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Clinical Aspects of Transgender Speech Feminization and Masculinization

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SUMMARY. Societal norms of speech, voice, and non-verbal communication are often strongly gendered. For transgender individuals who experience a mismatch between existing communication behaviours and felt sense of self, changes to the gendered aspects of communication can help reduce gender dysphoria, improving mental health and quality of life. While peer resources are often beneficial in changing overall appearance and presentation, speech and voice modification is best facilitated by a trans-competent speech professional. In this article we review clinical research relating to transgender speech and voice change and discuss clinical protocols for trans-specific assessment, treatment, and outcome evaluation. doi:10.1300/J485v09n03_08 *[Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <http://www.HaworthPress.com> © 2006 by The Haworth Press, Inc. All rights reserved.]*

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Transgender individuals may require assistance to feminize or masculinize speech, voice, and non-verbal communication. Changes to the gendered aspects of communication can help reduce gender dysphoria and facilitate gender presentation that is consistent with the felt sense of self, resulting in improved mental health and quality of life. With all parameters of communication, the goal is to allow the outside–speech, voice, and movement–to reflect what the client feels inside. While peer support resources can be highly beneficial in changing overall appearance and presentation, speech and voice modification is best facilitated by a

trans-competent speech professional who can provide a comprehensive evaluation, design an effective treatment program, and help prevent vocal problems that may arise from changes to habitual fundamental frequency or voice quality.

As with other transgender care, we recommend that speech services be offered in the context of a complete approach to transgender health that includes comprehensive primary care and a coordinated approach to psychological and social issues. Speech services must be individualized based on the individual's goals, the risks and benefits of treatment options, and consideration of social and economic issues.

THE IMPORTANCE OF SPEECH AND VOICE SERVICES IN TRANSGENDER CARE

Although studies assessing transgender speech needs have thus far involved only small numbers of participants, the results suggest that congruency of speech and gender identity is important to transgender individuals in both the male-to-female (MTF) and female-to-male (FTM) continuum.[1] For example, in a survey of a broad range of transgender individuals (N = 179)–including crossdressers and others who did not identify as transsexual–23% of respondents reported a current need for speech therapy (Goldberg, Matte, MacMillan, & Hudspith, 2003). In studies of MTF transsexuals, feminization of communication was rated extremely important by 73% of 11 participants in one study (Wollitzer, 1994), and as "very important" by over half of 28 respondents in another study (Neumann, Welzel, Gonnermann, & Wolfradt, 2002b). A study of FTM transsexuals reported that 88% of 16 participants considered masculinization of communication as important or more important than sex reassignment surgery (Van Borsel, De Cuypere, Rubens, & Destaerke, 2000).

In speech, voice, and transgender health literature, speech feminization is widely recognized as an important element of transgender care for MTFs (Andrews, 1999; Becklund-Freidenberg, 2002; Byrne, Dacakis, & Douglas, 2003; Dacakis, 2002; de Bruin, Coerts, & Greven, 2000; Gold, 1999; Hooper, 1985; King, Lindstedt,

Jensen, & Law, 1999; Neumann & Welzel, 2004; Neumann, Welzel, Gonnermann, & Wolfradt, 2002a; Oates & Dacakis, 1983, 1997; Pausewang-Gelfer & Schofield, 2000; Van Borsel, De Cuypere, & Van den Berghe, 2001; Wiltshire, 1995; Wollitzer, 1994). Speech masculinization for FTMs has not been as well studied (Oates & Dacakis, 1997; Soderpalm, Larsson, & Almquist, 2004; Van Borsel et al., 2000). Generally, the literature surveyed stated that testosterone therapy always results in drop in pitch sufficient to allow FTMs to live as men (Andrews, 1999; de Bruin et al., 2000; Gold, 1999; King et al., 1999; Oates & Dacakis, 1997; Petty, 2004; Soderpalm et al., 2004; Yang, Palmer, Murray, Meltzer, & Cohen, 2002). However, this is not empirically supported. A study of FTMs who had taken testosterone for at least one year (N = 16) found that 25% were sometimes perceived as female on the phone, with 31% expressing interest in therapy to further masculinize speech (Van Borsel et al., 2000). The speech needs of FTMs who do not take testosterone were not discussed in any of the literature surveyed.

There is great variation in the extent to which speech changes are undertaken or desired by transgender individuals. Some transgender persons who desire changes to speech and voice seek maximum feminization or masculinization, while others experience relief with a more androgynous presentation. Some transgender individuals seek to develop two speech patterns (one more masculine, one more feminine) either because they identify as bi-gendered or because external pressures relating to family, employment, cultural community, or other concerns prevent living full-time in a way that is consistent with felt sense of self. Most current transgender speech protocols do not support bi-modal speech as a treatment goal, based on the belief that to effect maximal change it is necessary to have a consistent single speech pattern. Switching back and forth between two speech and voice patterns may be too difficult for some clients, and inconsistent use decreases practice opportunities to acquire the new speech and voice pattern. However, the human capacity to learn and speak more than two languages, develop a specific accent for an acting role, and develop a singing voice that is different than speaking voice suggests it may be pos-

sible to develop bi-gender speech and voice. We encourage clinicians to be open to this possibility and not to routinely exclude clients who have two speech patterns as the treatment goal. We recommend that speech services be made available to the full spectrum of the transgender community.

EVIDENCE-BASED PRACTICE IN TRANSGENDER SPEECH AND VOICE CHANGE

The practice recommendations in this article are based on published literature specific to transgender speech, supplemental interviews with four expert clinicians, and the authors' professional experience. As research in this field is limited, some of our recommendations are based on current practices or theoretical rationale where the literature is inconclusive or absent.

In our review of the literature we found a paucity of evidence in the area of transgender speech, particularly in clinical practice. Early clinical research reported single subject case studies (Bralley, Bull, Gore, & Edgerton, 1978; Hooper, 1985; Kalra, 1977; Kaye, Bortz, & Toumi, 1993; Mount & Salmon, 1988; Yardley, 1976); more recently small group studies have reported outcomes of speech therapy (Byrne et al., 2003; Dacakis, 2000; Neumann et al., 2002b; Soderpalm et al., 2004) and pitch-elevating surgery (Brown, Perry, Cheesman, & Pring, 2000; de Jong, 2003; Gross, 1999; Kunachak, Prakunhungsit, & Sujjalak, 2000; Neumann et al., 2002b; Wagner, Fugain, Monneron-Girard, Cordier, & Chabolle, 2003; Yang et al., 2002). However, further research is needed to evaluate specific techniques and protocols.

In the literature and in our discussions with clinicians we noted that decisions about practice protocols were often significantly impacted by budget constraints, the logistics of the clinical setting (e.g., university-based student clinics running from September to April), and protocols necessary for conscientious research but not necessary in regular clinical practice. While there are administrative and logistical realities that need to be considered, we felt it was important to base our recommendations on what we felt to be optimal practice from a *clini-*cal perspective, based on the evidence currently available.

In North America, many clinicians providing transgender speech services do so in the private practice setting, and data from clients in these settings are rarely published. To assist in greater understanding of transgender speech issues and further development of practice protocols, we encourage clinicians in both university and private practice settings to ask transgender clients for permission to share anonymized assessment data with other speech professionals. As with all research, it is important that transgender clients' involvement in research be fully voluntary–i.e., services should not be contingent on agreement to publish outcome data.

The clinical process of feminization or masculinization of speech and the voice is predicated on the concept that there are "feminine" speech and voice norms and "masculine" speech and voice norms. Within linguistics there is generally recognition that norms of "feminine" and "masculine" discourse and language are socially determined phenomena that vary across cultures, regions, and historical periods. There is less understanding of the ways that voice may also be shaped by social influences (Delph-Janiurek, 1999). This is most obviously problematic in studies which assert universal "female" and "male" speech and voice characteristics based solely on study of English-language speakers, but in reviewing the literature we were also concerned by assumptions of homogeneity relating to age, culture, class, region, and social context between speaker and listener. While there is obvious value in considering existing empirical evidence relating to gender perceptions and attributions in development of speech feminization and masculinization protocols, we believe it is misleading to interpret the existing data relating to gender norms and voice as universally normative. In reviewing research findings we include discussion of the limits of these findings.

CORE COMPETENCIES OF THE SPEECH PROFESSIONAL IN TRANSGENDER CARE

While speech professionals do not need to be experts in every realm of transgender care to work with transgender clients, the clinician

providing speech feminization or masculinization services is expected to have basic trans-competence. Trans-competency in clinical services involves both the ability to interact in a respectful way with transgender individuals–sometimes termed *cultural competence* (Kohnert, Kennedy, Glaze, Kan, & Carney, 2003; Núñez, 2000)–and also clinical knowledge and skill relating to (a) speech and voice science, and (b) trans-specific assessment, treatment, and outcome evaluation (Goldberg, 2006).

Cultural competence in transgender speech and voice change refers to the capacity to provide respectful and relevant services to a diverse range of clients. In addition to general skill working with clients from a variety of cultural, ethnic, class, and age groups, the clinician is expected to be familiar with transgender terminology, diversity of gender identity and expression, the processes involved in gender transition, and trans-specific psychosocial issues that shape clients' goals and treatment options (Goldberg & Lindenberg, 2001). The clinician should also be aware of basic protocols such as use of the client's preferred gender pronoun and name in verbal interactions and written records.

Clinical competence in transgender speech and voice change requires a solid foundation in theory relating to adult speech and voice production, speech and voice disorders, speech and voice treatment techniques, and other elements of speech and voice science. We recommend that the speech clinician working with transgender individuals have at least two years clinical experience assessing and treating typical adult speech and voice disorders prior to working with transgender individuals, as the clinical processes of speech and voice feminization or masculinization require a high degree of clinical sophistication.

There are few opportunities to obtain training in speech and voice feminization or masculinization, and many clinicians learn as they work with transgender clients. This article is intended to help clinicians who already have both trans-awareness and experience in speech and voice work to become more familiar with gender differences in speech and voice; the effects of hormones and hormone therapy on speech and voice; treatment options to feminize or masculinize the voice; and trans-specific proto-

cols for assessment, treatment, evaluation, and followup.

Some transgender individuals seek speech services not to feminize or masculinize communication, but rather to address voice quality issues (such as hoarseness or raspiness following pitch-altering surgery), loss of singing range following changes to habitual speaking pitch range, or feelings of disconnection from the voice resulting from rapid hormonal or surgical changes. While clinicians working with transgender clients on these issues should be familiar with relevant trans-specific physical and psychosocial issues, the same clinical protocols generally used to deal with these concerns in other clients can successfully be used with transgender clients–i.e., no special trans-specific clinical protocols are needed. This article focuses on clinical protocols that are unique to speech feminization or masculinization, an area that (unless associated with vocal pathology) is considered trans-specific.

TRANS-SPECIFIC PRACTICE PROTOCOLS

Trans-Specific Speech Assessment

The first step in transgender speech treatment is a thorough assessment to guide the development of a therapeutic evaluation and treatment plan. The following section discusses recommendations relating to establishment of therapeutic rapport, recording of client history and objectives, evaluation of speech parameters, assessment of potential for change, determination of therapeutic goals, discussion of therapeutic options, and preparation for change. The additional evaluation required prior to pitch-elevating surgery is discussed in the section on surgical treatment protocols.

Building Therapeutic Rapport

The relationship between client and clinician begins with the first interactions. In initial sessions, the clinician is not only assessing the client, the client is also assessing the knowledge and supportiveness of the clinician. A relationship grounded in mutual respect, trust, and genuine care for the client's well-being facilitates

open communication and encourages active engagement in therapy; conversely, it can be difficult to build therapeutic rapport if conflicts arise in initial sessions. Many transgender individuals have had negative experiences with ill-informed or unempathetic health professionals, and there may be wariness about entering unreservedly into a relationship around communication–which is, by its nature, highly personal.

Because the assessment process sets the stage for all future interaction, it is extremely important to make the client feel respected and safe, and to create a feeling of positive anticipation for the therapy process. Issues that speech professionals need to consider in the intake process include storage of information, privacy issues in setting appointment times, client name preference, use of the client's preferred pronouns, and therapist bias and judgments about transgenderism (King et al., 1999).

Recording Relevant History

Client history should include information about both trans-specific concerns and also general issues that are known to impact therapeutic options and potential outcomes. While some transgender individuals are very comfortable talking about their history, others are more private. In some cases it may be appropriate to revisit sensitive questions after therapeutic rapport is well established, or to lead with general questions unrelated to trans-specific issues. As with the general population, some clients respond well to informal intake (e.g., the question "What brings you to see me?" may elicit a great deal of information); in other cases a more structured interview process or intake form may be beneficial. Sample intake forms are available as an online supplement at http://www.vch.ca/transhealth/resources/library/tcpdocs/guidelines-speech.pdf.

As with any client presenting for speech services, initial intake should include a general medical history, with particular attention to history of nose or throat complaints, respiratory ailments, hearing difficulties, voice disorders (including problems stemming from self-directed attempt to modify voice or heavy use of voice), or any other conditions that could impact speech (de Bruin et al., 2000; Pausewang-

Gelfer, 1999; Soderpalm et al., 2004). To assist in coordination of care, other health professionals involved in the client's general and trans-specific care should be noted (Soderpalm et al., 2004). Clients who present with difficulty swallowing, a dysphonic voice, or other symptoms that may indicate voice disorder–such as vocal fatigue, loss of range, or throat discomfort–should be referred for laryngological examination (Hearing, Speech & Deafness Center, 2005). All current medications, including feminizing or masculinizing hormones, should be recorded.

History of behaviours that may negatively impact speech, such as smoking (tobacco, cocaine, marijuana, etc.) and drinking alcohol should be explored (de Bruin et al., 2000; Pausewang-Gelfer, 1999). Because the stigma associated with substance use makes it difficult to get accurate information about current patterns of use, it may be useful to ask if a client "has ever . . ." rather than asking about current behaviour at the original intake; this can be revisited as part of treatment planning.

History of behaviours that may positively impact speech should also be explored. For example, it may be useful to inquire about personal, professional, and recreational use of voice (e.g., involvement in singing or acting) to determine whether previous training could be tapped during therapy. Previous attempts to feminize or masculinize speech should be investigated, including techniques used, duration of self- or professionally-directed therapy, and the client's subjective feelings about the outcome (Andrews, 1999; Dacakis, 2002; Pausewang-Gelfer, 1999; Perez, 2004).

Trans-specific history should include information about other feminization or masculinization treatments that may affect speech–such as testosterone therapy in FTMs or facial feminization surgery in MTFs–and any noted impact on speech following these treatments (Andrews, 1999; King et al., 1999; Pausewang-Gelfer, 1999; Soderpalm et al., 2004). It is not necessary to inquire specifically about trans-specific treatments that are unlikely to directly impact speech, such as history of chest, breast, or genital surgery. Relevant areas to explore include: (a) consideration of the impact of any planned surgeries on the timing of speech therapy, (b) any factors relating to transition that the

client feels are important in terms of motivation and timing of speech therapy–for example, wish to have speech change complete by a specific date to facilitate job change–and (c) any medical or psychosocial issues that the client feels may affect ability to engage in speech change (e.g., some transgender people report changes to concentration and emotional lability as a side effect of hormone regimens).

Evaluating Current Speech Parameters Associated with Gender

Thoroughly assessing the client's speech gives a baseline against which to measure change and provides information about which changes would be most useful (Andrews & Schmidt, 1997; Kaye et al., 1993; King et al., 1999). While voice parameters such as fundamental frequency and speaking frequency range can be measured objectively, many speech characteristics associated with gender, such as melody and vocal timbre, cannot be objectively quantified. A complete clinical impression should include the clinician's objective and subjective findings, and also the client's subjective assessment (Andrews & Schmidt, 1997; Byrne et al., 2003; Coleman, 1983; Dacakis, 2002; de Bruin et al., 2000; Gold, 1999; Mikos & Pausewang-Gelfer, 2001; Oates & Dacakis, 1997; Pausewang-Gelfer, 1999; Pausewang-Gelfer & Schofield, 2000; Wollitzer, 1994).

Following standard practice in an evaluation of speech and voice, audio recordings of the client's performance across a variety of tasks such as reading, picture description, and conversation should be made. These recordings assist the client and clinician in analyzing current communication patterns, setting goals for therapy, and determining a baseline against which to measure change. With the client's permission, the audio recordings may also be used as a resource to train student speech professionals.

If the clinician has access to digital technology and the client feels comfortable being videotaped, the assessment session can be taped and the footage then reviewed with the client. This may be a useful way of evaluating non-verbal communication features such as gestures, movement, and facial expressions. However, many clients find it intrusive, intimi-

dating, and embarrassing to be videotaped, and particularly to watch and discuss the tape with the clinician. We recommend using videotape only if the client is comfortable with this and there is strong clinician-client rapport.

To gather objective data in an assessment, a computer program that measures fundamental frequency, intensity, and vowel formants is necessary. Kay Elemetrics' Computer Speech Lab 4300 and "Dr. Speech" (Tiger DRS Inc.) were mentioned in the literature surveyed (Dacakis, 2002; Mount & Salmon, 1988; Soderpalm et al., 2004). Free software programs that measure fundamental frequency may be downloaded from the internet and can be useful for practice by clients who have computer access.

Client's Subjective Assessment

Because the client's goals for speech feminization or masculinization relate directly to both self-perception and feelings about the perceptions of others, it is important to understand the client's perspective and expectations in both of these areas (Andrews, 1999; Dacakis, 2002; Oates & Dacakis, 1997; Pausewang-Gelfer, 1999; Soderpalm et al., 2004). This may be done through informal discussion and/or formal measures such as standardized questionnaire.

If informal interview is the only tool used, to facilitate later assessment we recommend that the clinician use the same questions in pre- and post-evaluation. For example, the clinician could ask the client to describe three situations involving speaking that the client is dissatisfied with, and three things the client would like to change about the way she or he speaks in these situations.

A standard speech questionnaire like the Vocal Handicap Index or Voice Symptom Scale (Wilson et al., 2004) can be modified to include trans-specific concerns. The Transgender Self-Evaluation Questionnaire, developed by the lead author, is available online at http://www.vch.ca/transhealth/resources/library/tcpdocs/guidelines-speech.pdf; the La Trobe Communication Questionnaire (Byrne et al., 2003) is an example in the published literature.

Whether informal or formal assessment tools are used, it can be informative to ask cli-

ents to rate identity, self-perceived behaviour, appearance, and speech on a masculinity/femininity and male/female scale. This allows the clinician to gain a clearer picture of the client's identity and also aids in discussion of the client's feelings about possible discrepancies between gender identity and gender expression (Soderpalm et al., 2004).

Concern about others' perceptions often relates to *passability*–being perceived by others as a man or a woman. The desire to pass is a complex feeling that may be influenced by the client's self-defined gender; community norms; beliefs and expectations of friends, family, coworkers, community peers, or others who are close to the client; internalized transphobia; degree of social support; and experiences of mistreatment (as individuals who are visibly transgender are often more vulnerable to harassment, discrimination, and violence). Because norms relating to social interactions and speech are context-dependent, it is important to know the context for speech that the client is particularly concerned about, such as employment or social relationships (Becklund-Freidenberg, 2002). As the client begins changing speech and voice patterns, reactions of those close to the client (e.g. family, friends, coworkers, community peers) should be discussed (Andrews, 1999; Dacakis, 2002; Oates & Dacakis, 1983; Pausewang-Gelfer, 1999). For clients concerned with passability, the reactions of strangers are important and these should be recorded either through informal estimate or formal means such as a diary.

While some transgender individuals may seek speech services because they have difficulty passing on the telephone or in face-to-face communication, others are more concerned about reducing a perceived discrepancy between speech and identity. Assessing self-perception relates to the fit that clients feel between their current speech and their felt sense of gender–i.e., how the client feels hearing herself or himself talk. The question of how well speech fits with the client's perception of self may be easy for the client to answer right away, or it may come over time with experimentation, practice, and observation of role models. Both the literature and the clinicians we interviewed discussed the importance of a "good fit" between the speech and the client rather than at-

tempting to conform to an external stereotype of femininity or masculinity (Becklund-Freidenberg, 2002; Oates & Dacakis, 1997). Finding this good fit requires introspection on the client's part and an informed opinion about what is possible.

Clinician's Evaluation

Pitch. While there are several factors that together determine attributions of gender to a speaker, studies suggest that fundamental frequency (F_0) is primary in perception of a speaker as male or female (Byrne et al., 2003; Coleman, 1983; Günzburger, 1993; Wollitzer, 1994). Normative data for male and female F_0 vary across languages and dialects (Elert & Hammarberg, 1991; Graddol & Swann, 1989; Rose, 1991; Tom, 2004). Among English-language speakers, the mean F_0 for non-transgender men and women overlaps from 145-165 Hz (Oates & Dacakis, 1997). Studies of English-speaking transsexual women report that bringing F_0 into this range of overlap may not be sufficient, by itself, to shift the gender perception of listeners. For example, transsexual women with F_0 of 145-160 Hz (i.e., within the "gender-neutral" range for English speakers) are usually judged as male (Spencer, 1988; Wolfe, Ratusnik, Smith, & Northrop, 1990). The primacy of F_0 in perception of a speaker's gender in languages other than English was not discussed in the literature we reviewed.

Speech analysis software such as Kay Elemetrics can be used to measure the average speaking pitch and pitch range across several tasks (Dacakis, 2002; Mount & Salmon, 1988; Soderpalm et al., 2004). Data should be recorded in both hertz and semitones to facilitate clinical evaluation, using one of the readily available conversion tables (Hirano, 1981). The visual display of a software analysis program can provide valuable information for a client about habitual and target average speaking pitches, particularly in the context of discussion about typical male and female speaking pitch ranges in the client's primary language.

In addition to noting fundamental frequency and frequency range, it is useful to note if the pitch is higher (for MTFs) or lower (for FTMs) in a less complex task like reading than in spontaneous conversation. If so, the client may al-

ready be consciously or unconsciously attempting voice feminization or masculinization.

Although anatomy determines the upper and lower limits of an individual's pitch range, there is evidence that F_0 is largely dependent on social context (Hasegawa & Hata, 1995). Ideally, speaking pitch would be evaluated by collecting data in naturalistic situations common in the client's day-to-day life, and also with a variety of conversational partners. While this wider baseline would be informative, it may be impractical or prohibitively expensive to gather data in a public setting.

Intonation. Intonation (sometimes termed "inflection") is also considered important in gender perception, particularly when F_0 is in the "gender-neutral" range of overlap between male and female norms (Becklund-Freidenberg, 2002; Pausewang-Gelfer & Schofield, 2000; Spencer, 1988; Wolfe et al., 1990). In English, women tend to be more variable in intonation than men, generally using more upward glides and avoiding downward glides and level intonation patterns (Challoner, 2000; de Bruin et al., 2000; Gold, 1999; Oates & Dacakis, 1997; Wolfe et al., 1990; Wollitzer, 1994); as intonation varies significantly across languages, this should not be considered a universal norm.

Intonation patterns should be recorded using speech analysis software at the same time that frequency is recorded. The visual display recording can then be viewed with the client, to illustrate patterns associated with gender–for example, repeated and dramatic decrease in pitch at the end of a sentence is typically considered a male speech pattern among English speakers, while variability in intonation is considered a more typically female pattern among English speakers. Exaggerated intonation shifts may be observed in some transgender women trying to mimic non-transgender women (Wollitzer, 1994), and if present these should be pointed out to the client.

It is also useful to make clinical judgments about inflections during speech. Conversation or a sample of reading can be recorded, then played back with both the client and the clinician listening to the vocal inflections. During the subsequent discussion the clinician can assess the acuity of the client's perceptions. If the client is unable to hear what the clinician perceives to be important, the clinician can then give guidance such as, "Listen to how your voice stays flat when you say . . ." or "Listen to how your voice moves around when you say that. That is what we are looking for."

Resonance. In the literature surveyed, the term *resonance* was used to describe three distinct aspects of speech: (a) the effects of the vocal tract on the sound produced by the larynx (formant frequencies), (b) the vocal quality that corresponds to the perception of vibrations in various parts of the body, or (c) the function of the nose as a resonator. There is empirical evidence that vowel formant frequencies significantly influence the perception of English-language speakers as male or female (Coleman, 1983; Mikos & Pausewang-Gelfer, 2001; Pausewang-Gelfer & Mikos, 2005). Measuring the "corner vowels" /i/, /u/, and /a/ may be particularly useful in assessing transgender speech (Mount & Salmon, 1988; Spencer, 1988), as these vowels represent the maximal range of formant frequencies in vowel productions in many languages (Titze, 1997).

Among English-language speakers, vowel formant frequency is estimated at 20% lower in adult men than adult women (Coleman, 1983; Dacakis, 2002; Oates & Dacakis, 1983). The reasons for this are not clear, but a study of physiologically matched English, Hindi, and Mandarin male and female speakers ($N = 40$) concluded that differences in format frequencies are due primarily to cultural and linguistic factors rather than sex-based anatomical differences (Andrianopolous, Darrow, & Chen, 2001).

The role of the other types of "resonance" is less certain. Singers often refer to "chest resonance" as the full, rich sound that is produced in lower notes and accompanied by a feeling of the voice vibrating in the chest; "head resonance" describes a brighter, forward sound that accompanies sensations of the voice ringing or resonating in the mouth, nose, sinuses, or upper part of the head. While some authors suggest that among English-language speakers "chest resonance" is associated with male speech while "head resonance" is associated with female speech (de Bruin et al., 2000; Gold, 1999; Kujawski, 2003; Oates & Dacakis, 1997), there is no empirical evidence that increasing the subjective feeling of "head resonance" or decreasing the subjective feeling of "chest reso-

nance" increases the perception of MTF speakers as female (Dacakis, 2002). Further study is necessary to see if using these perceptions in training voice production produces difference in vowel formant frequencies.

Vocal intensity. Vocal intensity–the loudness of speech–may be measured with a sound level meter. In North America, the meter is usually placed 30 cm from the lips; at this distance, norms are 68-76 dBA for adult males and 68-74 dBA for adult females (Koschkee & Rammage, 1997). Despite the evidence that there is little sex-mediated difference in the loudness of actual speech, in some regions it is a common stereotype that women tend to speak more softly than men, and some clinicians include this speech parameter in assessment and treatment planning (Andrews, 1999; Dacakis, 2002; de Bruin et al., 2000; Günzburger, 1993; Oates & Dacakis, 1983). We recommend objectively measuring intensity if the client reports it as a problem or if the clinician subjectively feels it may be an issue.

Some transgender individuals who are self-conscious about speech may adopt insufficient vocal intensity in an attempt to avoid public attention, or MTFs may speak quietly to try to "soften" the voice (Dacakis, 2002). This can result in difficulty maintaining desired speech characteristics in situations where a higher vocal intensity is needed to counter high environmental noise or to convey intensity of emotion.

Voice quality. In English, most measures of voice quality are not consistently associated with categorization of voice as masculine or feminine (Andrews & Schmidt, 1997). However, "breathiness" is considered a feminine trait among English-language speakers (Becklund-Freidenberg, 2002; Dacakis, 2002; Gold, 1999; Oates & Dacakis, 1997; Wollitzer, 1994).

Voice quality is typically measured subjectively according to the speech professional's acoustic impression, possibly with the use of perceptual rating scales such as the Perceptual Voice Profile (Oates & Russell, 1997). Jitter and shimmer data may be collected by a software acoustic analysis package to support the clinical impression, but these parameters can be hard to measure accurately, requiring a very quiet space, rigid protocols, and finely calibrated equipment. The client should be referred

for a laryngological examination if the voice is judged to be dysphonic.

Articulation. Subjective impression may be made about the quality of articulatory productions. In the literature reviewed, several authors observed that among English-language speakers women tend to articulate more clearly than men but in a light manner, men tend to make harder articulatory contacts and "punch out" their words, men tend to drop final phonemes (e.g., "walkin" instead of "walking"), and men tend to reduce or alter the production of some speech sounds such as voiced "th" (Andrews, 1999; Gold, 1999; Oates & Dacakis, 1983, 1997). The literature includes subjective observations about habitual lip, tongue and jaw positions, without agreement about correlation with gender associations (Günzburger, 1993; Oates & Dacakis, 1983, 1997).

Durational characteristics. Depending on the durational characteristics of the client's primary language, it may be useful for the clinician to observe whether the client sustains voicing through speech sounds, words, and phrases, or uses a more staccato speech style where words and phrases are produced more separately. It has been suggested that in European languages women typically have a longer mean duration of voicing during phrases and isolated words, and linger on occasional vowel sounds (Andrews, 1999; Günzburger, 1993).

Language and discourse. While there are strong social stereotypes about gender norms and language (e.g., use of slang, size modifiers, and tag questions), gender-associated norms of language and discourse are so dependent on an ever-shifting social context that findings from studies done in past decades may not be reflective of current patterns and trends (Becklund-Freidenberg, 2002; Oates & Dacakis, 1983). Additionally, there is strong interplay between gendered language norms and norms relating to culture, class, sexual orientation, and age (Graddol & Swann, 1989; Linville, 1998; Moran, McCloskey, & Cady, 1995; Morris & Brown, 1994), so norms appropriate for one client would not be appropriate for another. If there are habits relating to modifiers, qualifiers, indirect versus direct speaking style, or other elements of language that the client finds discomforting or that the clinician feels may contribute to perceptions that don't fit the client's self-im-

age, we recommend that the clinician offer feedback in these areas.

Rather than attempting to memorize lists of qualifiers or artificially adopt set phrases, we recommend that modification of language and discourse be based on the client's own observations of gender markers in the specific environmental context of concern to the client (e.g., work, home, cultural community, social setting). To facilitate the determination of contextually appropriate speech and voice norms, the client should be encouraged to weigh research findings and the clinician's suggestions against her or his lived experience. Clients with strong beliefs about "appropriate" language may benefit from clinician assistance to compare stereotypical ideas of behaviour to the actual observed behaviour of peers.

Non-verbal communication. Norms relating to posture, gestures, and other non-verbal aspects of communication are strongly influenced by cultural, class, and age norms. Generally, in the dominant culture of North America, maintenance of eye contact, increased smiling, nodding and inclining toward others, increased use of hand and arm gestures, and occasional touching of the listener are associated with feminine communication patterns (Andrews, 1999; Gold, 1999). While it is not within the typical scope of practice of a speech-language pathologist to provide a detailed assessment of non-verbal communication behaviours, anything that is striking to the clinician or to the client should be noted as part of the subjective evaluation.

Subjective Third-Party Evaluation

In some cases it may be helpful to have one or more naïve listeners provide subjective impressions of a recording of the client's speech. This may be useful when clients are particularly concerned with passability, or when clients are unable to appreciate changes that have taken place. For example, one study found that MTF clients did not rate their speech as more feminine following therapy, but observers did (Soderpalm et al., 2004). To be considered "naïve," the listener should not be a speech clinician or student, and should also not be familiar with the client's goals. If passability is the goal, the listener should rate not only the cli-

ent's femininity or masculinity, but should also be asked to judge whether the speaker was male or female.

Assessing Potential for Speech and Voice Change

Clients vary in ability to achieve certain pitches, match a target pitch, and follow models of intonation or articulatory productions (Becklund-Freidenberg, 2002; Byrne et al., 2003; Dacakis, 2000, 2002; Soderpalm et al., 2004; Van Borsel et al., 2000). Using an exploratory diagnostic process helps determine how physically and psychologically easy or difficult it may be to effect change, and gives information about the sort of intervention that may be necessary in therapy. For example, if a client has difficulty matching pitches auditorily, using a visual pitch display will probably be necessary. If the pitch range appears restricted, a lower (MTF) or higher (FTM) frequency pitch target would be more appropriate, and specific exercises to increase vocal range such as Stemple's vocal function exercises (Sabol, Lee, & Stemple, 1995; Stemple, Lee, D'Amico, & Pickup, 1994) should be considered. If the MTF client has a seamless transition into falsetto, some falsetto notes may be available for widening the upper range of vocal inflections.

Speaking Pitch

There are a number of ways to explore average speaking pitch and speaking pitch range.

1. The client glissandos around in the upper (MTF) or lower (FTM) range, without moving into falsetto (MTF), then sustains a pitch and uses it to intone a word and short phrase. This is recorded and then evaluated for quality and ease of phonation. This is repeated several times throughout the range. The client is also asked to intone words and phrases in higher pitches (MTF) or lower pitches (FTM) to ensure there is room for vocal inflections (Kujawski, 2003).
2. An arbitrary target pitch is set by the clinician and the client matches it. Then, choosing pitches above or below that one, they decide on an initial target. It

should be noted that this pitch is for practice purposes only and can be changed at any time.

3. A pitch that is one fourth of an octave above (MTF) or below (FTM) the habitual speaking pitch is set by the clinician and the client matches it. The initial interval in *Auld Lang Syne* or *Here Comes the Bride* can be used to help the client understand the pitch change that is sought.

4. The clinician models a frequency within the lower range of female norms (MTF) or upper range of male norms (FTM) on a visual display in a computer voice analysis program, and the client produces a pitch that stays above (MTF) or below (FTM) it.

5. The client says a phrase in her most feminine (MTF) or his most masculine (FTM) voice.

For MTFs with low pitch, diagnostic therapy should be done to see if facilitation techniques enable higher pitches. Using sounds that facilitate efficient vocal fold vibration such as /m/, /z/, lip trilling, and tongue trilling, the client phonates in a higher pitch, either randomly or matching a pitch set by the clinician. The goal is to produce the sound at the desired pitch without any feeling of strain in the throat, emphasizing a strong feeling of vibrating or buzzing in the front of the face. For FTMs with high pitch, it may be useful to explore facilitation techniques that give sensations of ease and resonance in the lowest register of the voice.

If the client is unable to produce a higher or lower pitch without throat sensation or fatigue, the clinician may want to start with some standard voice therapy exercises to reduce inappropriate habits. Referral to an otolaryngologist may also be indicated.

Inflections

A short sentence is read by the client and examined for its inflectional variation. The target is an inflectional pattern consistent with the gender norms for the client's language. For English-speaking MTFs who are seeking to feminize speech, the goal is an inflectional pattern that is wide but still natural-sounding; for FTM English-speakers seeking to masculinize

speech, the goal is an inflectional pattern that is narrower but not "flat" sounding. If the pattern is consistent with the client's goals relating to feminine or masculine speech norms, this is noted; if not, the clinician can model a more consistent inflectional pattern and the client can copy it. The result is played back for the client to hear the effect. This exercise gives information on the client's ability to hear and model vocal inflections, and also gives the client feedback about how the voice may sound if a different inflectional pattern is adopted.

Other Parameters

Changes to other parameters such as tongue carriage, articulatory productions, vocal quality, and vocal loudness can be considered if either the client or clinician thinks they may be important to address. In the initial session, useful information can be gleaned by exploring a number of speech/voice parameters from the trans-competent clinician's repertoire.

Assisting the Client to Determine Therapeutic Goals

To help the client determine fully informed, considered, and achievable therapeutic goals, it is useful for the clinician to provide a synopsis of the client's baseline speech and voice characteristics, physiologic limitations and estimated potential for change, and an informed professional opinion about the parameters that would be beneficial to address to achieve the client's stated objective (Dacakis, 2002; Hooper, 1985; Neumann et al., 2002b; Oates & Dacakis, 1983, 1997; Pausewang-Gelfer, 1999; Wollitzer, 1994). For example, if an English-speaking MTF client presents with the primary concern that her voice is not perceived as female, it may be appropriate to target a higher fundamental frequency if her habitual speaking pitch is 100 Hz; if her average pitch is higher than 150 Hz, it may be more appropriate to target resonance, inflection, and other speech characteristics that are believed to have a greater influence on gender perception when pitch is above the English-language norms for male speech.

Table 1 summarizes aspects of speech that are associated with sex and gender attribution, and associated English-language norms. Norms

TABLE 1. English-Language Norms of Speech and Voice Associated with Gender

Considered Highly Salient to Gender Attributions		
Element of Speech	Female/Feminine Norms	Male/Masculine Norms
Pitch	Mean =196-224 Hz, range = 145 Hz-275 Hz; higher upper and lower limits of range	Mean = 107-132 Hz, range = 80 Hz-165 Hz
Formant frequencies	Higher	Lower
Intonation	More variable in intonation, more upward glides	More level intonation, more downward glides
Weaker Evidence to Support Role in Gender Attributions		
Element of Speech	Female/Feminine Norms	Male/Masculine Norms
Loudness	68-74 dBA	68-76 dBA
Breathiness	Perceived as mildly breathy, softer speech onsets	Not perceived as breathy, harder speech onsets
Articulation	Clear, light	Forceful onsets; dropped phonemes, reduced use of voiced "th"
Duration	Longer mean duration of phrases and isolated words, lingering on vowels	Staccato speech style

should be considered as a spectrum rather than two isolated poles, to encourage speech professionals and clients to carefully consider therapeutic goals that fit with sense of self.

Assisting the Client to Understand Therapeutic Options

Some transgender individuals have sophisticated knowledge about gender-related speech parameters and therapeutic options, and come to the initial assessment with a clear direction they wish to pursue. Others have no knowledge and expect guidance from a professional. During the initial evaluation it is important to assess the individual's knowledge of speech and voice. Consumer education materials have been developed as part of the Trans Care Project to help promote consistent and accurate information about transgender speech change and treatment options (Davies & Goldberg, 2006). In all cases, care should be taken to ensure that clients understand potential benefits and risks relating to both non-surgical and sur-

gical voice change, and recommendations to prevent vocal fatigue or voice disorder (Dacakis, 2000, 2002; Hooper, 1985; Kaye et al., 1993; Kunachak et al., 2000; Oates & Dacakis, 1997, 1983; Thomas, 2003; Yang et al., 2002).

Because changes to specific acoustic voice characteristics affect numerous perceptual variables, a well-rounded speech treatment plan will target "constellations of related voice characteristics rather than independent acoustic variables" (Wollitzer, 1994, p. 99). For example, raising pitch may increase laryngeal tension and vocal tract constriction, influencing shimmer, jitter, signal-to-noise ratio, and resonance (and thus subjective perceptions of voice quality). For this reason, an optimal speech therapy program should target all parameters of speech, not just those related to pitch.

Preparing for the Process of Speech Modification

Speech feminization or masculinization is a long process requiring considerable work on

the client's part. While therapy outcomes cannot be predetermined, the estimated amount of daily practice time and expected duration of the course of therapy should be discussed, as should the factors that can influence the course of therapy (Byrne et al., 2003). As changing speech requires altering deeply ingrained communication habits and behaviors that can be difficult to modify, it may be useful to use the "Stages of Change" model (Prochaska, DiClemente, & Norcross, 1992; Zimmerman, Olsen, & Bosworth, 2000) or other behavioral change tools to assist in anticipating and addressing barriers to implementing change.

If pitch-changing surgery is sought, there should be discussion of the parameters of speech that may still need work after surgery, such as intonation and format frequency. Clients should also be informed of the estimated healing time involved and the time required to stabilize the new pitch (Dacakis, 2002; Neumann et al., 2004; Wagner et al., 2003).

Treatment Options and Techniques to Feminize or Masculinize Speech and Voice

Non-Surgical Treatment (Speech Therapy)

Speech Therapy Goals

As discussed earlier, we recommend that the clinician assist the client to determine therapeutic goals, recognizing that transgender individuals have diverse identities and objectives regarding feminization or masculinization and that the clinician should not be directive in promoting specific goals. The range of therapeutic goals may include any or all of the following.

Speech assessment, information, and other preparation for speech therapy. Some clients are interested primarily in a speech assessment and a professional opinion on what would be involved in changing elements of speech. Information about therapeutic options can help with decisions regarding the timing of gender transition. One program described in the literature offered three to four introductory sessions that provided information about gender differences in communication, information about vocal hygiene and prevention of voice disorders, and

exercises to increase flexibility of voice production (Dacakis, 2002).

Enhanced observation and awareness of speech patterns of self and others. While transgender individuals are often highly skilled at observing others, practice may be needed to understand, observe, and analyze the specific components of speech (Hooper, 1985).

Changes to speech. Average speaking pitch, pitch range, inflections, formant frequency, breathiness, loudness, articulation, tongue position, language, facial expressions, and gestures may be targeted to feminize or masculinize speech (Bralley et al., 1978; Brown et al., 2000; Dacakis, 2000, 2002; de Bruin et al., 2000; Gold, 1999; Hooper, 1985; Kalra, 1977; Kaye et al., 1993; Kujawski, 2003; Mount & Salmon, 1988; Oates & Dacakis, 1997; Pausewang-Gelfer, 1999; Soderpalm et al., 2004). Specific objectives relating to voice modification depend on what is feasible to produce without strain, what fits with the client's self-image, and how important passability is to the client; some clients may be comfortable with gender-neutral speech, while others will want to aim for a voice that is perceived by listeners as male or female. For clients who are concerned about "fitting in" or about passability, rather than adopting an artificial set of speech norms it is recommended that clients observe communication patterns in their social, cultural, and work environments to develop a context-specific set of norms (Oates & Dacakis, 1997).

Prevention of vocal fatigue. Use of the vocal tract in non-habitual ways can cause strain. Important therapeutic goals are the maintenance of efficient and easy speech, establishing appropriate practice, and informing the client about how best to maintain vocal health (Dacakis, 2000, 2002; Gold, 1999; Kaye et al., 1993; Mount & Salmon, 1988; Oates & Dacakis, 1983, 1997; Soderpalm et al., 2004).

Treatment Format

Traditionally, speech therapy has emphasized one-to-one work to facilitate the personalized intervention necessary to modify and monitor change in target behaviours. However, speech therapy groups–typically comprised of four to six clients–are commonly used to work with specific populations (e.g., individuals

with aphasia, people recovering from traumatic brain injury, clients with fluency disorders). Group therapy can facilitate peer support and encouragement, and reduce self-consciousness that may be experienced when the client is working alone with the therapist.

It has been our experience that both individual and group therapy are important components of transgender speech care. We recommend that both formats be made available, with the option for a client to take part in either or both depending on therapeutic needs and goals.

Components of a transgender speech therapy program that can be done well in a group include:

1. Education and information. Clients undergoing speech feminization or masculinization need to understand how the voice is produced; how physiological differences in male and female voice production system affect the voice and listener perception; physiologic and social norms relating to gender and speech; treatment options, outcomes, and risks; and techniques to prevent strain associated with voice change. While some transgender individuals are extremely well-informed about speech, others have no knowledge or have been exposed to inaccurate information via the internet or peer groups.
2. Discussion. Group format is ideal for participants to share observations, insights, and practical advice. In the *Changing Keys* speech and voice feminization groups developed by the lead author (discussed later in this article), participants have commented on how useful they found these discussions.
3. Speech therapy exercises. There are several advantages to using a group setting to offer those components of a therapy program that are required by all individuals. These would include relaxation exercises, basic exercises in efficient vocal technique, and ear training (using listening exercises to train a heightened perception of differences in speech). For individuals who feel self-conscious about doing speech exercises, participating in a group can have a normalizing effect.

Role-playing is more easily done in a group, and the opportunity to observe others can give valuable insight into participants' own practice. Additionally, the group provides a safe setting to learn listening skills, and to practice observing speech in a way that will not be intrusive in a real-world setting.

The necessary repetition of training exercises can be done in a group as long as the therapist is able to monitor the progress of all the participants and give individual input and feedback as required. The group can be divided into pairs to give practice time in both talking and listening.

Some interventions require one-to-one work with a therapist, including: (a) determining appropriate target pitch, (b) training target pitch if the individual has difficulty matching pitches auditorily, (c) significantly changing individual characteristics associated with "feminine" or "masculine" speech, and (d) individualized, specific input on anything the individual has difficulty understanding or doing in the group setting. Individualized input is especially important in training an efficient voice that is resistant to vocal fatigue or dysphonia.

Length of Treatment Time

Treatment time varies greatly depending on the degree of change sought, the client's vocal abilities, and psychosocial issues. There is no professional consensus on the optimal length of treatment for maximal treatment efficacy. One study reported a modest correlation between the number of therapy sessions and mean pitch achieved at the end of therapy (Dacakis, 2000); however, another reported that client satisfaction was not related to the number of therapy sessions, and that clients tended to become frustrated and discouraged when therapy continued over a long period of time (Soderpalm et al., 2004). It has been our experience that treatment generally ranges from a minimum of 15 hours to a maximum of 1 year of weekly sessions, and that shorter, more intensive treatment times encourage motivation and accommodate changes to life circumstances more readily than prolonged treatment.

Psychosocial adjustment is an important part of changing speech. Participants may require time to get in touch with what sort of voice best matches the person within. This is by necessity a process that takes time and professional input as to what is possible. Many transgender individuals begin with the goal of having a pitch that is unrealistically high (MTF) or low (FTM); only with experimentation and practice will it become apparent that this is probably not achievable, necessary, or even desirable. Additionally, it can take time to feel that an altered voice is an authentic expression of self rather than an artificial "mask." If psychosocial issues are significantly impacting treatment, referral to a trans-competent mental health professional may be useful.

Therapeutic Techniques

In an extensive review of speech literature, we did not find any published protocols for speech therapy with FTMs. We recommend that speech-language pathologists working with FTMs be clear that they are using a trial protocol, and seek client permission to record, evaluate, and publish information on the efficacy of the protocol.

There are numerous published protocols for speech feminizing therapy with MTFs (Andrews, 1999; Becklund-Freidenberg, 2002; de Bruin et al., 2000; Gold, 1999; Hooper, 1985; Kujawski, 2003; Mount & Salmon, 1988; Oates & Dacakis, 1997; Pausewang-Gelfer, 1999). As an example of a local protocol, the *Changing Keys* program–a mix of group and individual therapy–is discussed in Appendix A.

Evaluating the design of treatment protocols. Although treatment protocols must be flexible enough to address each client's goals, physiologic parameters, and psychosocial needs, therapy should be grounded in current knowledge of best clinical practice of speech and voice therapy. In the absence of empirical evidence testing the efficacy of specific techniques to feminize or masculinize speech, we evaluated speech therapy protocols on the basis of *clinical rationale*–a clearly articulated, logical, and valid reason for choosing a specific protocol or technique. On this basis, we feel the following strategies are supportable:

1. Imitation of non-transgender people observed in daily life (de Bruin et al., 2000; Gold, 1999; Hooper, 1985; Kujawski, 2003; Mount & Salmon, 1988; Neumann, 2000b; Oates & Dacakis, 1997). This input from the real world is useful in helping clients develop spontaneous speech habits that "fit" in their particular community.

2. Progressively complex practice while maintaining good voice quality (Hooper, 1985; Kujawski, 2003; Mount & Salmon, 1988; Oates & Dacakis, 1997; Pausewang-Gelfer, 1999). Integration of pitch, pitch range, and inflections is typically done in progressively complex practice (vowels, monosyllabic words, phrases, sentences; reading, answering questions, interactive dialogue). Motor learning theory suggests that, initially, simple behaviours are acquired more easily than complex ones (Kent & Lybolt, 1982). However, behaviours that are to be done together must be learned together.

3. Vocal flexibility exercises to maintain vocal range and voice quality (Pausewang-Gelfer, 1999). Vocal range and flexibility exercises are a standard part of a voice therapy protocol.

4. Motor training (Oates & Dacakis, 1997). As speech is a motor act, input is most useful when it is given at the motor-sensory level. Matching a sensory target (e.g., "Does your voice feel easy or stuck? In the face or in the throat?") is a more effective method of training the desired production than giving verbal instructions such as, "Do this with your jaw" (Titze & Verdolini, in press).

5. Identifying and altering voice qualities when coughing, laughing, and clearing the throat (Andrews, 1999; Dacakis, 2002; de Bruin et al., 2000; Oates & Dacakis, 1997). These vegetative and spontaneous laryngeal functions may be higher or lower in pitch than the client desires and may respond to therapeutic input.

6. Experimentation with a broad range of voice styles (Gold, 1999). Experimentation with a broad range of voice styles, including ones that might be considered far

beyond what the client would actually want to use, expands the range of possibilities, and makes smaller changes–ones the client may actually use–feel less extreme.

Non-Verbal Communication: Facial Expressions, Posture, and Movement

Some transgender individuals are keen observers of non-verbal behavior and are acutely attuned to gendered norms relating to non-verbal communication. Others may require assistance from a speech therapist. While recognizing that non-verbal communication is extremely important, some speech-language pathologists feel unqualified to offer input; others may feel more comfortable doing so. Depending on an individual clinician's expertise in this area and the client's financial resources, options can include:

1. Focusing on strengthening the client's observational skills. Experimentation and observation are more useful than learning and following rigid patterns of behaviour.
2. Offering general feedback on the client's self-defined parameters for change. Based on observation of community peers, the client can identify desired parameters for change, practice these changes in the therapy session, and receive subjective feedback from the clinician. Parameters for change may include smiling, eye contact, facial expressions, posture, and gestures while speaking and listening. Feedback depends on the desired goal (e.g., did the client smile more or less? When?) and also the clinician's subjective sense of whether the change seemed appropriate.
3. Offering general feedback about social conventions relating to masculine or feminine expressions and movement. The client should be informed of the culturally-specific nature of non-verbal communication norms and the limits of the clinician's expertise in this area. It can be helpful to discuss the difference between stereotypes, norms, and observed behavior, and to remind the client to consider the clinician's input in light of their own experience and perspective.

4. Referring to peer support resources. While the level of knowledge about non-verbal communication varies greatly among peer support providers, individual or group peer support may offer experiential insights and an arena for practice. As peer knowledge often has strong currency, it can be important to remind clients to weigh the suggestions of peers against their own experience.
5. Referring to a trans-competent clinician who has training in non-verbal communication. In some regions, workshops specifically for transgender women are available, such as the "Give Voice" program run by Sandy Hirsch in Seattle. Movement coaches in theatre training programs may be able to assist in finding or developing local resources.

Habituation

As with any speech therapy, habituation and generalization of feminized or masculinized communication is both challenging and necessary. There is a profound difference between being able to maintain a pitch change on a prolonged vowel in a clinical setting and sustaining changes throughout speech in everyday life, particularly when making offhand remarks in casual conversation when self-monitoring may not be as vigilant, or when the client is under stress or fatigued (Becklund-Freidenberg, 2002). Strategies to promote carryover into everyday life may include (a) practicing words that are typically part of daily conversation, such as, "Hi," "Bye," "Yes," and "No"; (b) focusing practice of conversational speech on situations or topics related to the client's life; (c) simulating real-life situations that the client feels pose the most difficulty, such as a job interview or interaction in a coffee shop (Goodnow, 2001; Hooper, 1985); (d) experimenting with emotional intensity by practicing sentences expressing joy, sorrow, irritation, and anger; and (e) practicing with the clinician outside the clinic setting, in telephone and in-person interactions.

Follow-Up Sessions

A small study of MTF transsexuals ($N = 10$) reported a significant correlation between a

longer treatment time and stable elevation of pitch over time (Dacakis, 2000). In view of this finding, followup sessions after the initial treatment has finished, or facilitated support groups for ongoing practice, may be important in maintaining change. Clinically supervised followup also provides an excellent opportunity to gather much-needed data about the effectiveness of a protocol over time.

Clinical group or individual followup sessions. There is not yet any empirical evidence regarding the optimum frequency for followup sessions, the optimum content, or the criteria for termination. In the absence of data, we suggest that refresher sessions be initially offered 3 months after treatment and then at 4 to 6 month intervals, or as the clinician and client deem appropriate.

Followup sessions should include a discussion of successes, problems, strategies, and difficulties the client has experienced since the end of therapy; a review of the core exercises of the program (to ensure the client is practicing correctly and to determine if the exercises are still appropriate); and time to address any concerns that have arisen since the end of treatment. Ideally, followup would include re-evaluation of the same parameters measured in the pre-treatment assessment, both to assess the maintenance of the desired changes and also to evaluate the effectiveness of refresher sessions.

If the initial therapy was provided in a group setting, a group setting is a natural forum for refresher sessions. As with group format for initial therapy, group format for refresher work offers valuable opportunities for clients to compare experiences. In our experience this can be most useful and encouraging, especially for those in the early stages of gender transition. Individualized followup may be more appropriate than group format if the client has numerous concerns or unusual concerns that require individual attention, or if the client feels uncomfortable in a group setting.

Client-run speech support groups. Self-help groups are commonly organized for individuals with speech and language disorders such as aphasia and stuttering, and may also be useful for transgender individuals who have completed clinical treatment and are seeking peer support to maintain or strengthen speech changes. Client-run speech groups can provide

motivation to maintain practice, a forum to practice and to share ideas and concerns, and an opportunity to socialize and do specific role-playing. Client-run groups can also foster the client's sense of ownership and control of speech and voice production, rather than feeling dependent on the therapist.

In any self-help group there is a danger that an individual may inappropriately assume a professional clinical role. In a speech group, this could be circumvented by providing group facilitation training to members, having the speech-language pathologist as guest visitor from time to time, and having self-help sessions along with therapist-run refresher sessions.

Modification to Improve Accessibility and Utility to Clients with Access Barriers

Protocols must be flexible enough to address diversity of service needs and issues relating to access. In the transgender speech literature reviewed for this project, there was little discussion of modification to address the needs of clients who have difficulty accessing the typical setting or format of speech service, such as individuals who have speech, hearing, cognitive, or learning disabilities; are not highly fluent in English or are not literate; or are geographically isolated or cannot leave a residential long-term care facility or prison. Without empirical evidence to guide practice, we offer the following suggestions based on our experience providing services to a diverse range of transgender clients.

Distance services. Individuals who are physically unable to attend speech therapy or are awaiting speech therapy services could benefit from an information package available through the mail or internet. This kind of "distance learning program" is currently under development at La Trobe University in Australia (G. Dacakis, personal communication, March 7, 2005). Such a distance learning program could include information on the mechanics of speech and voice production, gendered aspects of speech and voice, tips on observing and listening to conversations of men and women in the client's own community, evaluation of commercial speech training programs available on the Internet, and phonosurgery risks and benefits–similar to the consumer education

materials described earlier (Davies & Goldberg, 2006).

"Telehealth" is increasingly being explored for distance delivery of speech therapy services (Duffy, Werven, & Arons, 1997; Haynes & Kully, 2005; Jessiman, 2003; Mashima et al., 2003; Myers, 2005). Speech therapy cannot be done by telephone or email as therapy requires a comprehensive evaluation, regular monitoring of the client's performance, and specific training input. However, clients can use telephone or email to consult with a clinician and receive general information. Video hookup connecting a rural health unit with an urban speech program can be used to train rural practitioners and to provide a partial level of service to geographically isolated clients.

Multilingual services. For individuals who do not speak the dominant language, a basic information package can be translated into a variety of languages. Interpretation or translation of more in-depth information is challenging in speech services, as the clinician must speak the client's language well enough to be aware of subtleties of inflections, inflectional range, word stress, and semantic and syntactic choices. In cases where the speech therapist and client do not speak the same language, the only direct therapeutic input that could perhaps be given would be in changing the average speaking pitch. SLPs who are multilingual should be encouraged and supported to take trans-specific training, perhaps working in consultation with a more trans-experienced clinician to provide service in the client's primary language.

If the client is partially fluent in the language spoken by the therapist, wishes speech therapy in this language, and will be speaking this language in everyday life, therapy delivered in the client's secondary language can be beneficial as the client has the opportunity of learning more feminine or masculine patterns of speech as she or he acquires the language. For individuals who are only partially fluent in the language spoken by the therapist, the therapeutic process will likely be longer and will require much more individualized input.

Access for individuals with disabilities. Transgender clients with speech or hearing disabilities who are able to attend speech therapy sessions may find great benefit from using visual input during speech therapy. This has been used with good success with other populations–for example, palotography and ultrasound have been used in work with people who are hard of hearing and have phonological disorders (Bernhardt, Bacsfalvi, Gick, Radanov, & Williams, 2005; Bernhardt, Gick, Bacsfalvi, & Adler-Bock, 2005; Bernhardt, Gick, Bacsfalvi, & Ashdown, 2003). For transgender clients, there are a number of software programs that record fundamental frequency and allow the creation of a "model wave." The clinician could record a desired average speaking pitch or an intonation pattern and the client could then use the visual input to copy it; alternatively, the clinician could record the lowest (MTF) or highest (FTM) desirable frequency and the client could use the visual input to keep the speaking pitch above (MTF) or below (FTM) this line.

If a client has cognitive or learning disabilities, depending on the nature of the disability it may be useful to include a loved one or care aid in the therapeutic process. This person could help the client establish a regular practice schedule and give input to the exercises, under the guidance of the speech-language pathologist. A different format may be useful for the client who has difficulty processing the information necessary to change speech habits. Rather than using an approach that requires introspection (e.g., "How does that sound? Am I feeling my voice in my face?"), the clinician may be more directive in determining which exercises would be most useful and could be done appropriately by the client; the clinician and client together would draw up a practice schedule, and the client would simply practise the motor movements outlined. Individualized attention is likely more effective than group work to provide the client with more intensive input. To be successful, this kind of format would require regular clinical intervention and support outside the therapy room.

Self-Guided Speech Feminization

There are a variety of videos, websites, and other materials available for self-guided speech feminization. We cannot comment on the efficacy of these materials, but we are concerned that (a) many are not produced by speech professionals, and (b) there are risks associated with attempting to change voice without pro-

fessional assistance. Speech feminization or masculinization involves substantial changes in habitual production and so has the potential to cause a voice disorder or aggravate an existing one. We strongly recommend that anyone seeking to feminize or masculinize speech first be assessed by a speech-language pathologist, that a speech clinician be involved in monitoring progress, and that a speech clinician be consulted if there are any symptoms of vocal fatigue or negative changes to vocal quality. Additionally, we recommend that consumers be cautious of any materials promoting a rigid set of speech norms, as speech is too individually and culturally driven to be guided solely by a set of generic rules.

Surgical Treatment: Pitch-Elevating Surgery

Surgical techniques to elevate pitch are based on the physiological components of pitch:

$$F_0 = (\text{vibrating length of vocal folds}/2) \times (\text{mean vocal fold tension/vocal fold density})^{1/2}$$

(Kunachak et al., 2000). Fundamental frequency can thus be raised by shortening the folds, decreasing the total mass of the folds, or by increasing the tension of the folds (Neumann et al., 2002a; Pickuth et al., 2000; Yang et al., 2002). Surgical techniques to achieve this include (a) anterior commissure advancement, (b) creation of an anterior vocal web, (c) cricothyroid approximation, (d) induction of scarring along the vocal folds, or (e) reduction of vocal folds by intracordal steroid injection, laser evaporation of the vocal fold, or composite reduction or reconstruction of the vocal fold (Brown et al., 2000; Donald, 1982; Kunachak et al., 2000; Neumann et al., 2002a, 2002b; Orloff, 2000; Pickuth et al., 2000; Thomas, 2005; Wagner et al., 2003; Yang et al., 2003). To date, we feel that cricothyroid approximation is the only method that has been assessed with sufficient rigor to be considered a viable treatment option (Brown et al., 2000; de Jong, 2003; Neumann et al., 2002b; Oates & Dacakis, 1997; Soderpalm et al., 2004; Wagner et al., 2003; Yang et al., 2002).

Thyroid chondroplasty may be performed at the same time as vocal surgery to reduce the laryngeal prominence (Brown et al., 2000; Kunachak et al., 2000; Neumann et al., 2002a; Neumann & Welzel, 2004; Wagner et al., 2003). This is a cosmetic procedure that should not affect the voice.

Risk-Benefit Ratio of Pitch-Elevating Surgery

There is a paucity of outcome data for pitch-elevating surgery, particularly longitudinal data to monitor outcomes over time, but there are concerns that the outcome is highly variable and that initial results tend to diminish over time (Koufman, n.d.). In addition, reported negative effects of pitch-elevating surgery include compromised voice quality, diminished vocal loudness, adverse impact on swallowing or breathing, sore throat, wound infection, and scarring (Brown et al., 2000; Dacakis, 2002; Koufman, n.d.; Lawrence, 2004; Oates & Dacakis, 1997; Neumann & Welzel, 2004; Petty, 2004; Thomas, 2003, 2005; Wagner et al., 2003; Yang et al., 2002).

In general, professional opinion is mixed about pitch-elevating surgery, with some clinicians stating that it is not a viable treatment option (Andrews, 1999; Koufman, n.d.), and others recommending that surgery be considered a treatment of last resort for MTFs who have not experienced satisfactory increase in voice pitch following speech therapy (Lawrence, 2004; Oates & Dacakis, 1997; Wagner et al., 2003). Other clinicians are more enthusiastic about pitch-elevating surgery, suggesting that surgery can protect the voice from damage caused by strain to elevate pitch through non-surgical means (Brown et al., 2000; Neumann & Welzel, 2004; Thomas, 2005; Yang et al., 2002). While there are clear risks of vocal surgery and the decision to pursue vocal surgery should be carefully considered, we feel the decision about risk-benefit ratio and preferred technique is best left to the patient, with input from both a trans-experienced surgeon and a trans-experienced speech-language pathologist.

Pre-Surgical Assessment

In addition to the standard screening performed prior to any surgery, such as assessment

for risks relating to anesthesia and infection, assessment prior to pitch-elevating surgery should include anatomical and functional assessment of the larynx, subjective auditory assessment by both a speech-language pathologist and the surgeon, and computer recording and analysis of pitch range (Neumann & Welzel, 2004; Yang et al., 2002). Care should be taken to ensure the patient understands the risks and anticipated outcome of the technique that will be used.

After finding that some subjects have strained and unnaturally elevated voices following surgery, attributed to habitually speaking at an artificially elevated pitch for sustained periods of time prior to surgery, one surgical group reported testing for ability to phonate at a pitch within the masculine range as part of pre-operative consultation (Yang et al., 2002). Clients who are unable to do this were felt to have the equivalent of a muscle tension dysphonia, and were referred for preoperative voice therapy to recover the ability to produce relaxed phonation.

Estrogen is associated with risk for deep vein thrombosis and pulmonary embolism (Dahl, Feldman, Goldberg, & Jaberi, 2006). If the patient will be immobilized for a prolonged period during or following pitch-elevating surgery, consultation with the prescribing physician is necessary to discuss the advisability of tapering estrogen use before surgery (Bowman & Goldberg, 2006).

Smoking increases the risk of complications from anesthetic and impairs healing, and there is evidence that smoking following pitch-elevating surgery can negatively impact on voice quality and pitch (Wagner et al., 2003). Patients should be informed of the risks associated with smoking and of smoking cessation resources, and strongly encouraged to not smoke prior to or immediately following surgery.

Post-Surgical Care

Post-surgical care depends on the specific surgical technique employed. The surgeon should review aftercare instructions with the patient as part of informed consent prior to surgery. The surgeon should also be accessible for questions relating to post-operative complications. The patient's local primary care provider

should consult with the surgeon to determine appropriate followup.

Immediately following surgery, temporarily decreased pitch, diminished voice quality, and edema were commonly reported in the literature, with spontaneous recovery in most cases. Less common complications that required medical intervention included mild emphysema, neck abscess, negative response to the sutures or plates used in cricothyroid approximation (requiring removal of the material), and loosening of the sutures used in cricothyroid approximation, requiring further surgery (Neumann & Welzel, 2004; Wagner et al., 2003).

For most pitch-elevating surgical techniques, it is recommended that patients not use the voice at all for one to seven days after surgery, and then use the voice cautiously until any discomfort due to postoperative edema has passed (Brown et al., 2000; Neumann & Welzel, 2004; Orloff, 2000). For the more invasive combined thyroid cartilage and vocal fold reduction, two weeks vocal rest is suggested (Kunachak et al., 2000). Following cricothyroid approximation, steam inhalation may be recommended to hydrate and lubricate the vocal cords, to promote healing (Brown et al., 2000).

Speech therapy is recommended following surgery to help the patient adapt to and stabilize the new voice (Neumann & Welzel, 2004; Wagner et al., 2003). If pitch-elevating surgery was performed before other components of speech had been satisfactorily altered, resonance, articulation, and other components may also need to be addressed via speech therapy (Dacakis, 2002; Neumann & Welzel, 2004).

OUTCOME EVALUATION

Evaluation is a continuous process in speech care, with various informal and formal methods that may be used to determine progress and shape the direction of future treatment (Hooper, 1985; Mount & Salmon, 1988; Soderpalm et al., 2004). We recommend that at minimum the baseline assessment be repeated immediately following the end of therapy, and post-treatment data compared to pre-treatment findings. If the client is agreeable to long-term followup,

given the paucity of long-term data it would be ideal for the client to be re-evaluated 6 months, 1 year, 5 years, and 10 years after treatment; for transient clients this degree of followup may not be possible, but even data at 6 and 12 months would be a significant contribution to the field.

In addition to re-evaluating objective and subjective impressions of speech as per the initial assessment, we recommend that clients be invited to evaluate satisfaction with the outcome of treatment (Bralley et al., 1978; Byrne et al., 2003; Kujawski, 2003; Mount & Salmon, 1988; Pausewang-Gelfer, 1999; Soderpalm et al., 2004). Several trans-specific studies reported a discrepancy between subjective satisfaction and objective or subjective changes to voice, with some clients pleased with the outcome despite minimal objective change, and others perceiving less change than that reported by naïve listeners (Bralley et al., 1978; Dacakis, 2000; Soderpalm et al., 2004; Spencer, 1988). This raises the question of what is considered a "successful" intervention. Some authors interpreted the findings as evidence that clients cannot accurately judge "successful" voice change (Bralley et al., 1978); others felt that discrepancy between subjective satisfaction and objective changes to voice may have stemmed from increased passability in other dimensions (e.g., from hormones or electrolysis), a good working relationship with the clinician, or satisfaction with the availability or cost of the service (Dacakis, 2000). It is also possible that client goals shifted over time or that clients' goals for speech did not center on pitch or passability, the typical measures employed for evaluation.

Earlier we suggested that the primary goal of speech feminization or masculinization is to decrease discrepancy between speech and the client's sense of self; it is, we think, highly relevant to ask about the client's feelings about "fit" between speech and identity as part of post-treatment assessment, even if the client did not explicitly state this as an objective at the start of treatment (Soderpalm et al., 2004). Another relevant measure might be the client's report of being able to use the desired speech consistently in the settings that were identified as the targets at the outset of therapy (Kujawski, 2003; Pausewang-Gelfer, 1999).

We also encourage clinicians to invite clients to evaluate the quality of service provided.

In some cases the clients may be very satisfied with the clinician's performance despite minimal changes to speech; whatever the outcome, clients may have constructive critical feedback to offer the clinician regarding the ability to relate information clearly and accurately, sensitivity and respect in communication, overall familiarity with transgender concerns, efficient coordination with other clinicians, and accessibility of treatment.

If long-term followup is feasible, in addition to the standard re-evaluation of speech it may be useful to inquire about clients' continuation of therapeutic exercises and symptoms of vocal fatigue (Dacakis, 2000; Soderpalm et al., 2004). Three of five participants in one long-term study reported that after speech therapy had ended, they attempted further change through techniques learned from the internet or in books (Soderpalm et al., 2004). It may be useful to offer consumer education regarding risk prevention and ongoing monitoring to clients who are interested in pursuing techniques outside a professional setting.

CONCLUDING REMARKS

Speech and voice change services for transgender individuals are an important element of transgender care. Treatments to feminize and masculinize speech and voice can help reduce discomfort for the dysphoric client, improving confidence and comfort in day-to-day communication interactions. As self-directed speech and voice change can result in vocal strain we strongly recommend that professional speech services be included in transgender health programs and made available not only to transsexuals but also crossdressers, bi-gendered people, androgynous people, and others who desire to feminize or masculinize their speech and voice.

There is currently an insufficient data base to determine evidence-based best protocols in transgender speech and voice modification. We hope that this article will both assist speech professionals in adapting and modifying existing protocols to address a client's individual needs, and also stimulate interest in evaluation of practice protocols for MTFs and FTMs. Further research in this area is strongly recommended.

NOTE

1. Published transgender speech research focuses on transsexual women, with only a few studies involving male crossdressers or female-to-male transsexuals. In this document we use "male-to-female" (MTF) broadly unless otherwise noted, to describe a spectrum of people who were assigned "male" at birth and who wish to feminize or de-masculinize their speech (including male crossdressers, transsexual women, and bi-gendered or androgynous people born male). Similarly, "female-to-male" (FTM) refers to people who were assigned "female" at birth and who wish to masculinize or de-feminize their speech. This breadth of terminology is used to promote inclusion of non-transsexual clients who may seek speech feminization or masculinization services.

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APPENDIX. The *Changing Keys* Program

Changing Keys (CK) is an English-language speech feminization program offered in Vancouver, British Columbia, Canada. CK was created by a speech-language pathologist (Shelagh Davies) as part of the Transgender Health Program's services. The program consists of (a) a one-hour individual speech and voice evaluation at the start of the program, (b) weekly two-hour speech and voice therapy group sessions, for seven weeks, (c) individualized sessions midway through the seven weeks, (d) speech therapy exercises to be done between groups ("homework"), (e) a one-hour individual speech and voice evaluation at the end of the program, and (f) a refresher session held 3 to 4 months after the course has ended. CK is held at a multidisciplinary inner city community health centre that serves large numbers of transgender clients and houses the Transgender Health Program and a transgender peer support group.

The program is limited to six self-identified transgender women who want to feminize their voice, don't have coverage for speech therapy through Extended Health or other benefits, can commit to coming to all of the sessions and doing practice sessions between groups, feel comfortable working on voice in a group setting, and are able to read and speak comfortably in English (individual speech therapy is recommended for clients who are only partially fluent in English, to allow more clinician attention). It is not necessary that participants be living as women, be taking hormones, or have had surgery. Participants are asked to present as women or gender-neutral at the therapy sessions, as this is felt to facilitate practice of feminine voice.

The program is subsidized by the Vancouver Coastal Health Authority, a health governance body responsible for delivery of health services in the Vancouver-Coast region of British Columbia, to make it possible for low-income transgender women to participate. Participants are asked to pay what they feel they can afford within a sliding scale of $0-$100 for the entire program. This funding structure was key in making the program accessible as there are high rates of poverty among transgender women (Goldberg et al., 2003).

APPLICATION PROCEDURE AND CLIENT SCREENING

CK is advertised extensively by notices and posters to service providers who work with transgender women, announcements in community peer support groups, and online announcements to community mailing lists. Interested participants are asked to apply to the Transgender Health Program by providing contact information and answering seven questions relating to eligibility:

1. What is your goal for taking part in Changing Keys?
2. This pilot is restricted to people who self-identify as transgender women/male-to-female. Does this fit for you?
3. This pilot is restricted to people who don't have coverage for speech therapy through Extended Health or other benefits. Do you have benefits that pay for speech therapy? If so, we recommend you use those benefits to pay for private sessions.

4. Have you read over the dates, and can you commit to coming to all the sessions?
5. What are your preferred times for the pre- and post-group assessment?
6. Are you comfortable listening to information about voice and doing practice exercises with other transgender women in a group?
7. Are you able to read and speak comfortably in English? If not, please contact the Transgender Health Program to discuss options. (The Transgender Health Program can explore possible referral to a multilingual speech therapist in private practice, or arrange funded interpretation service for individualized sessions with an English-speaking speech therapist.)

PROGRAM STRUCTURE

Initial Assessment

The assessment provides an opportunity to evaluate the client's current speech and voice production habits, determine how well the speech matches the inner sense of self, consider what changes would be beneficial, and evaluate how easy or difficult the changes would be. Speech and voice parameters assessed include average speaking pitch, speaking pitch range, impression of vocal inflectional patterns, and voice quality. If vocal loudness subjectively appears to be outside normal female range it is objectively evaluated by measuring the average, maximum and minimum speaking loudness. Speech and voice are assessed in oral reading, picture description, and spontaneous conversation. Discrepancies of parameters among tasks are noted. The assessment is audiotaped so it can be reviewed at the end of the program and compared with the follow-up evaluation.

A subjective evaluation is also done. The client describes three specific things she would like to change about her speech and voice or three situations in which she would like to sound more feminine. She also fills in a questionnaire describing how her current speech and voice affect her life.

The client is asked to identify real-life situations–ranging from easy to difficult–in which she can practice generalizing what was learned in the sessions. This helps her try things out while still having the support of the group. It also allows participants to take ownership of the techniques as they are learning them and can be a powerful motivator to continue practice.

The assessment includes trial therapy to determine how easily the client is able to make changes in her speech and voice. Parameters assessed may include producing voice at a higher pitch, varying

vocal inflections, changing voice quality, and modifying characteristics of articulation.

At the end of the assessment the results are discussed with the client, and together the client and the therapist establish goals for specific therapy. The therapy process is explained to the client, the expected commitment is described, and any questions about the therapy program are answered. The client should leave the evaluation with a clear idea of what changes are possible and useful, and have a sense of the processes involved.

Weekly Sessions

Six 2-hour group sessions are held weekly. Sessions are divided into four parts: (a) checking in on previous week's practice, observation and carry-over activities–what worked, what didn't, and what needs to be modified in group exercises or the individual's practice, (b) voice training, with the goals of producing an easy, resonant voice at the target pitch and generalizing it into speech of increasing complexity, (c) exercises directed at a specific topic, such as increasing vocal inflections, and (d) information and discussion: e.g., pitch-raising surgery, gender markers in communication.

Individualized Sessions

Halfway through the program there are 30-minute individual sessions with each participant. These are used to give one-to-one input into particular areas of difficulty and to modify exercises to suit each client. For example, if the client has difficulty sustaining the voice at a target pitch, specific voice training is given or a more suitable pitch is used. These sessions are often client-driven, with the client providing the focus for the session.

Homework

As this is a short, intensive program, participants are expected to do substantial practice between sessions. Although homework requires substantial commitment, clients are often highly motivated and diligent in practice. Homework consists of three parts:

1. Basic vocal training exercises. These exercises are taught the first day of therapy and are to be done for 10 minutes twice a day. Instructions are written in the course manual and recorded on a CD or tape.
2. Weekly topics of practice. These include specific practice of the speech parameters discussed in the weekly therapy session, such as transferring a higher speaking pitch into different real life situations (e.g., asking for a

transfer on a bus or answering the phone), using wider vocal inflections, and being an active listener.

3. Observations. Becoming familiar with gendered differences in communication is essential to making changes, but unstructured observation can be overwhelming and ineffective. Each week, participants are asked to observe a specific aspect of women's speech. For example, questions relating to inflection may include: How does a woman's voice move around during speech? How are inflections different among women? Do inflections vary with the age of the speaker, the speaking situation, how the woman may be feeling emotionally, her conversational partner? Other topics have included: Do women laugh or smile at different times than men? How do women take turns in conversation? What do women do when they are listening? What is it about speech that makes it sound feminine or masculine?

Final Assessment

The parameters measured in the initial assessment are re-measured and the client again completes the subjective evaluation form. The pre- and post- measurements and the tape recordings are compared and changes noted. Suggestions for modification and continuation of practice are discussed. The client's input about the course is sought.

Refresher Session

A 2 hour refresher session is held 3 to 4 months after the completion of the program. Participants bring a completed self-evaluation questionnaire and vocal parameters are reassessed. The basic exercises of the program are reviewed and there is time to discuss successes and challenges of using their new voice in the real world. This session serves as both a motivator for continued practice and an opportunity for the clinician to provide guidance on difficulties experienced by the client.

VOICE TRAINING

One of the aims of the Changing Keys program is to develop the production of a higher speaking pitch range that is efficient and easy to produce–a common goal of most course participants. The protocol used is based on the Lessac Marsden Resonant Voice Therapy (LMRVT) program, developed by Katherine Verdolini (Titze & Verdolini, in press).

Verdolini developed this therapy protocol for treating voice disorders, using input from both traditional singing and speaking voice pedagogy and current concepts in voice science and psychology. Although the protocol was not developed specifically to train transgender women, the twin focuses of ease and forward resonance sensations train efficient voice production that helps protect the vocal folds from damage. The forward focus may also help increase vowel formants, helping the voice to be perceived as female (Becklund-Freidenberg, 2002).

The core exercise program is taught in the first session and includes stretching, relaxing exercises, and producing the voice at a target pitch. Specific sounds that have been shown to encourage efficient vocal fold vibration and maximize forward resonance sensations are used to train the higher pitch. Voice training takes approximately 60 minutes in the first session, and then 20-30 minutes in subsequent sessions. Participants are instructed on how to monitor their practice. Difficulties that occur in practice, such as throat tightness or effortful production, are addressed in subsequent sessions and individual instruction is given as necessary.

Core Exercise Program

Relaxation

We begin with standard general relaxation exercises to relax the head and neck area, jaw, tongue, face, and mid-body respiratory muscles; additional exercises may be suggested for individual participants as needed. A goal during this time is to increase general awareness of how the mind and body feel at this particular point in this particular day: tired or rested, anxious or calm, focused or scattered, tight shoulders, breath-holding, etc.

Facilitating Production in the Upper Pitch Range

Using a voiced bilabial fricative ("raspberry") or a tongue trill (Spanish "r") the clients glide the voice around in the middle to upper pitch range. This technique is used in both voice therapy and singing pedagogy and has been described in Joseph Stemple's Vocal Function Exercises (Sabol et al., 1995; Stemple et al., 1994). According to Stemple, going to the end ranges of the voice has a similar effect as stretching a muscle to end range; the exercise facilitates ease and efficiency in the middle ranges. For our purposes, we are exploring the sensations of producing a higher-pitched voice easily and efficiently.

Sensations during the exercise are carefully monitored. The voice should feel resonant and easy in the throat at all pitches. If the throat begins to tighten in the higher pitches, voice therapy facilitation techniques are used. The goal is to produce a resonant, easy sound throughout the upper pitch range. Going into falsetto register is fine in this exercise. Although the target speaking pitch should be in modal rather than falsetto register, some transsexual women are able to use the falsetto occasionally when using a wide pitch range, and this can sound acceptable as long as it is well blended with the rest of the voice.

After this voice training program, the voice should not feel tired: it should feel warmed up and ready to use. If the voice begins to feel tired or if there is throat sensation, this is a signal that some intervention needs to be done in the way of modifying voice production technique. The exercise of gliding around in the upper part of the voice is then expanded into vowels.

Producing a Higher-Pitched Voice

Raising the average speaking pitch is a common goal among group participants, and is supported in the literature and by experienced clinicians. However, there is a wide range of clinical opinion about how to train a higher pitched voice and what pitch is optimal to target. Most clinicians agree that a goal for English-language speakers is to train a voice that is somewhere in the "middle range" between nontransgender English-speaking men's and women's voices–between 155 and 185 Hz. However, transsexual women frequently prefer a higher target pitch, so some experimentation may be necessary to establish what is both possible and optimal.

Once the body and voice have been "warmed up" using the previous exercises, we start the voice on a 2 to 3 second /m/ at F3 or 185 Hz. Because this is a group program, we use one pitch for practice; in one-to-one sessions it would be possible to choose a target pitch that matches a client's individual goals and existing vocal capacity. F3 (185 Hz) is a training pitch, not a target for average speaking pitch: it is higher than what most transsexual women will use in everyday speech. However, it is beneficial for participants to experience the sensations of producing a voice without strain that is much higher than their accustomed pitch. If this pitch produces strain for any participants, we lower the target pitch to one that can be produced with feelings of ease. A number of CK participants have commented that F3 (185 Hz) is too low and they use a higher one when doing this practice at home.

In accordance with the LMRVT protocol, clients are asked to monitor two things as they practice: Does the voice feel easy to produce, and does the sound feel like it is going up and out (or does it feel like it is getting caught–in the throat or anywhere else)? If the client does not have these sensations of ease, we do specific facilitation exercises. We then use the LMRVT protocol to expand this sensation of easy, resonant voice production into sounds and words. The goal is to generalize this easy, resonant, higher-pitched voice, first in structured speech and then into spontaneous speech in increasingly difficult situations.

Extending the Higher-Pitched Voice into Speech

Generalizing the use of higher pitch follows standard speech and voice therapy protocols, starting with easier tasks and gradually working into more challenging ones. Speech tasks are those that are common in speech and voice therapy, progressing from single words to short phrases, greetings, short oral reading tasks, picture descriptions, and structured questions and answers. While the voice is first produced at only one pitch (chanting), as soon as possible regular speech inflections are introduced.

Maintaining elevated pitch in a resonant voice that feels easy to produce is a vocally athletic task; the client is sustaining a pitch that the vocal mechanism was not constructed to produce. It must be done efficiently, both to sound like natural female speech and also to avoid the development of voice problems. Transferring this easy, resonant, efficient method of producing a higher pitched voice into everyday life is both challenging and important.

In doing these exercises the client begins to develop a physical sense of how she can produce a feminine voice and an aural sense of what it sounds like. It will necessarily sound very different from her male voice. This altered perception can be quite disorienting and it is essential to have a time period of adjustment to play around with what is possible and what may be the best fit with the participant's personality and sense of self.

As pitch work progresses, the average speaking pitch is checked periodically. There is no expectation that the average pitch will remain at the target training pitch of 185 Hz, but if it drops below 155 Hz there needs to be further work producing a higher voice in sustained sounds. At this point, practice in vocal inflections is begun, along with practice in producing the higher pitches.

Vocal Inflections

This phase of treatment begins with a discussion about English-language vocal inflections and associations with "femininity" and "masculinity," to determine clients' perceptions and existing knowledge. In feminizing vocal inflections among English-language speakers the goals are to decrease flat inflections, increase inflectional range, and increase vocal flexibility (the amount the voice moves around within a phrase, rather than the extent of pitch excursions).

As with other topics, we start work on vocal inflections by listening. For this purpose I use a tape of eight speakers describing a picture. The speakers are males and females of different ages and cultural backgrounds. We listen specifically to the vocal inflections used by the speakers, paying particular attention to different patterns used by men and women. Clients are also instructed to listen to conversations in their community and pay particular attention to vocal inflections.

Individuals who have habitually used little vocal inflection in speech often find that expanding the inflectional range feels embarrassing and artificial. In exploring vocal inflectional range clients are encouraged to go "over the top," far beyond what they would realistically use in speech. This can have a freeing effect and also allow the client to experiment without being restricted by what would be considered appropriate; refinements happen at a later stage of the program.

Exercises initially use limited vocabulary so the client must use a range of vocal inflections to convey meaning and emotional expression. As in any standard speech therapy protocol, the complexity of the task increases as the person's performance improves. Carryover into everyday life can be facilitated by choosing a specific phrase or sentence that the client uses frequently.

Work with inflections continues throughout the program, as this is an important aspect of speech and also one that usually takes time to change and habituate. As with pitch, clients frequently report they need to monitor these vocal parameters constantly during conversation. For this reason it is useful in the early stages of therapy to choose specific practice times when the client will be conscious of speech and voice production and use the techniques learned in therapy. The client is asked to begin with a person or place that is "comfortable" or "easy," and gradually extend the practice rather than confronting very difficult situations right away. Building confidence in the new speech and voice is an important part of the therapy program.

Vocal Quality: Breathy versus Resonant Speech

Among English-language speakers, mildly breathy speech is associated with feminine voice. Many transgender women have already adopted a breathy voice by the time they seek therapy. Mild breathiness also has the advantage of automatically modifying hard attacks on consonants and vowels, giving speech a softer quality. However there is a contradiction between resonant voice, which is the focus of CK, and breathy voice. A breathy quality is produced with less efficiency so the voice may be more prone to vocal fatigue and not be heard against background noise.

This contradiction is discussed as part of the group sessions and participants generally report intuitively finding their own ways of dealing with voice quality issues. For participants experiencing throat pain or vocal fatigue, the resonant voice works best as it lasts longer and is louder; other participants feel more comfortable with a breathier quality as it better conveys the impression they want. Some participants adopt a resonant voice in loud situations and a breathier one in quiet ones. This ability to change vocal qualities requires good control over voice production and may be a reasonable goal for some transgender women who are concerned about voice quality issues.

Vocal Loudness

CK participants typically struggle more with achieving adequate loudness in a noisy environment than an inappropriately loud speaking voice. Using a resonant voice increases loudness in an efficient and effective way, and can be trained specifically to be used where there is a lot of background noise. If loudness is a concern for participants, the group does a vocal exercise involving repetition of a phrase with differing levels of loudness. The goal is to increase the loudness by increasing resonance sensation, not by pushing from the throat. If the resonant voice is judged as too loud, there are specific training exercises that reduce loudness while maintaining forward focus; as discussed earlier, adopting a breathy quality will automatically reduce loudness.

Motor Speech Characteristics

Hard onsets on initial vowels and consonants are generally considered a masculine speech characteristic among English-language speakers (Andrews, 1999; Gold, 1999). Adopting a breathy voice quality may be enough to soften the onsets so they are no longer perceived as abrupt; conversely, softening

the onsets may give a softer, breathier quality to the voice. As it is easier to modify a general feature of voice production than to specifically change each production of an initial phoneme, paying attention to voice quality may be the easier way to achieve a cluster of goals. We discuss articulation as we are experimenting with voice quality so participants are aware of the interaction.

Encouraging more connected speech production can also help reduce the abrupt interruptions in speech flow that hard onsets create. This technique is similar to vocal prolongation used in fluency therapy; however, in this instance, the speech rate is maintained at a normal or near normal level.

In working with articulation we listen to examples of "feminine" and "masculine" patterns or listen to the speech of a group participant who already uses connected speech and gentle onsets. The group then repeats specific phrases or words, to get the feeling of that kind of production. Due to time constraints the group generally does not spend a significant length of time on articulation; if it is of particular concern to an individual, intervention may take place in a private session.

Language and Discourse Pragmatics

Although language choice and speaker-listener interaction during conversation are influenced by many factors other than gender, there is a body of work in the sociolinguistics and popular literature specific to gender influences on communication. We discuss this literature in CK, both to give a point of reference and to stimulate debate and observation skills. Participants then see whether or not what is written in textbooks is actually happening in their own communities. This encourages context-specific norms that are flexible and can easily be adapted to suit the client's personality and situation. Also, since word choice and interaction in conversation vary greatly from person to person and situation to situation, training specific behaviours is too rigid. The participants are encouraged to consider what women and men in their own communities are doing, and to determine which patterns feel comfortable to them.

Topics discussed include in this phase of the program include: (a) the use of qualifiers and tags, such as "isn't it," "sort of," "kind of," "don't you think," "I think that," and "could you possibly," (b) sharing difficulties and problems as a means of establishing connection, (c) confirming the speaker's emotional messages, (d) making comments about another woman's clothing or appearance, (e) direct versus indirect confrontation, (f) listening styles and behaviors, and (g) cues relating to conversational turn-taking and interruptions.

Role playing is typically used for therapy exercises that target language choice and discourse pragmatics. For example, if the purpose of the exercise was to use words that convey more emotional content, the participants could describe a picture, focusing on its emotional impact. For exercises focusing on development of active listening skills, participants may practice in pairs; the listener is instructed to encourage the speaker and actively show that she is paying attention, while the speaker must seek the listener's opinion and involvement in the conversation. If the goal was to make a casual connection with another woman in a public place, two participants could role-play having a casual conversation in a public setting, such as chatting in a lineup at a cashier, trying on clothes, or waiting at a bus stop. To facilitate carryover, participants are asked to practice the issue addressed in the group in real-world situations, as homework.

PRELIMINARY EVALUATION OF CHANGING KEYS

CK is a new program, and evaluation of its effectiveness is still in the early stages. Preliminary results suggest a range of outcomes, with some participants experiencing more significant change than others. On a self-evaluation questionnaire most participants noted positive changes in their speech and voice, and expressed increased confidence when speaking. Further evaluation is needed to assess the program's effectiveness and refine the CK protocol.