

An Analysis of All Applications for Sex Reassignment Surgery in Sweden, 1960–2010: Prevalence, Incidence, and Regrets

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Abstract Incidence and prevalence of applications in Sweden for legal and surgical sex reassignment were examined over a 50-year period (1960–2010), including the legal and surgical reversal applications. A total of 767 people (289 natal females and 478 natal males) applied for legal and surgical sex reassignment. Out of these, 89 % (252 female-to-males [FM] and 429 male-to-females [MF]) received a new legal gender and underwent sex reassignment surgery (SRS). A total of 25 individuals (7 natal females and 18 natal males), equaling 3.3 %, were denied a new legal gender and SRS. The remaining withdrew their application, were on a waiting list for surgery, or were granted partial treatment. The incidence of applications was calculated and stratified over four periods between 1972 and 2010. The incidence increased significantly from 0.16 to 0.42/100,000/year

(FM) and from 0.23 to 0.73/100,000/year (MF). The most pronounced increase occurred after 2000. The proportion of FM individuals 30 years or older at the time of application remained stable around 30 %. In contrast, the proportion of MF individuals 30 years or older increased from 37 % in the first decade to 60 % in the latter three decades. The point prevalence at December 2010 for individuals who applied for a new legal gender was for FM 1:13,120 and for MF 1:7,750. The FM:MF sex ratio fluctuated but was 1:1.66 for the whole study period. There were 15 (5 MF and 10 MF) regret applications corresponding to a 2.2 % regret rate for both sexes. There was a significant decline of regrets over the time period.

Keywords Transsexualism · Gender identity disorder · Gender dysphoria · Incidence · Prevalence · Sex ratio

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Introduction

Gender identity denotes the personal sense of being a female or male. Gender dysphoria denotes the distress caused by a discrepancy between the gender identity and a person's sex assigned at birth. For some people, the level of distress meets criteria for a formal diagnosis of Transsexualism according to ICD-10, Transsexualism according to DSM-III and DSM-III-R, Gender Identity Disorder according to the DSM-IV and DSM-IV-TR, or Gender Dysphoria according to the DSM-5 (American Psychiatric Association, 1980, 1987, 1994, 2000, 2013; World Health Organization, 1992). The clinical presentation generally includes discomfort with natal sex characteristics and a request for medical help to alter the phenotypic expression of the body. Requests may include treatment with contrary sex hormones, hair removal in natal males, surgery to aid changes of primary and secondary sex characteristics, and a new legal gender.

Epidemiological studies on incidence, prevalence, and sex ratio of transsexualism are usually based on indirect calculations, for example the number of individuals in a specified catchment area (a whole country or part of a country) who apply for sex reassignment at gender clinics, who receive a diagnosis of transsexualism, who start sex reassignment treatment, and/or apply for legal gender recognition (Zucker & Lawrence, 2009). Most but not all incidence and prevalence estimates have been based on the population over 15 years of age. Legal sex reassignment is in most countries not allowed before the legal age, which is 18 years in most countries. Germany is an exception with no lower age limit.

Table 1 summarizes the reported prevalence, incidence, and sex ratio in different regions. Prevalence figures range from 1:8,300–1:400,000 for female-to-males (FM) and 1:2,900–1:100,000 for male-to-females (MF). Incidence figures for diagnosed transsexualism are available from Australia, Catalonia, Denmark, England and Wales, Germany, and Sweden and vary from 0.15 to 0.73 per 100,000 per year for both genders (Gómez-Gil et al., 2006; Hoenig & Kenna, 1974; Landén, Wålinder, & Lundström, 1996; Meyer zu Hoberge, 2009; Olsson & Möller, 2003; Ross, Wålinder, Lundström, & Thuwe, 1981; Sørensen & Hertoft, 1980; Wålinder, 1971; Weitze & Osburg, 1996). There is a dearth of studies assessing incidence rates over time in adults. In Sweden, the incidence rate of applications for sex reassignment surgery (SRS) increased from 0.17/100,000/year between 1972 and 1992 to 0.24/100,000/year between 1992 and 2002 (Landén et al., 1996; Olsson & Möller, 2003). Anecdotal evidence suggests that this trend has accelerated after 2002. In Canada, a sharp increase was reported in referrals of adolescents with gender dysphoria between the periods 2000–2003 and 2008–2011 (Wood et al., 2013). Similar data for adolescents have been reported from Amsterdam's clinic for adolescents (de Vries & Cohen-Kettenis, 2012).

As can be seen in Table 1, the sex ratio (here reported as FM:MF ratio) differs across studies, clinics, and countries. Some have found an excess of MF, for example 1:6 in New Zealand (Veale, 2008), 1:6.1 in Australia (Ross et al., 1981), 1:3 in Singapore (Tsoi, 1988), and 1:2.6 in Catalonia (Gómez-Gil et al., 2006). Other have showed a more equal sex ratio such as 1.3:1 in Hamburg, Germany, 1.1:1 in Oslo, Norway (Kreukels et al., 2010), and 1:1 in Finland (Pimenoff, 2006) whereas Japan and Poland have reported an excess of FM, 2:1 and 3.4:1, respectively (Baba et al., 2011; Dulko & Imielinski, 2004). A trend towards a more equal sex distribution over time has been demonstrated in Germany, from 1:2.3 (1981–1990) to 1:1.5 (1991–2000) (Meyer zu Hoberge, 2009; Weitze & Osburg, 1996). Likewise, the sex ratio in Serbia has gone from 1:2 in 1987 to 1:1 in 2007 (Vujovic, Popovic, Sbutega-Milosevic, Djordjevic, & Gooren, 2008). Sweden went in the opposite direction from 1:1.4 in 1972 to 1:1.8 in 2002 (Olsson & Möller, 2003).

Sweden is uniquely positioned to assess trends in applications for gender reassignment/confirmation at a national

level as every person requesting a legal sex change and a genital surgical procedure must apply to the Legal Board of the National Board of Health and Welfare. The aims of this study were to investigate incidence trends and prevalence for persons applying for a new legal gender and SRS, as well as the number of applications for reversal to the original sex. We also examined changes over time with respect to sex ratio, applicants' age, average time elapsed from first visit to being granted a new legal gender, reasons for application rejection, and numbers of individuals choosing surgical treatment abroad.

Method

The Swedish Procedure for Sex Reassignment

A law regulating surgical and legal sex reassignment in Sweden came into force in 1972. The law was updated on January 1, 2013. During the period examined, the law stated that if the person since youth had felt that she/he belongs to a sex other than that recorded on the birth certificate, had lived for a considerable time in accordance with this new gender role, and is anticipated to continue to live in such a gender role, the person could obtain permission for surgical and legal sex reassignment. Gradual changes in praxis have for the last 30 years enable late onset gender dysphoric individuals to be included. The person must be at least 18 years old, a Swedish citizen, unmarried, and sterile. As of January 1, 2013, the prerequisite of being unmarried was removed and it is now sufficient to have permanent residency in Sweden. As of July 1, 2013, the prerequisite of being sterile was removed.

Figure 1 illustrates the flow described below. Individuals presenting with gender dysphoria in Sweden are referred to one of six specialized gender teams that adhere to a national consensus program regulating evaluation and treatment. This national consensus program includes approximately 1 year of evaluation. Individuals diagnosed with transsexualism then start gender confirmation treatment, including cross-sex hormones along with real life experience. FMs also may undergo bilateral mastectomy with chest contouring. MFs receive hair removal, and speech therapy. Adolescents are treated as adults although they cannot receive permission for genital surgery and a new legal gender before 18 years of age.

After a minimum of 2 years of evaluation and treatment, the person can apply to the Legal Board of the National Board of Health and Welfare in order to receive permission for SRS and a change of legal sex status. A medical certificate based on the evaluation describing the gender dysphoria, the diagnosis of transsexualism, and other potential health problems accompanies the application. Until 1990, it was common with a two-step procedure where the initial application was for name change and sterilization. The second application was for final permission to undergo surgical and legal gender reassignment. All application

Table 1 Incidence, prevalence, and sex ratio of transsexualism in different countries

Author	Country	Year or time period	Incidence/ 100,000/year	Prevalence FM	Prevalence MF	Sex ratio FM:MF	Population	Prevalence and incidence calculations based on
Sørensen and Hertoft (1982)	Denmark	1951–1981	x	x	x	1:3.6	Surgical and legal sex reassigned individuals	15 years and older
Hoening and Kenna (1974)	England and Wales	1958–1968	0.17–0.26 total	1:108,000	1:34,000	1:2.9	Referral to a clinic and diagnosed, according to Wälinder (1968)	15 years and older
Wälinder (1968)	Sweden	1965–1967	x	1:103,000	1:37,000	1:2.5	Application to a clinic and diagnosed according to Wälinder (1968)	15 years and older
Wälinder (1971)	Sweden	1967–1970	0.15 total	x	x	1:1	Application to a clinic and diagnosed according to Wälinder (1968)	15 years and older
Dixen, Maddever, Van Maasdam, and Edwards (1984)	USA	ca. 1967–1979	x	x	x	1:1.7	Applicants for sex reassignment	15 years and older
Pauly (1968)	USA	1968	x	1:400,000	1:100,000	1:4	Applying for treatment and diagnosed with transsexualism	Total population
O’Gorman (1982)	Northern-Ireland	ca. 1968–1981	x	1:100,000	1:35,000	1:3	Diagnosed with transsexualism	Total population
Sørensen and Hertoft (1980)	Denmark	1970–1977	0.21 total 0.11 FM 0.31 MF	x	x	1:2.8	Applicants for sex reassignment	15 years and older
Garrels et al. (2000)	Germany	1970–1998	x	x	x	1:1.9	Diagnosed with transsexualism at clinics	Not stated
Landén, Wälinder, and Lundström, (1996)	Sweden	1972–1992	0.17 total	x	x	1:1.4	Applications to court for legal and surgical sex reassignment	15 years and older
Godlewski (1988)	Cracow, Poland	1974–1980	x	x	x	5.5:1	Diagnosed with transsexualism (DSM-III)	Not stated
van Kesteren, Gooren, and Megens (1996)	The Netherlands	1975–1992	x	1:30,400	1:11,900	1:3	Presented at the clinic with gender dysphoria	Total population
Ross, Wälinder, Lundström, and Thuwe (1981)	Australia	1976–1978	0.58 total	1:150,000	1:24,000	1:6.1	Referrals to a clinic and diagnosed according to Wälinder (1968)	15 years and older
Eklund, Gooren, and Bezemer (1988)	The Netherlands	1976–1986	x	1:54,000	1:18,000	1:3	Started hormone therapy and diagnosed according to Wälinder (1968)	15 years and older
Blanchard, Clemmensen, and Steiner (1987)	Canada	1980–1984	x	x	x	1:1.7	Referred to own clinic due to gender dysphoria	16 years and older
Weitze and Osburg (1996)	West Germany	1981–1990	0.24 total	1:94,000	1:36,000	1:2.3	Applications for legal sex reassignment to court	Total population
De Cuypere et al. (2007)	Belgium	1985–2003	x	1:33,800	1:12,900	1:2.43	Individuals who had underwent SRS	15 years and older
Tsoi (1988)	Singapore	1986	x	1:8,300	1:2900	1:3	Applied for SRS and diagnosed, with transsexualism (DSM-III)	15 years and older
Bakker, van Kesteren, Gooren, and Bezemer (1993)	The Netherlands	1986–1990	x	1:30,400	1:11,900	1:2.5	Started hormone therapy and diagnosed according to Wälinder (1968)	15 years and older
De Cuypere, Janes, and Rubens (1995)	Belgium	1986–1994	x	x	x	1:1.7	Diagnosis of transsexualism	15 years and older

Table 1 continued

Author	Country	Year or time period	Incidence/ 100,000/year	Prevalence FM	Prevalence MF	Sex ratio FM:MF	Population	Prevalence and incidence calculations based on
Meyer zu Hoberge (2009)	Germany	1991–2000 incidence 1981–2000 prevalence	0.34 total 0.26 FM 0.41 MF	1:32,050	1:18,250	1:1.5	Applications for legal sex reassignment to court	Total population
Olsson and Möller (2003)	Sweden	1992–2002	0.24 total	x	x	1:1.9	Applications to court for legal and surgical sex reassignment	15 years and older
Pimenoff (2006)	Finland	1993–2002	x	x	x	1:1	Application for castration due to transsexualism	Not stated
Veale (2008)	New Zealand	1995–2008	x	1:22,700	1:3600	1:6	Gender change in passport	15 years and older
Gómez-Gil et al. (2006)	Catalonia	1996–2004 prevalence 2000–2004 incidence	0.73 total	1:48,100	1:21,000	1:2.6	Diagnosed transsexualism (ICD-10)	15–65
Wilson, Sharp, and Carr (1999)	Scotland	ca. 1998	x	1:31,200	1:7400	1:4	Patients with gender dysphoria with or without treatment known by GP;	15 years and older
Wilson, Sharp, and Carr (1999)	Scotland	ca. 1998	x	1:52,100	1:12,800	1:3.8	Receiving hormone therapy or post-surgery	15 years or older
Gómez-Gil, Trilla, Salamero, Godás, and Valdés (2009)	Barcelona, Spain	2000–2006	x	x	x	1:2.24	Diagnosed with transsexualism (ICD-10)	Not stated
Smith, van Goosen, Kuiper, and Cohen-Kettenis (2005)	The Netherlands	Before 2003	x	x	x	1:1.5	Completed sex reassignment	15 years of old
Baba et al. (2011)	Japanese region Hokkaido	2003–2010	x	1:12,200	1:25,200	2:1	Applying for treatment at a clinic and diagnosed with GID (DSM-IV)	Total population
Kreukels et al. (2010)	Amsterdam, Netherlands	2009	x	x	x	1:2.34	Applicants with gender dysphoria data from own clinic	17 years and older
Kreukels et al. (2010)	Ghent, Belgium	2009	x	x	x	1:2.5	Applicants with gender dysphoria data from own clinic	16 years and older
Kreukels et al. (2010)	Hamburg, Germany	2009	x	x	x	1.33:1	Applicants with gender dysphoria data from own clinic	16 years and older
Kreukels et al. (2010)	Oslo, Norway	2009	x	x	x	1.12:1	Applicants with gender dysphoria from own clinic	16 years and older
Dulko and Imielinski (2004)	Poland	Not stated	x	x	x	3.4:1	Diagnosis of transsexualism	Not stated

records are classified as secret and kept on file. If the application is approved, a new national registration number signifying the new gender is assigned after SRS. The time lapse between application and permission for surgery and finally a new legal gender is currently no more than 1 year. Persons who have undergone SRS abroad can present the Board with a certificate that they have had surgical sex reassignment and receive legal gender reassignment without evaluation and real life experience. The National Board of Health and Welfare also handles applications for reversal to the original sex in cases of regrets (regret applications). Regret applications are also accompanied by a medical certificate. To date, all regret applications have been approved, which gives the person the right to treatment to reverse the body as much as possible. All costs for medical care and pharmacological treatment, except facial surgery, are covered by the national health insurance.

Subjects and Procedure

All application files from 1960 to 2010 were reviewed with permission from the Ethical review board, Stockholm, and the National Board of Health and Welfare. Files from January 1, 2011 to June 30, 2011 were also analyzed in order to determine if applications were approved or not. We extracted data on assigned sex at birth, date of birth, date of first visit to a healthcare provider with a documentation of gender dysphoria, date of application for legal and surgical sex reassignment or name change and sterilization if it was a two-step procedure. Furthermore, date and outcome of the decision (if refused, the reasons for this), date of new legal gender, whether the person had undergone sex reassignment abroad, and regret applications were extracted. Age of the applicants was calculated based on the date of the first application. Data were missing for 26 cases and, for these cases, age at first application was estimated to have occurred two months before the date of decision if that was available, or otherwise 12 months before the date of the second application, or if that was also missing, 24 months before the date of the new legal gender.

Incidence for the first application per individual was calculated and stratified for four periods between 1972 and 2010 (the time the law has been in force). The means of the total Swedish population over 17 years of age for the first and the last year of the 10-year intervals were used for incidence calculations (Sweden Statistics, 2012). We had no data on the number of sex reassigned individuals alive and residing in Sweden at each given time point, which precluded exact point prevalence figures (total number of cases in the population divided by the number of individuals in the population) or lifetime prevalence. However, several previous studies have reported transsexualism prevalence rates without taking into account the number of living cases (Baba et al., 2011; De Cuypere et al., 2007; Tsoi, 1988; Veale, 2008). For comparison reasons, we therefore decided to calculate prevalence

numbers based on all persons who ever applied for a new legal gender as if they were all alive during the study period. This will slightly overestimate the point prevalence. The regret rate is defined as the number of sex reassigned individuals at the time period when they did their first application that will later apply for reversal to the original sex, compared to the total number of individuals who did their first application at that time period and received a new legal gender. The data were stratified in 10 years' time periods. The study was conducted in the same way as earlier Swedish incidence studies (Landén et al., 1996; Olsson & Möller, 2003; Wålinder, 1971), with the exception that we calculated incidence rates for the population over 17 instead of over 14 years of age, since a new legal gender cannot be granted before 18.

Statistics

All tables and statistical analyses were generated in the software package R: A Language and Environment for Statistical Computing (R Core Team, 2013). For dichotomous data, cross tabulation with χ^2 or Fisher's exact test were used where appropriate. Results were defined statistically significant if the *p* value was <0.0001.

Results

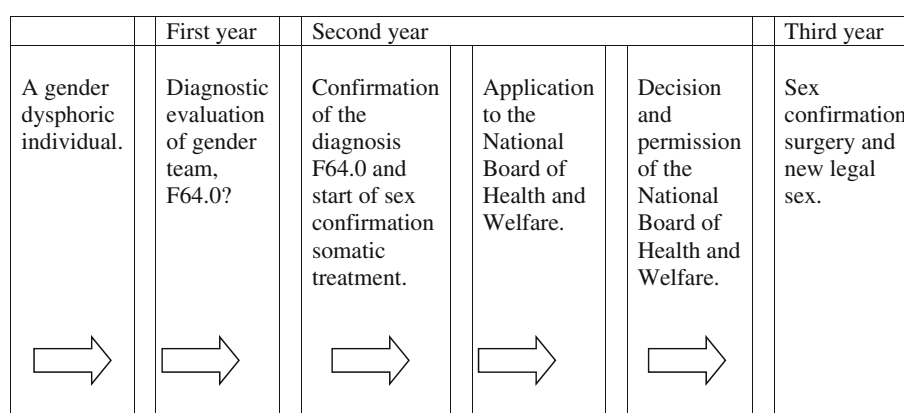
Number of Applications, Granted Applications, and Time to New Legal Gender

A total of 767 people (289 natal females and 478 natal males) applied for legal and surgical sex reassignment in Sweden due to transsexualism/gender dysphoria during the period 1960–2010. Figure 2 shows the number of natal females and natal males applying for a new legal gender stratified per year. Of these 767 applicants, 89 % or 681 persons (FM: 252/289, 87 %; MF: 429/478, 90 %) were granted a new legal gender and had undergone sex confirmation surgery by the end of June 2011. Eight individuals (4 FM and 4 MF) of 681 were assigned a new legal gender before the law came in force 1972. A total of 25 persons (3.3 %, 7 natal females and 18 natal males) were denied a new legal gender due to reasons listed in Table 2. The mean time between the first visit at any clinic for gender dysphoria and a new legal gender for the 681 individuals who underwent sex reassignment declined from a mean of 87 (SD = 70) months between 1972 and 1980, to 46 (SD = 31) months between 2001 and 2010.

Incidence

Table 3 shows stratified incidence of applications for a new legal gender for the four periods for each gender. The overall incidence of applications for a new legal sex increased from

Fig. 1 Procedural flow for individuals applying for sex confirmation genital surgery and new legal sex



0.20/100,000/year (1972–1980) to 0.57/100,000/year (2001–2010). For FMs, there was a 2.5 fold increase from 0.16 to 0.42/100,000/year from the first decade to the last; and for MFs, there was a threefold increase from 0.23 to 0.73/100,000/year. The incidence differed significantly between the time periods for both genders combined, $\chi^2(3) = 308$, $p < .0001$, as well as for FM, $\chi^2(3) = 107$, $p < .0001$, and MF, $\chi^2(3)$, $p < .0001$. Likewise, the incidence rates for people who actually received a new sex tripled for both sexes from 0.16 to 0.51/100,000/year (FM: 0.13–0.37/100,000/year, MF: 0.20–0.66/100,000/year).

Prevalence

At the end of December 2010, there were 3,791,791 females and 3,704,685 males over 17 years of age alive and living in Sweden. This gives a point prevalence for persons who had applied for a new legal gender of 1:13,120 for FM and 1:7,750 for MF. As of the same date, the point prevalence for persons who had undergone legal and surgical sex reassignment in Sweden during 2010 was 1:15,047 for FM and 1:8,636 for MF.

Sex Ratio

The FM:MF sex ratio for those who applied was 1:1.66 for the whole study period, but fluctuated between 1:1.42 and 1:1.93 as presented in Table 3. The fluctuation of the sex ratio was not significant over time, $\chi^2(3) = 2.76$. The sex ratio for those who received a new legal gender was 1:1.53 (1972–1980), 1:1.45 (1981–1990), 1:1.89 (1991–2000), 1:1.73 (2001–2010), and was 1:1.70 for the whole study period 1960–2010.

Age of Applicants

The median (min–max) age at application for the whole period was 27 years (16–65) for FMs and 32 years (18–75) for MFs. The proportion of FMs who were 30 years of age or older at the time of application remained stable at around 30 %. By contrast, MFs 30 years of age or older increased

from 37 % in the first decade to around 60 % over the last three decades (see Table 3).

Regrets

A total of 15 individuals (5 FM and 10 MF) out of 681 who received a new legal gender between 1960 and 2010 applied for reversal to the original sex (regret applications). This corresponds to a regret rate of 2.2 % for both sexes (2.0 % FM and 2.3 % MF). As showed in Table 4, the regret rate decreased significantly over the whole study period, Fisher's exact test, $p < .0001$. The median (min–max) age at which this group first applied for a new legal sex was 22 (18–52) years in FM and 35 (27–49) years in MF. The median (range) time elapsed from attaining a new legal gender to the regret application was

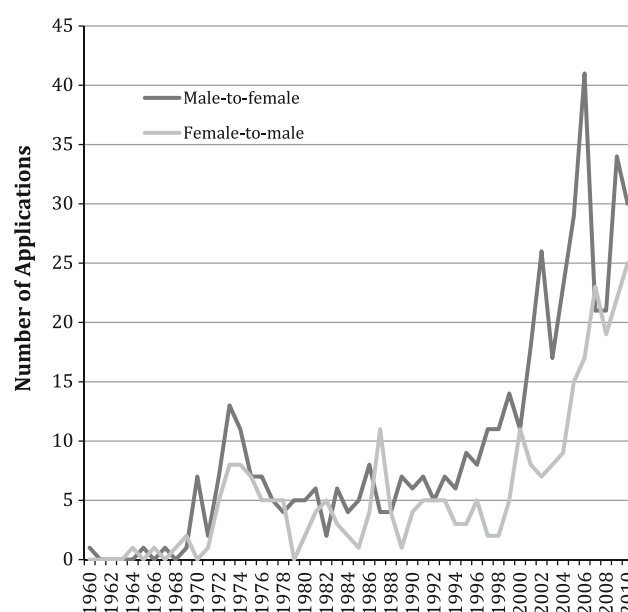


Fig. 2 New applicants for a new legal sex and permission for sex confirmation surgery to the National Board of Health and Welfare in Sweden, 1960–2010, per year, males and females as assigned at birth

Table 2 Applications and outcomes for new legal and surgical sex reassignment submitted to the National Board of Health and Welfare in a Swedish sample, male or female as assigned at birth, between January 1960 and June 2011

Applications for new legal sex January 1960–December 2010 (% of all applications)	Assigned female <i>N</i> = 289 (37.7 %)	Assigned male <i>N</i> = 478 (62.3 %)	Total <i>N</i> = 767 (100 %)
Granted new legal sex between January 1960 and 30 June 2011, out of the applications made January 1960–December 2010 (% of all applications)	252 (87.2 %)	429 (89.7 %)	681 (88.8 %)
Permission not granted for new legal sex (% of all applications)	37 (12.8 %)	49 (10.3 %)	86 (11.2 %)
Reasons for not granting new legal sex			
Application withdrawn by applicant (% of all applications)	3 (1.0 %)	6 (1.3 %) ^a	9 (1.2 %)
Pending new legal sex; chosen by applicant (% of all applications)	17 (5.9 %)	11 (2.3 %)	28 (3.7 %)
Waiting-list for operation (% of all applications)	8 (2.8 %)	9 (1.9 %)	17 (2.2 %)
Partly granted; name-change (% of all applications)	2 (0.7 %)	5 (1.0 %)	7 (0.9 %)
Dismissal of the application (% of all applications)	7 (2.4 %)	18 (3.8 %)	25 (3.3 %)
Reasons for dismissal			
Did not meet diagnosis criteria (% of all applications)	2 (0.7 %)	6 (1.3 %)	8 (1.0 %)
Application incomplete (% of all applications)	3 (1.0 %)	9 (1.9 %)	12 (1.6 %)
Co-morbidity (% of all applications)	2 (0.7 %)	0	2 (0.3 %)
Not sterile (% of all applications)	0	1 (0.2 %)	1 (0.1 %)
Missing data (% of all applications)	0	2 (0.4 %)	2 (0.3 %)

^a One male applicant died during the time period after application and before permission granted and legally accounted as withdrawn

7.5 years (90 months, range 75–137) for FM, and 8.5 years (102 months, range 22–177) for MF.

SRS Abroad

A total of 41 persons had surgical sex reassignment abroad: 2 females aged 29 and 42, and 39 males with median (min–max) age 36 (18–59). Most sex reassignments abroad occurred after 1991 (36/41). The surgery was conducted mainly in Thailand and the US (36/41) while the remainder took place in the UK, the Baltic States, or Norway. One of these 41 individuals had been denied sex reassignment in Sweden prior to surgery abroad. The rest had not applied for legal and surgical sex reassignment in Sweden before they underwent their surgery abroad. Up to 2010, there had been no regret applications from this group.

Discussion

We studied the applications for sex reassignment in the total population of Sweden during 50 years. There was a pronounced increase of applications from the year 2000. Approximately 2.5 times more FMs and three times more MFs applied between 2001 and 2010 compared to the three previous decades. This accords with reports from Toronto and the Netherlands where the number of adolescents who seek help for gender dysphoria has increased (de Vries & Cohen-Kettenis, 2012; Wood et al., 2013). The same has also been reported from Catalonia (Gómez-Gil et al., 2006).

There are several possible explanations for the increase in gender reassignment applications. First, a drift in diagnostic criteria has occurred in that the Legal Board in Sweden has been increasingly more likely to sanction late onset MF (Ols-son & Möller, 2003). As a consequence, the proportion of MF

Table 3 Incidence of FM and MF applications/100,000/year stratified in 10-year periods, 1972–2010, with median age and percentage over 30 years of age at time for application and sex ratio

Year of application	FM number/ female population >17 years/	FM incidence/ 100,000/ year	FM age median (min–max)	FM % above 30 years old (%)	MF number/ male population >17 years	MF incidence/ 100,000/ year	MF age median (min–max)	MF % above 30 years old (%)	Sex ratio FM:MF
1972–1980	45/3,166,037	0.16	29 (16–51)	36	64/3,062,456	0.23	27 (18–55)	37	1:1.42
1981–1990	39/3,340,105	0.12	26 (18–45)	33	52/3,198,147	0.16	33 (18–56)	62	1:1.33
1991–2000	46/3,497,821	0.13	26 (18–65)	28	89/3,347,178	0.27	36 (19–55)	61	1:1.93
2001–2010	153/3,674,613	0.42	27 (17–53)	31	260/3,559,056	0.73	33 (18–75)	59	1:1.70

in general and late onset MF in particular increased during the study period. But this occurred back in the 1980s and 1990s and cannot explain the surge after the turn of the century. Second, it has been suggested that homophobia in countries like Australia and Singapore may cause gay males to undergo SRS (Ross et al., 1981; Tsoi, 1988). A recent report from Toronto suggests that the increased number of applications from adolescents may be because it is perceived easier to be transsexual than homosexual, but it is unknown whether this applies to adults (Wood et al., 2013). A Swedish survey found more tolerant attitudes toward transsexual than homosexual persons (Landén & Innala, 2000, 2002). Homophobia is nevertheless an unlikely explanation to an increase in MF:s in Sweden, which rates low on homophobia; same-sex marriage has for example been allowed for 10 years (ILGA-Europe, 2013). A third potential explanation could be easier access to care and better care for transsexualism. Reports from Singapore and the Netherlands suggest that good care of gender dysphoric people and especially good surgical techniques for MFs facilitates sex reassignment (Bakker, van Kesteren, Gooren, & Bezemer, 1993; Tsoi, 1988). Since 1999, evaluation of those who request gender change has been centralized in Stockholm County (which comprises 20 % of the Swedish population). Prior to that, care of transsexual individuals was more random and the level of expertise and experience varied considerably between care providers. Fourth, increased public awareness, easier access to information, and increasing societal acceptance of individuals with gender dysphoria may have contributed to the increased incidence. Internet access in Swedish households increased from 47 % in 2003 to 91 % in 2010 (Sweden Statistics, 2013) and people with gender dysphoria may have become aware of their condition and learned to seek help via the internet, which also gives the possibility for easy connections with support groups.

We estimated the point prevalence for individuals who have been granted a new legal gender and who have undergone a complete sex reassignment to be 1:15,047 in FM and 1:8,636 in MF. These figures should be compared with the prevalence among Belgian-born people who had undergone complete SRS 2003, as estimated by data retrieved from all

surgical departments in the country, which were 1:33,800 in FM and 1:12,900 in MF (De Cuyper et al., 2007). The Swedish figures slightly overestimate the prevalence as we were not able to exclude those who deceased after sex reassignment and those who were born outside Sweden (see “Method”). But this is unlikely to explain the more than double prevalence for FM compared to Belgium.

The FM:MF sex ratio in Sweden was rather stable between 1972 and 2010. There was a trend towards more male applicants during 1991 and 2000 (1:1.93) that abated during the following decade to 1:1.73. Presumably, several structural and other factors influence the sex ratio and also the frequency of applications. Such factors, which may differ across countries, include access to healthcare and insurance coverage, trust in healthcare providers, diagnostic traditions, legal possibilities for being granted a new legal gender, and societal prejudice (Nieder et al., 2011; Okabe et al., 2008).

The average age at application was stable over the time period for both genders. FMs were younger (median 27 years old) than MFs (median 32 years old). These figures are in line with those from the European Network of the Investigation on Gender Incongruence (ENIGI) consortium (the clinics in Amsterdam, Gent, Hamburg, and Oslo) (Nieder et al., 2011). By contrast, in Singapore and Spain, the mean age was 24–25 years in both groups (Gómez-Gil et al., 2009; Tsoi, 1988). This is in line with the suggestion that applicants for gender reassignment tend to be older in individualistic countries (Sweden is an individualistic country according to Hofstede’s index that divides cultures and countries into either individualistic or collectivistic) compared to collectivistic countries like Spain and Singapore (Lawrence, 2010). The proportion of FMs over 30 years old was stable at 30 %. By contrast, the percentage of MFs over 30 years of age increased from 37 to 60 % during the study period. This is most likely related to the change in the interpretation of the law and diagnostic criteria that occurred ca. 1985, when also late onset gender dysphoria was accepted for legal and surgical sex reassignment.

The time from the first appointment for gender dysphoria until being granted a new legal gender decreased from 7.3 years

Table 4 Individuals who will subsequently apply for reversal to the original sex

Time period	Number of sex reassigned individuals at the time period when they did their first application that will later apply for reversal to the original sex/total number of individuals who did their first applications at this time period who received a new legal sex (%)	Number of regret applications, during that time period
1960–1971	4/15 (27 %)	0
1972–1980	6/103 (5.8 %)	5
1981–1990	1/76 (1.3 %)	3
1991–2000	3/127 (2.4 %)	3
2001–2010	1/360 (0.3 %)	4
1960–2010	15/681 (2.2 %)	15

in the first decade (1972–1981) to 3.8 years in the last (2001–2011). This represents an improvement in care, even though 3.8 years may still seem unnecessarily long to complete the entire process. Only 3.3 % of applicants were denied a new legal gender by the Legal Board of the National Board of Health and Welfare. This implies good diagnostic precision and selection of individuals who can proceed to a complete legal sex change. An alternative interpretation would be that the gender teams adjusted well to the demands of the legal prerequisites and, because of this, act as gatekeepers. The 3.3 % (2.4 % FM and 3.8 % MF) denial rate was slightly higher than has been reported from Germany: 1 % for FM and 3 % for MF (Meyer zu Hoberge, 2009).

In June 2011, 30 applicants who had been granted permission to undergo surgery and subsequently obtain a new legal gender status (17 females and 13 males) had postponed surgery more than 12 months (Table 1). It is assumed that these people were waiting for a change in the Swedish law in order to escape the requirement to be sterile to be eligible for sex change operation. By rule of court and EC regulation, this requirement has since been revoked and the Swedish law changed.

The regret rate defined as application for reversal of the legal gender status among those who were sex reassigned was 2.2 % for the whole period 1960–2010 with no significant sex difference. The risk of regretting the procedure was higher if one had been granted a new legal gender before 1990 (11/15). For the two last decades, the regret rate was 2.4 % (1991–2000) and 0.3 % (2001–2010), respectively. The decline in the regret rate for the whole period 1960–2010 was significant. However, the last period is still undecided since the median time lag until applying for a reversal was 8 years. If excluding 2001–2010 the *p* value is .002. The Swedish regret rate is slightly higher compared to previous reports: 1 % for FM and 1–1.5 % for MF (Pfäfflin, 1992), 0.4 % for both genders (Weitze & Osburg, 1996), and 0.6 % for both genders (Meyer zu Hoberge, 2009). This might be explained by the extensive follow-up time in the present study and by the fact that virtually all cases of regrets are captured in the Swedish registry system. The FMs who applied for reversal were younger at application than those who did not (median 22 years compared to 27 years for the whole FM group). Conversely, the MFs who later applied for reversal were older when they applied for sex reassignment than those who did not (median 35 years vs. 32 years for the whole MF group). Since the group is small, these data must, however, be interpreted cautiously. A previous Swedish study identified lack of family support and transsexualism secondary to transvestism (today late onset gender dysphoria) as risk factors for regret (Landén, Wålinder, Lambert, & Lundström, 1998). Since then, all gender teams in Sweden include support to next-of-kin, which hence might have contributed to the decreased rate of regret. A Canadian study with 84.1 % follow-up rate of at least one year post SRS identified heterosexual MF as significant factor for regret (Blanchard, Steiner, Clemmensen, & Dickey,

1989). We had no data on sexual orientation in the present study and can neither confirm nor refute this finding. A German study identified poor differential diagnosis, failure to carry out the social transition, and poor surgical result and lack of proper care in treating the patients as risk-factors for regrets (Pfäfflin, 1992). Another study identified dissatisfaction with the physical and functional result of the SRS as a factor for regret to the treatment (Lawrence, 2003). One could speculate that workup procedures and surgical treatment have improved since 1990 contributing to a declined regret rate. It was beyond the scope of this study to survey details about the regret process and we can neither confirm nor refute previous predictors of regret.

About 6 %, more MF than FM, underwent surgical procedures abroad at their own expense, mostly in the U.S. and Thailand. This began ca. 1991 and has gradually become more common. In some instances, it reflects a wish to speed up the process or avoid the evaluation process.

Although all applications for legal gender reassignment were included, it is important to emphasize that this study does not represent all people with transsexualism or gender dysphoria; there may still be those who do not need or want a medical transition or have been denied early in the process by health care providers. The incidence of gender dysphoria/incongruence in a population, disregarding requests for treatment, is not known in Sweden but there is some information from the U.S., The Netherlands, Finland, and Taiwan. In a household probability sample of adults in Massachusetts, 0.5 % labeled themselves as transgender (Conron, Scott, Stowell, & Landers, 2012). In a recent Dutch study, 0.6 % of males and 0.2 % of females were gender dysphoric (Kuyper & Wijzen, 2014). In a population-based Finnish sample (222 men and 349 women 18–44 years), 6 % reported that they had felt like the opposite sex and/or wished they had the body of the opposite gender (Ålgars, Santtila, & Sandnabba, 2010). In a college student sample (2,588 men and 2,463 women) from Taiwan, 7.3 % females and 1.9 % males reported that they often or very often wished to be the opposite sex (Lai, Chiu, Gadow, Gau, & Hwu, 2010). These data must be interpreted cautiously due to differences in methodology and different definitions of gender dysphoria and importantly, these figures do not reflect the proportion of people who need or request medical help to ease their gender dysphoria. Nevertheless, these studies suggest that some degree of gender dysphoria is more common than the number of persons who actually decide to proceed with a gender reassignment. If societal changes result in increased awareness and acceptance of gender change, a further increase in incidence cannot be excluded.

Strengths and Limitations

This study was unique as it represents a complete national cohort of individuals who have applied for legal gender change in Sweden over the past 40 years. The quality of the data was

assured by access to all the original files and applications since 1960 and by the legal framework regulating legal sex change in Sweden. This contrasts with many studies from other countries that only pertain to one or a few clinics in a country and therefore cannot provide reliable prevalence estimates (Baba et al., 2011; Gómez-Gil et al., 2006). Moreover, this study covered 50 years which allows for observation of secular trends over the years. The methodology was similar to previous Swedish studies, which allows for comparisons (Landén et al., 1996; Olsson & Möller, 2003; Wålinder, 1971). A limitation was that the point prevalence was slightly overestimated (see “Method”). We had no data about sexual orientation and could therefore not test this factor in relation to changes in sex ratio or regrets.

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References

- Ålgars, M., Santtila, P., & Sandnabba, N. K. (2010). Conflicted gender identity, body dissatisfaction, and disordered eating in adult men and women. *Sex Roles*, 63, 118–125. doi:10.1007/s11199-010-9758-6.
- American Psychiatric Association. (1980). *Diagnostic and statistical manual of mental disorders* (3rd ed.). Washington, DC: Author.
- American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.
- Baba, T., Endo, T., Ikeda, K., Shimizu, A., Honnma, H., Ikeda, H., et al. (2011). Distinctive features of female-to-male transsexualism and prevalence of gender identity disorder in Japan. *Journal of Sexual Medicine*, 8, 1686–1693. doi:10.1111/j.1743-6109.2011.02252.x.
- Bakker, A., van Kesteren, P. J., Gooren, L. J., & Bezemer, P. D. (1993). The prevalence of transsexualism in the Netherlands. *Acta Psychiatrica Scandinavica*, 87, 237–238.
- Blanchard, R., Clemmensen, L. H., & Steiner, B. W. (1987). Heterosexual and homosexual gender dysphoria. *Archive of Sexual Behavior*, 16, 139–152.
- Blanchard, R., Steiner, B. W., Clemmensen, L., & Dickey, R. (1989). Prediction of regrets in postoperative transsexuals. *Canadian Journal of Psychiatry*, 34, 43–45.
- Conron, K. J., Scott, G., Stowell, G. S., & Landers, S. J. (2012). Transgender health in Massachusetts: Results from a household probability sample of adults. *American Journal of Public Health*, 102, 118–122. doi:10.2105/AJPH.2011.300315.
- De Cuypere, G., Janes, C., & Rubens, R. (1995). Psychosocial functioning of transsexuals in Belgium. *Acta Psychiatrica Scandinavica*, 91, 180–184.
- De Cuypere, G., Van Hemelrijck, M., Michel, A., Carael, B., Heylens, G., Rubens, R., et al. (2007). Prevalence and demography of transsexualism in Belgium. *European Psychiatry*, 22, 137–141. doi:10.1016/j.eurpsy.2006.10.002.
- de Vries, A. L. C., & Cohen-Kettenis, P. T. (2012). Clinical management of gender dysphoria in children and adolescents: The Dutch approach. *Journal of Homosexuality*, 59, 301–320. doi:10.1080/00918369.2012.653300.
- Dixen, J. M., Maddever, M., Van Maasdam, J., & Edwards, P. W. (1984). Psychosocial characteristics of applicants evaluated for surgical gender reassignment. *Archive of Sexual Behavior*, 13, 269–276.
- Dulko, S., & Imielinski, C. (2004). The epidemiology of transsexualism in Poland. *Journal of Psychosomatic Research*, 56, 637.
- Eklund, P. L., Gooren, L. J., & Bezemer, P. D. (1988). Prevalence of transsexualism in the Netherlands. *British Journal of Psychiatry*, 152, 638–640.
- Garrels, L., Kockott, G., Michael, N., Preuss, W., Renter, K., Schmidt, G., et al. (2000). Sex ratio of transsexuals in Germany: The development over three decades. *Acta Psychiatrica Scandinavica*, 102, 445–448.
- Godlewski, J. (1988). Transsexualism and anatomic sex ratio reversal in Poland. *Archives of Sexual Behavior*, 17, 547–548.
- Gómez-Gil, E., Trilla García, A., Godás Sieso, T., Halperin Rabinovich, I., Puig Domingo, M., Vidal Hagemeyer, A., et al. (2006). Estimación de la prevalencia, incidencia y razón de sexos del transexualismo en Cataluña según la demanda asistencial [Estimation of prevalence, incidence and sex ratio of transsexualism in Catalonia according to health care demand]. *Actas Españolas de Psiquiatría*, 34, 295–302.
- Gómez-Gil, E., Trilla, A., Salameiro, M., Godás, T., & Valdés, M. (2009). Sociodemographic, clinical, and psychiatric characteristics of transsexuals from Spain. *Archives of Sexual Behavior*, 38, 378–392. doi:10.1007/s10508-007-9307-8.
- Hoenig, J., & Kenna, J. C. (1974). The prevalence of transsexualism in England and Wales. *British Journal of Psychiatry*, 124, 181–190.
- ILGA-Europe, the European Region of the International Lesbian, Gay, Bisexual, Trans and Intersex Association. (2013). *The rainbow map and index*. Retrieved from http://www.ilga-europe.org/home/publications/reports_and_other_materials/rainbow_europe_map_and_index_may_2012.
- Kreukels, B. P., Haraldsen, I. R., De Cuypere, G., Richter-Appelt, H., Gijls, L., & Cohen-Kettenis, P. T. (2010). A European network for the investigation of gender incongruence: The ENIGI initiative. *European Psychiatry*, 27, 445–450. doi:10.1016/j.eurpsy.2010.04.009.
- Kuyper, L., & Wijsen, C. (2014). Gender identities and gender dysphoria in the Netherlands. *Archives of Sexual Behavior*, 43, 377–385. doi:10.1007/s10508-013-0140-y.
- Lai, M. C., Chiu, Y. N., Gadow, K. D., Gau, S. S., & Hwu, H. G. (2010). Correlates of gender dysphoria in Taiwanese university students. *Archives of Sexual Behavior*, 39, 1415–1428. doi:10.1007/s10508-009-9570-y.
- Landén, M., & Innala, S. (2000). Attitudes toward transsexualism in a Swedish national survey. *Archives of Sexual Behavior*, 29, 375–388.
- Landén, M., & Innala, S. (2002). The effect of a biological explanation on attitudes towards homosexual persons. A Swedish national sample study. *Nordic Journal of Psychiatry*, 56, 181–186. doi:10.1080/080394802317607156.
- Landén, M., Wålinder, J., Lambert, G., & Lundström, B. (1998). Factors predictive of regret in sex reassignment. *Acta Psychiatrica Scandinavica*, 97, 284–289.

- Landén, M., Wålinder, J., & Lundström, B. (1996). Prevalence, incidence and sex ratio of transsexualism. *Acta Psychiatrica Scandinavica*, 93, 221–223.
- Lawrence, A. A. (2003). Factors associated with satisfaction or regret following male-to-female sex reassignment surgery. *Archives of Sexual Behavior*, 32, 299–315.
- Lawrence, A. A. (2010). Societal individualism predicts prevalence of nonhomosexual orientation in male-to-female transsexualism. *Archives of Sexual Behavior*, 39, 573–583. doi:10.1007/s10508-008-9420-3.
- Meyer zu Hoberge, S. (2009). *Prevalence, incidence and sex ratio of transsexualism in Germany established by counting applications of the German Transsexual Act during the period 1991 until 2000*. Unpublished doctoral thesis, Medical Faculty Christian-Albrechts-Universität zu Kiel, Kiel, Germany.
- Nieder, T. O., Herff, M., Cerwenka, S., Preuss, W. F., Cohen-Kettenis, P. T., De Cuypere, G., et al. (2011). Age of onset and sexual orientation in transsexual males and females. *Journal of Sexual Medicine*, 8, 783–791.
- O’Gorman, E. C. (1982). A retrospective study of epidemiological and clinical aspects of 28 transsexual patients. *Archives of Sexual Behavior*, 11, 231–236.
- Okabe, N., Sato, T., Matsumoto, Y., Ido, Y., Terada, S., & Kuroda, S. (2008). Clinical characteristics of patients with gender identity disorder at a Japanese gender identity disorder clinic. *Psychiatry Research*, 157, 315–318. doi:10.1016/j.psychres.2007.07.022.
- Olsson, S. E., & Möller, A. R. (2003). On the incidence and sex ratio of transsexualism in Sweden, 1972–2002. *Archives of Sexual Behavior*, 32, 381–386.
- Pauly, I. (1968). The current status of change of sex operation. *Journal of Nervous and Mental Disease*, 147, 460–471.
- Pfäfflin, F. (1992). Regrets after sex reassignment surgery. *Journal of Psychology and Human Sexuality*, 5, 69–85.
- Pimenoff, V. (2006). On the care of transsexuals in Finland. *International Journal of Transgenderism*, 9, 23–33.
- R Foundation for Statistical Computing. (2013). R: A Language and Environment for Statistical Computing, Vienna, Austria. Retrieved from <http://www.r-project.org/>.
- Ross, M. W., Wålinder, J., Lundström, B., & Thuwe, I. (1981). Cross-cultural approaches to transsexualism. A comparison between Sweden and Australia. *Acta Psychiatrica Scandinavica*, 63, 75–82.
- Smith, Y. L., van Goozen, S. H., Kuiper, A. J., & Cohen-Kettenis, P. T. (2005). Transsexual subtypes: Clinical and theoretical significance. *Psychiatry Research*, 137, 151–160.
- Sørensen, T., & Hertoft, P. (1980). Sexmodifying operations on transsexuals in Denmark in the period 1950–1977. *Acta Psychiatrica Scandinavica*, 61, 56–66.
- Sørensen, T., & Hertoft, P. (1982). Male and female transsexualism: The Danish experience with 37 patients. *Archives of Sexual Behavior*, 11, 133–155.
- Sweden Statistics. (2012). *Befolkningsstatistik*. Retrieved from http://www.scb.se/Pages/SSD/SSD_SelectVariables_340507.aspx?px_tableid=ssd_extern%3aBefolkningNy&rxid=0b3f5d00-ca4f-4813-9c77-5803f5fff6da.
- Sweden Statistics. (2013). *Tillgång till it-utrustning och internet i hemmet för personer i åldern 16–74 år. År 2003–2012*. Retrieved from http://www.scb.se/Pages/SSD/SSD_TablePresentation_340486.aspx?layout=tableViewLayout1&rxid=f3be8994-75f3-4f4c-b0d6-e17cf3d08019.
- Tsoi, W. F. (1988). The prevalence of transsexualism in Singapore. *Acta Psychiatrica Scandinavica*, 78, 501–504.
- van Kesteren, P. J., Gooren, L. J., & Megens, J. A. (1996). An epidemiological and demographic study of transsexuals in the Netherlands. *Archives of Sexual Behavior*, 25, 589–600.
- Veale, J. F. (2008). Prevalence of transsexualism among New Zealand passport holders. *Australian and New Zealand Journal of Psychiatry*, 42, 887–889.
- Vujovic, S., Popovic, S., Sbutega-Milosevic, G., Djordjevic, M., & Gooren, L. (2008). Transsexualism in Serbia: A twenty-year follow-up study. *Journal of Sexual Medicine*, 6, 1018–1023. doi:10.1111/j.1743-6109.2008.00799.x.
- Wålinder, J. (1968). Transsexualism: definition, prevalence, and sex distribution. *Acta Psychiatrica Scandinavica*, 203(Suppl.), 255–258.
- Wålinder, J. (1971). Incidence and sex ratio of transsexualism in Sweden. *British Journal of Psychiatry*, 119, 195–196.
- Weitze, C., & Osburg, S. (1996). Transsexualism in Germany: Empirical data on epidemiology and application of the German Transsexuals’ Act during its first ten years. *Archives of Sexual Behavior*, 25, 409–425.
- Wilson, P., Sharp, C., & Carr, S. (1999). The prevalence of gender dysphoria in Scotland: A primary care study. *British Journal of General Practice*, 49, 991–992.
- Wood, H., Sasaki, S., Bradley, S. J., Singh, D., Fantus, S., Owen-Anderson, A., ... Zucker, K. J. (2013). Patterns of referral to a gender identity service for children and adolescents (1976–2011): Age, sex ratio, and sexual orientation [Letter to the Editor]. *Journal of Sex and Marital Therapy*, 39, 1–6. doi:10.1080/0092623X.2012.675022.
- World Health Organization. (1992). *The international statistical classification of diseases, and related health problems* (10th ed.). Geneva: Author.
- Zucker, K. J., & Lawrence, A. A. (2009). Epidemiology of Gender Identity Disorder: Recommendations for the Standards of Care of the World Professional Association for Transgender Health. *International Journal of Transgenderism*, 11, 8–18.