States that identify as transgender. The National Transgender Discrimination Survey (NTDS), conducted by the National Center for Transgender Equality (NCTE) and National Gay and Lesbian Task Force in 2011, included more than 7,500 respondents in the US who identify under the "transgender" umbrella.⁸ The ratio of MtF:FtM transsexuals that is implied from these data is 2:1 (Grant, 2011), which is less aggressive than the 3.5:1 that is implied by some aggregated global data (De Cuypere, 2007). The NTDS also revealed that 61% of transgender people in the United States

⁶ Transgender people who seek out medical or surgical treatment for gender dysphoria are referred to as transsexuals in medical literature.

⁷ Pauly (1968) estimated a prevalence of MtF of 1:100,000 and FtM of 1:400,000; Tsoi (1988) estimated a prevalence of MtF of 1:2,900 and FtM of 1:8,300.

⁸ The self-identified gender labels included transsexual, MtF, FtM, gender nonconforming, genderqueer, two-spirit, cross-dresser, androgynous, third gender, feminine male, masculine feminine or butch, intersex, drag performer (king/queen), and AG or Aggressive (Grant, 2011).

have received hormonal therapy or surgery, but only 33% have undergone surgical transition (Grant, 2011). Furthermore, the survey revealed that a majority of trans people plan to undergo gender confirmation surgery at some point in the future (**Table 2**). Using the aforementioned nation-specific estimates of trans prevalence, ratio of intended transition (MtF vs. FtM), and intent to pursue surgery, we can estimate the current size of the transsexual market by procedure (**Table 4**).⁹

Because the Census Bureau only provides cisgender options in their surveys, there is no reliable data on the geographic distribution of the transgender population. The NTDS provides a regional distribution of the transgender people who responded to the 2011 survey (**Table 3**) (Grant, 2011). Sampling bias likely confounds the results, but if we assume an equal propensity for trans people to respond and a uniform distribution of the survey in each region, then these data are the best approximation for the geographic distribution of this community in the United States.

The transgender population is one of the most economically vulnerable and medically underserved populations in the nation. In terms of personal finances, data suggests a transgender individual is four-times more likely than a cisgender person to reside in a household that makes less than \$10,000 per year (Grant, 2011). A majority of transgender people also report losing a job due to discrimination (Grant, 2011). In fact, nearly 14% of trans population is unemployed, which was more than 50% greater than the yearly average at the time of the survey (Grant, 2011). As presented earlier, the legal framework to expand both public and private insurance reimbursement for transgender surgery is evolving, but still only 5% of employers offer insurance policies that cover transition-related care and approximately 31% of the US population reside in states where Medicaid reimburses for these expenses (Taylor, 2015).

The staggering lack of insurance coverage means that most trans people likely pay out-of-pocket for transition-related medical therapy and surgical services. The average cost of the surgical

⁹ Surgeries are categorized into “top-surgery,” which includes breast augmentation in MtF or chest contouring in FtM, and “bottom-surgery,” which includes vaginoplasty in MtF, metoidioplasty in FtM, or phalloplasty in FtM. Other types of transgender surgery, such as facial feminization/masculinization, are not included due to a paucity of data in the National Transgender Discrimination Survey.

transition is hard to measure, but likely ranges from \$10,000 to \$100,000 (Fottrell, 2015) with an average of about \$30,000 (State of California Department of Insurance, 2012). In the face of discrimination, abuse, and medical needs that are financially out-of-reach, the transgender community is incredibly vulnerable. In fact, 41% of transgender people admit to attempting suicide, which is a staggering statistic compared to the observed 1.6% who attempt suicide in the general population of the United States. With experts reaching a consensus on the positive effects of hormone therapy and/or surgery at preventing suicide, the incredible need to increase geographic and financial access to gender confirmation surgery is the literal difference between life and death (Coleman, 2011).

Competitive Landscape for Surgical Services

A range of medical specialists fulfill the diversity of surgical procedures (**Table 1**) sought by transgender people during their gender transition.¹⁰ While there is no governing body that defines what training is required, board certification in certain surgical specialties facilitates insurance reimbursement and protects providers against malpractice litigation. WPATH recommends that “Physicians who perform surgical treatments for gender dysphoria should be urologists, gynecologists, plastic surgeons, or general surgeons, and board-certified as such by the relevant national and/or regional association” (WPATH, 2001).

In the mid-20th century, after gender transforming surgical techniques were adopted from Europe, gender confirmation surgery was concentrated in large, academic medical centers in the United States. In 1966, Johns Hopkins established the first university-based transgender surgery clinic for adults in the United States. University of Minnesota, Stanford University, and Northwestern University followed. In the 1980s, these services migrated to private practice, possibly out of controversy within academic centers in serving the transgender community (Levy, 2000). All four of the aforementioned university-based surgery clinics have since dissolved and have been replaced by multi-disciplinary transgender health centers that include surgical services at University of California at San Francisco, University of Michigan, and Oregon Health and Sciences University. While most major metropolitan areas have transgender health centers that provide a range of primary care and specialty services to adult transgender people, only these three medical centers provide integrated surgical care. Academic surgical departments can offer these services without affiliation with an internal transgender health center, but only four of the websites of 73 of the largest academic surgical centers in the United States advertise for transgender surgical services (University of Utah Medical Center, Mt. Sinai Hospital, University of Florida Health, and University of Miami Health System) (**Appendix B**)¹¹ Strong data is lacking on how the market for transgender surgeries are divided between hospital-

¹⁰ Including, plastic and reconstructive surgeons, gynecologists, urologists, otolaryngologists, dermatologists, and general surgeons.

¹¹ Online search performed by author on January 4, 2016

based and private practice surgeons, but with variable and scant insurance coverage nation-wide for these procedures, most patients likely pay out-of-pocket to private practice surgeons.

Using data on the market size for each procedure as presented in **Table 4**, the regional distribution of the transgender population as presented in **Table 3**, and an online database for surgeons who advertise gender conformation surgery (<http://www.radremedy.org>) (**Appendix C**), the regional provider saturation for both top-surgery and bottom-surgery can be extrapolated (**Table 5**). The data suggest that the Midwest is tied for the largest absolute market for all surgeries (242,500 patients) as well as the lowest average provider per available patient (2.00 providers per 10,000 patients seeking gender confirmation surgery). Because not all providers are board-certified or have received special training across the spectrum of procedures studied, it is important to highlight the best markets in each category. For example, gynecologists are only trained in bottom-surgery and some plastic surgeons are only comfortable performing top-surgery. For MtF procedures, New England has the lowest provider saturation in top-surgery at 1.26 and the Mid-west is the most undeveloped market in bottom-surgery at 0.33 providers per 10,000 patients. For FtM procedures, the Mid-Atlantic region has the lowest provider saturation in top-surgery at 4.86 and New England has the lowest saturation in bottom-surgery at 0.53 providers per 10,000 patients. Nationally, bottom-surgery in both MtF and FtM patients are the least developed markets for transgender surgery with provider saturation of 1.06 and 1.18 providers per 10,000 patients, respectively.

Surgery Pricing and Market Potential

Price data in transgender surgery varies widely for myriad reasons. First, in a cash-heavy market such as this, prices are at the discretion of the surgeon. He or she has the freedom to adjust the price on a patient-by-patient basis in order to account for the expected difficulty of the case or to compete locally. Costs for anesthesia also vary on a case-by-case basis in accordance to how much time the patient spends under anesthetic. Lastly, each patient picks from the menu of surgical options to match their functional and aesthetic goals in their new gender identity within their unique budget.

Jamison Green, president of WPATH, commented in 2015 that gender confirming surgery can range widely from \$10,000 to \$100,000 and that most patients spend between \$30,000 to \$40,000 (Levy, 2015). From 6.5 years of insurance claims data in California, some suggest that the total cost to support gender conformation (medically and/or surgically) ranges from \$67 to \$86,800 with an average of \$29,929 per patient (State of California Department of Insurance, 2012), which loosely supports Green's estimate. These data are derived from the entire gamut of surgical and medical options available to complete gender conformation, as it is conjointly defined between the patient and their multi-disciplinary medical team. Data from a small set of online advertisements by private practice surgeons in the United States indicate that prices vary both within and between providers (<http://www.tssurgeryguide.com>) (**Table 6**). For example, for a masculinizing top-surgery (FtM), Dr. Harold M. Reed (Bay Harbor, Florida) charges between \$5,000 and \$8,500 (http://www.tssurgeryguide.com/Dr_Reed.html). Dr. Toby R. Meltzer (Scottsdale, AZ), on the other hand, charges \$11,500 (http://www.tssurgeryguide.com/Dr_Meltzer.html).

Using the data on the total patients interested in each surgery (**Table 4**) and the average price per surgery (**Table 6**), the total available market for top- and bottom-surgery in the United States ranges between \$11.3 and \$20.0 billion (**Table 7**).¹² By these calculations, the MtF market is 1.7 times larger in estimated dollars than the FtM market for gender confirmation surgery, which is slightly less than the assumed ratio of the two transgender identities within the population (2:1). The data also show that the market for bottom-surgery is 3.15 times larger than the market for top-surgery in dollar value. The largest single procedural category in estimated dollars is MtF bottom-surgery at an average of \$9.7B and the smallest single category is FtM top-surgery at \$1.1B.

¹² The total market for transgender related healthcare is much larger because hormonal treatment, psychological therapy, and additional surgical procedures are not included. Assuming there are about 1 million transgender individuals in the united states and that each requires about \$29,000 to transition (State of California Department of Insurance, 2012), then the overall cost for transgender transitional services is approximately \$29B.

Patient-to-Provider Referral and Advertisement

The perceived value of the surgeon's work is probably more important than price in attracting new patients. Providers in this space rely upon two main sources of referrals, from the medical community and the transgender community. Most surgeons adhere to the WPATH Standards of Care, which recommends that all patients before surgery have: (1) at least 18 years of age or have met the age of legal consent in their country, (2) well-documented and persistent gender dysphoria, (3) completed one year of hormone therapy in the case of genital surgery, (4) one year of successfully living as the desired gender identity in the case of genital surgery, and (5) the capacity to give informed consent and understand the complete risks and benefits of the procedure(s) (WPATH, 2001). Because all patients must have a well-documented history of gender dysphoria, some patients are referred to a surgeon by psychiatrists, psychologists, or behavioral therapists. Primary care physicians and endocrinologists also play a major role in the referral patterns to surgeons performing gender conformation surgery.

Word-of-mouth marketing is critical to any private practice medical professional, but the transgender population is particularly close-knit and vocal online about their surgical experiences. Patients who have undergone some part of the surgical transition help others find the right surgeon based on their geography and gender transition goals. Of course, these conversations happen within natural networks of people, but also within online forums.¹³ In this way, the online presence that a surgeon creates through a dedicated webpage for their practice or search engine optimization takes a backseat to his reputation as it is carried by the voices of his patients.

¹³ Examples of online transgender forums include <http://www.trueselves.com>, <http://forum.beginninglifeforums.com>, and <http://www.susans.org>.

Discussion

A surgeon who intends to contribute to the surgical transition of transgender people has many considerations to make in order to cater to this unique community. First, he or she must make an honest assessment of their training to determine what procedures they can deliver with the highest quality. It would be rare for a surgeon to be trained equally in top-surgery, bottom-surgery, and facial aesthetics. However, a board certified plastic and reconstructive surgeon, especially one who trained at one of the three academic centers with multidisciplinary transgender surgical centers, might have had exposure to this wide range of procedures. Even then, he or she might collaborate with other surgical specialists, such as urologists or gynecologists, to offer the best results.

From a financial perspective, the market for surgical services in the transgender community is likely underserved. The NTDS estimates that a minority of trans people have undergone either top- or bottom-surgery (**Table 2**). We estimate that the market size for these two categories of procedures is between \$11 and \$20 billion dollars, with top-surgery representing \$2 to \$5 billion and bottom-surgery \$9 to \$15 billion (**Table 7**). The overall market size for all transgender surgical services is likely higher when procedures such as facial feminization/masculinization or laser hair removal are considered.

Surgeons who cater to the transgender population are not equally distributed across the United States. As a new provider in this market, one might consider joining a practice or hospital located in a region with the lowest density of surgeons to transgender patients who plan to undergo gender confirmation surgery. In the rare chance that a surgeon can skillfully perform top- and bottom-surgery in both MtF and FtM patients, the Midwest is the least crowded market at 2.0 surgeons per 10,000 transgender patients (**Table 5**). New England is the best market by provider saturation in both MtF top-surgery (1.26 providers per 10,000 patients) and FtM bottom-surgery (0.53). For the remaining procedures, the Midwest is the least crowded for MtF bottom-surgery (0.33) and the Mid-Atlantic for FtM top-surgery (4.86).

These data suggest that the West and California have more surgeons per transgender patient than the remaining regions. This may be an effect of the liberal legislation in the Pacific states that protect transgender patients from discriminatory insurance policies (**Figure 1**). However, New England is home to two states with the same legal protections, and yet the market is not saturated with surgeons. Because our model assumed an equal distribution of demand for surgery across geographic regions, this difference in provider saturation may be explained by a real difference in the likelihood of transgender people in each region to seek out particular surgeries. For example, in the liberal cultural and political environment of the West, patients may feel more comfortable seeking out a broader range of surgical procedures to publically transition their outward gender expression. This would increase our estimates of the demand for surgical services in this region, and subsequently represent an overestimate of the provider saturation.

Insurance coverage is another variable to consider in selecting the right region to create a new transgender surgical practice. With three states each that ban insurance exclusions of transgender health, New England and the West (with California) are the most favorable regions to attract insured transgender patients. However, insurance companies do not provide blanket coverage for all gender confirmation procedures and the market largely remains cash-driven. A surgeon who caters to the transgender population will likely have greatest success by attracting a mix of insured and uninsured patients. The Midwest boasts the lowest provider saturation and includes one state (Illinois) with a major metropolitan area that extends insurance coverage to gender confirmation surgery. For these reasons, Illinois may be the most attractive market for surgeons who plan to provide surgical services to the transgender population, at least on average across the spectrum of procedures and in both MtF and FtM patients.

A new surgeon in this market would flounder without a strong referral source both within and outside of the medical community. He or she might choose to affiliate with a hospital or transgender health center to achieve a predictable stream of new patient referrals. Alternatively, a private practice surgeon might form informal referral agreements with local endocrinologists, mental health workers, other surgeons, or primary care physicians. Population health management may become the new standard in insurance reimbursement through Accountable Care Organizations (ACOs). Surgeons in the community might be forced to formalize their

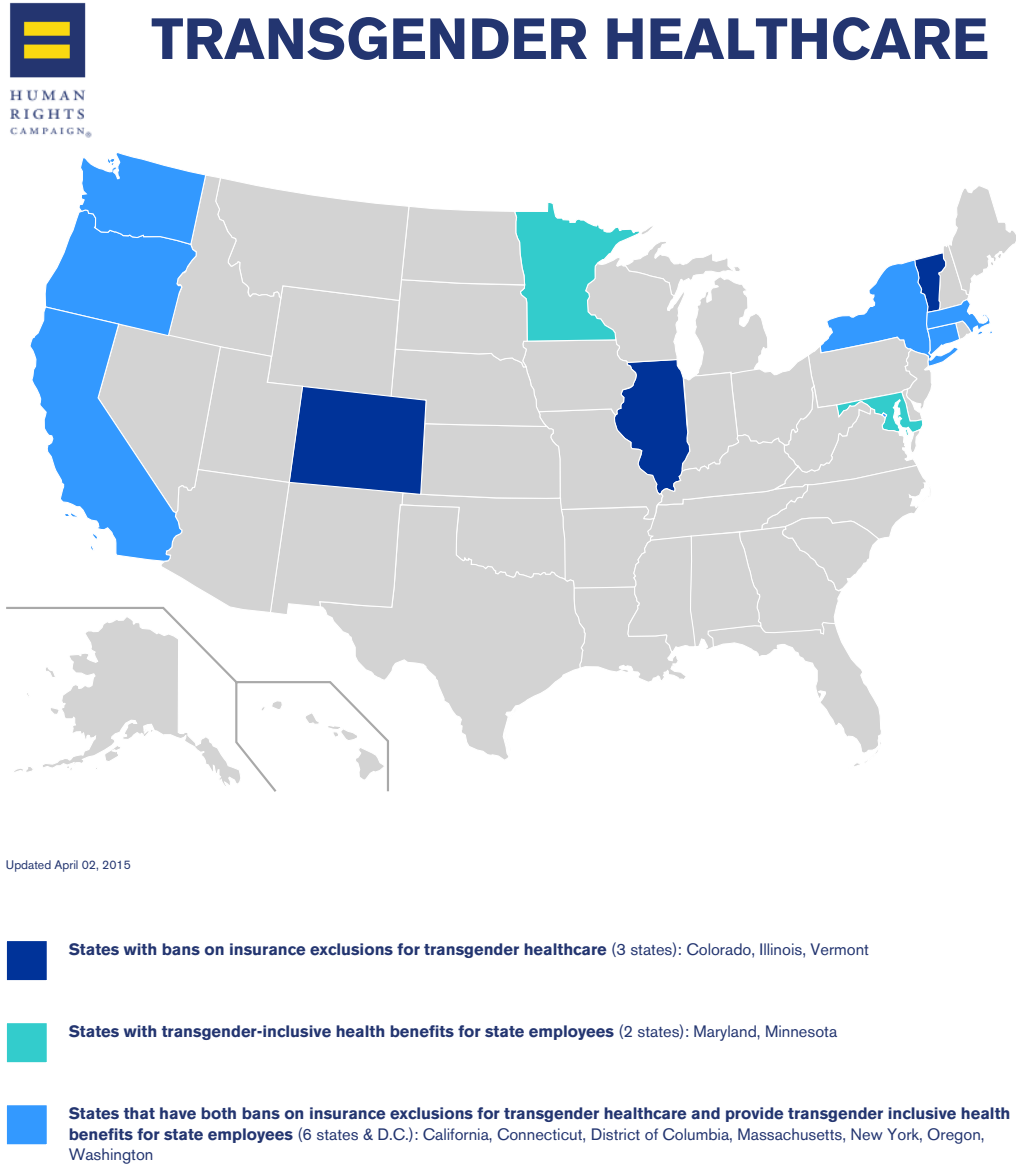
referral network and join an ACO, which will likely be managed under the banner of a larger hospital group or health system.

Outside of the medical community, a surgeon's brand within the transgender community is vital to their success. As discussed, person-to-person networks in real life and virtually are a critical component of the surgeon discovery process for a transgender patient. A surgeon's brand within this community is a reflection of the quality of their surgical results, but also a function of how they treat and care for their patients. Empathy for the transgender patient requires an appreciation for the unique characteristics of this population. First, an understanding of the vocabulary and a consciousness about the pronouns used in conversation with a patient is critical to conveying respect and understanding. One should always allow a patient to self-identify their gender and appreciate that sexual orientation is not dependent on this. Secondly, surgeons should appreciate that transgender people are a socioeconomically vulnerable population, on average. Trans people report lower income, higher suicide rates, and long histories of discrimination. All patients deserve empathy from their provider, but one should appreciate the weight of emotions involved in seeking out a permanent physical change to match one's inward gender identity.

Surgeons who treat the transgender community have a responsibility to push public opinion forward on equality in healthcare. Many professional surgical associations have released statements of support for extending affordable healthcare to the transgender community (Lambda Legal, 2011). These associations should lobby federal and state legislators to extend the ban on insurance exclusions for transgender surgery. In those few states where access to affordable surgical services is legally protected for transgender patients, surgeons should implore the insurance companies and government to cover the complete range of surgical options. This is best achieved through academic pursuits that can establish the cost-effectiveness¹⁴ of the procedures. More importantly, a surgeon involved in transgender care should protect the image of the transgender population within their community and increase understanding of the discrimination they face, within the medical system and beyond.

¹⁴ Cost-effectiveness is defined as the incremental improvement in quality of life per dollar spent on a treatment or procedure.

Figure 1. States that Provide Insurance Reimbursement for Transgender Surgery



Source: Human Rights Campaign, http://www.hrc.org/state_maps, accessed January 24, 2016

Table 1. Surgical Options in Gender Confirmation Surgery

	Male-to-Female (MtF)	Female-to-Male (FtM)
<i>Breast/chest Surgery</i>	Augmentation mammoplasty (implants/lipofilling)	Subcutaneous mastectomy Creation of male chest
<i>Genital Surgery</i>	Penectomy Orchiectomy Vaginoplasty Clitoroplasty Vulvoplasty	Hysterectomy/salpingoophorectomy Reconstruction of the fixed part of the urethra Metoidioplasty Phalloplasty (employing a pedicled or free vascularized flap) Vaginectomy Scrotoplasty Implantation of erection prosthesis Implantation of testicular prostheses
<i>Nongenital, nonbreast surgical interventions</i>	Facial feminization surgery Liposuction Lipofilling Voice surgery Thyroid cartilage reduction Gluteal augmentation (implants/lipofilling) Hair reconstruction Various aesthetic procedures	Voice surgery Liposuction Lipofilling Pectoral implants Various aesthetic procedures

Source: Adapted from the World Professional Association for Transgender Health, Standards of Care, Version 7 (WPATH, 2011)

Table 2. Patients Planning for Gender Confirmation Surgery

	Male-to-Female (MtF)	
	Breast Augmentation	Vaginoplasty
<i>Don't Want</i>	26%	14%
<i>Have Had</i>	21%	23%
<i>Want Someday</i>	53%	64%

	Female-to-Male (FtM)		
	Chest Surgery	Metoidioplasty/Creation of Testes	Phalloplasty
<i>Don't Want</i>	7%	44%	72%
<i>Have Had</i>	43%	4%	2%
<i>Want Someday</i>	50%	53%	27%

Source: National Transgender Discrimination Survey (Grant, 2011)

Table 3. Regional Estimates of the Transgender Population in the United States

	Distribution of Transgender Population^a	Total Transgender Population	Total MtF	Total FtM
New England	9%	90,000	60,000	30,000
Mid-Atlantic	21%	210,000	140,000	70,000
South	18%	180,000	120,000	60,000
Mid-West	21%	210,000	140,000	70,000
West (except CA)	17%	170,000	113,333	56,667
California	15%	150,000	100,000	50,000

Assumptions: There are approximately one million transgender people in the United States (Gates 2011 & US Census Bureau) and the ratio of MtF:FtM is 2:1 (Grant, 2011).

Note: New England (ME, NH, VT, MA, RI, CT), Mid-Atlantic (NY, NJ, DE, PA, MD, DC, VA, WV), South (NC, SC, GA, FL, AL, MS, LA, TX, OK, AR, TN, KY) Midwest (OH, MI, IN, IL, WI, MN, IA, MO, KS, NE, SD, ND), West (NM, AZ, CO, WY, UT, NV, MT, ID, WA, OR, AK, HI), California (CA)

^aNational Transgender Discrimination Survey (Grant, 2011)

Table 4. Regional Estimates of Potential Market Size by Desired Gender and Procedure Type

	Potential MtF Market Size		Potential FtM Market Size	
	<i>Top-Surgery^a</i>	<i>Bottom-Surgery^b</i>	<i>Top-Surgery^c</i>	<i>Bottom-Surgery^d</i>
New England	31,800	38,400	15,000	18,750
Mid-Atlantic	74,200	89,600	35,000	43,750
South	63,600	76,800	30,000	37,500
Mid-West	74,200	89,600	35,000	43,750
West (except CA)	60,067	72,533	28,333	35,417
California	53,000	64,000	25,000	31,250

^a Breast augmentation

^b Vaginoplasty only, does not include clitoroplasty or vulvoplasty.

^c Broadly defined as “chest surgery,” which includes mastectomy with or without nipple resizing/repositioning.

^d Metoidioplasty/creation of testes or phalloplasty.

Assumptions: There are approximately one million transgender people in the United States (Gates 2011 & US Census Bureau) and the ratio of MtF:FtM is 2:1 (Grant, 2011). The demand for each procedure type is derived from the Nation Transgender Discrimination Survey (Table 2) and is assumed to be uniform across the defined regions. For bottom-surgery in FtM, a simple average of the demand for Metoidioplasty/creation of testes and Phalloplasty was derived from Table 2.

Note: New England (ME, NH, VT, MA, RI, CT), Mid-Atlantic (NY, NJ, DE, PA, MD, DC, VA, WV), South (NC, SC, GA, FL, AL, MS, LA, TX, OK, AR, TN, KY) Midwest (OH, MI, IN, IL, WI, MN, IA, MO, KS, NE, SD, ND), West (NM, AZ, CO, WY, UT, NV, MT, ID, WA, OR, AK, HI), California (CA)

Table 5. Regional Estimates of Surgical Providers per 10,000 Potential Patients by Desired Gender and Procedure

	MtF			FtM			MtF + FtM Mean
	Top-Surgery ^a	Bottom-Surgery ^b		Top-Surgery ^c	Bottom-Surgery ^d		
New England	1.26	0.78	1.02	6.00	0.53	3.27	2.14
Mid-Atlantic	2.29	1.00	1.65	4.86	1.60	3.23	2.44
South	3.46	1.69	2.58	8.00	1.60	4.80	3.69
Mid-West	1.62	0.33	0.98	5.14	0.91	3.03	2.00
West (except CA)	2.83	0.69	1.76	8.47	0.85	4.66	3.21
California	2.08	1.87	1.98	6.00	1.60	3.80	2.89
	2.26	1.06	Mean	6.41	1.18	Mean	



By column, decreasing ratio of surgeons:patients

Note: Average across regions and desired gender for top-surgery is 4.33 and 1.12 for bottom-surgery

Note: New England (ME, NH, VT, MA, RI, CT), Mid-Atlantic (NY, NJ, DE, PA, MD, DC, VA, WV), South (NC, SC, GA, FL, AL, MS, LA, TX, OK, AR, TN, KY) Midwest (OH, MI, IN, IL, WI, MN, IA, MO, KS, NE, SD, ND), West (NM, AZ, CO, WY, UT, NV, MT, ID, WA, OR, AK, HI), California (CA)

Assumptions: “Number of providers” represents the number of advertising surgeons for the specific procedures, which was derived from <http://www.radremedy.org>. The number of patients per procedure per region was carried over from Table 4.

^a Breast augmentation

^b Vaginoplasty only, does not include clitoroplasty or vulvoplasty.

^c Broadly defined as “chest surgery,” which includes mastectomy with or without nipple resizing/repositioning.

^d Metoidioplasty/creation of testes or phalloplasty.

Table 6. Price Estimates for Procedural Categories in Gender Transformation

	MtF		FtM	
	<i>Top-Surgery^a</i>	<i>Bottom-Surgery^b</i>	<i>Top-Surgery^c</i>	<i>Bottom-Surgery^d</i>
<i>Low</i>	\$5,000	\$15,000	\$2,000	\$13,000
<i>High</i>	\$10,000	\$30,000	\$11,000	\$80,000

Source: <http://www.tssurgeryguide.com> and Levy, 2015

^a Breast augmentation

^b Vaginoplasty only, does not include clitoroplasty or vulvoplasty.

^c Broadly defined as “chest surgery,” which includes mastectomy with or without nipple resizing/repositioning.

^d Metoidioplasty/creation of testes or phalloplasty.

Table 7. Estimated Total Market Size by Desired Gender and Surgery Type (billions of dollars)

		MtF			
		<i>Top-Surgery^a</i>	<i>Bottom-Surgery^b</i>		
<i>Low</i>		\$1.78	\$6.46	\$8.25	
<i>High</i>		\$3.57	\$12.93	\$16.50	
		\$2.68	\$9.70	\$12.37	Average

		FtM			
		<i>Top-Surgery^c</i>	<i>Bottom-Surgery^d</i>		
<i>Low</i>		\$0.34	\$2.74	\$3.07	
<i>High</i>		\$1.85	\$1.68	\$3.54	
		\$1.09	\$2.21	\$3.30	Average

		Aggregate Market Size			
		<i>Top-Surgery^e</i>	<i>Bottom-Surgery^f</i>		
<i>Low</i>		\$2.12	\$9.20	\$11.32	
<i>High</i>		\$5.42	\$14.61	\$20.03	Overall

Assumptions: Demand for procedures is derived from Table 4. Price estimates per procedure are derived from Table 6.

^a Breast augmentation

^b Vaginoplasty only, does not include clitoroplasty or vulvoplasty.

^c Broadly defined as “chest surgery,” which includes mastectomy with or without nipple resizing/repositioning.

^d Metoidioplasty/creation of testes or phalloplasty.

^e Procedures in *a* and *c*

^f Procedures in *b* and *d*

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Appendix

A. Reference. Evidence-based Review of Clinical Outcomes in Gender Confirmation Surgery

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B. Table 2. List of Academic Medical Centers with Major Surgical Training Programs and Multidisciplinary Transgender Health Centers or Single Department that Advertises for Transgender Surgical Services

			Multidisciplinary Center	Single Department
1	AZ	Mayo Clinic College of Medicine (Arizona) Program		
2	CA	Loma Linda University Program		
3	CA	UCLA Medical Center Program		
4	CA	University of Southern California/LAC+USC Medical Center Program		
5	CA	University of California (Irvine) Program		
6	CA	Stanford University Program		
7	CA	University of California (Davis) Health System Program		
8	CA	University of California (San Diego) Medical Center Program		
9	CA	University of California (San Francisco) Program	1	
10	CT	Yale-New Haven Medical Center Program		
11	DC	Georgetown University Hospital Program		
12	FL	University of Florida Program		1
13	FL	Jackson Memorial Hospital/Jackson Health System Program		1
14	FL	University of South Florida Morsani Program		
15	GA	Emory University School of Medicine Program		
16	IL	McGaw Medical Center of Northwestern University Program		
17	IL	University of Chicago Program		
18	IL	Loyola University Medical Center Program		
19	IL	Southern Illinois University Program		
20	IN	Indiana University School of Medicine Program		
21	KS	University of Kansas School of Medicine Program		
22	KY	University of Kentucky College of Medicine Program		
23	LA	Louisiana State University School of Medicine Program		
24	MA	Brigham and Women's Hospital/Harvard Medical School Program		
25	MA	University of Massachusetts Program		
26	MD	Johns Hopkins University/University of Maryland Program		
27	MI	University of Michigan Program	1	

28	MI	Detroit Medical Center/Wayne State University Program		
29	MI	Grand Rapids Medical Education Partners/Michigan State University Program		
30	MN	University of Minnesota Program		
31	MN	Mayo Clinic College of Medicine (Rochester) Program		
32	MO	University of Missouri-Columbia Program		
33	MO	Washington University/B-JH/SLCH Consortium Program		
34	MO	St Louis University School of Medicine Program		
35	MS	University of Mississippi School of Medicine Program		
36	NC	University of North Carolina Hospitals Program		
37	NC	Duke University Hospital Program		
38	NC	Wake Forest University School of Medicine Program		
39	NH	Dartmouth-Hitchcock Medical Center Program		
40	NJ	Cooper Medical School of Rowan University/Cooper University Hospital Program		
41	NJ	Rutgers New Jersey Medical School Program		
42	NV	University of Nevada School of Medicine (Las Vegas) Program		
43	NY	Albany Medical Center Program		
44	NY	Montefiore Medical Center/Albert Einstein College of Medicine of Yeshiva University Program		
45	NY	Hofstra North Shore-LIJ School of Medicine Program		
46	NY	Icahn School of Medicine at Mount Sinai Program		1
47	NY	New York Presbyterian Hospital (Cornell Campus) Program		
48	NY	New York University School of Medicine Program		
49	NY	University of Rochester Program		
50	OH	University of Cincinnati Medical Center/College of Medicine Program		
51	OH	Case Western Reserve University/University Hospitals Case Medical Center Program		
52	OH	Cleveland Clinic Foundation Program		
53	OH	Ohio State University Hospital Program		
54	OH	Wright State University Program		
55	OK	University of Oklahoma Health Sciences Center Program		
56	OR	Oregon Health & Science University Program	1	

57	PA	Lehigh Valley Health Network/University of South Florida College of Medicine Program		
58	PA	Penn State Milton S Hershey Medical Center Program		
59	PA	University of Pennsylvania Program		
60	PA	UPMC Medical Education Program		
61	RI	Brown University Program		
62	TN	University of Tennessee College of Medicine Program		
63	TX	University of Texas Southwestern Medical School Program		
64	TX	University of Texas Medical Branch Hospitals Program		
65	TX	Baylor College of Medicine Program		
66	TX	Texas A&M College of Medicine/Scott and White Memorial Hospital Program		
67	UT	University of Utah Medical Center Program		1
68	VA	University of Virginia Program		
69	VA	Virginia Commonwealth University Health System Program		
70	VA	Carilion Clinic-Virginia Tech Carilion School of Medicine Program		
71	WA	University of Washington Program		
72	WI	University of Wisconsin Program		
73	WI	Medical College of Wisconsin Affiliated Hospitals Program		

Source: List of surgical training programs derived from <https://services.aamc.org/eras/erasstats/par/>, advertising centers derived from online search by author on January 26, 2016

C. Table 1. Providers Advertising for Surgical Services to Transgender Population by State

NEW ENGLAND						
	MtF			FtM		
	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons
ME	0	0	0	1	0	1
NH	1	1	2	1	0	1
VT	0	0	0	0	0	0
MA	2	1	3	6	0	6
RI	0	0	0	0	0	0
CT	1	1	1	1	1	1
	4	3	6	9	1	9
MID-ATLANTIC						
	MtF			FtM		
	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons
NY	8	3	9	8	2	8
NJ	3	1	3	3	1	3
DE	0	0	0	0	0	0
PA	2	2	2	2	3	3
MD	2	1	2	2	1	2
DC	0	1	1	0	0	0
VA	2	1	3	2	0	2
WV	0	0	0	0	0	0
	17	9	20	17	7	18
SOUTH						
	MtF			FtM		
	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons
NC	4	2	4	3	0	3
SC	0	0	0	0	0	0
GA	2	1	3	2	1	3
FL	6	4	7	6	2	6
AL	0	0	0	0	0	0
MS	0	0	0	0	0	0
LA	2	1	2	2	1	2
TX	7	5	8	8	1	8
OK	1	0	1	2	0	2
AR	0	0	0	0	0	0

TN	0	0	0	0	1	1
KY	0	0	0	1	0	1
	22	13	25	24	6	26

MIDWEST

	MtF			FtM		
	<i>Top Surgery</i>	<i>Bottom-Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom-Surgery</i>	Total Surgeons
OH	2	0	2	3	1	4
MI	0	0	0	0	1	1
IN	2	1	2	1	0	1
IL	4	2	5	5	2	6
WI	1	0	1	1	0	1
MN	2	0	2	4	0	4
IA	0	0	0	1	0	1
MO	0	0	0	0	0	0
KS	0	0	0	1	0	1
NE	1	0	1	2	0	2
SD	0	0	0	0	0	0
ND	0	0	0	0	0	0
	12	3	13	18	4	21

WEST

	MtF			FtM		
	<i>Top Surgery</i>	<i>Bottom-Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom-Surgery</i>	Total Surgeons
NM	2	1	2	2	0	2
AZ	3	1	3	3	1	3
CO	2	0	2	6	0	6
WY	0	0	0	0	0	0
UT	0	0	0	1	0	1
NV	1	0	1	0	0	0
MT	1	0	1	1	0	1
ID	0	0	0	0	0	0
WA	4	0	4	4	0	4
OR	3	3	5	4	2	5
AK	0	0	0	0	0	0
HI	1	0	1	3	0	3
	17	5	19	24	3	25

CALIFORNIA

MtF	FtM
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	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons	<i>Top Surgery</i>	<i>Bottom- Surgery</i>	Total Surgeons
CA	11	12	19	15	5	17

Source: Derived from <http://www.ramremedy.com>, search performed by author on January 25, 2016