

Gerontechnology, Viagra, and other PDE-5 inhibitors

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J. Hillman. Gerontechnology, Viagra, and other PDE-5 inhibitors. Gerontechnology 2009; 8(4):197-208; doi: 10.4017/gt.2009.08.04.002.00 Studies worldwide suggest that the majority of men maintain moderate to high levels of sexual interest throughout the lifespan, but often report some degree of sexual dysfunction. This review is designed to provide essential information regarding erectile dysfunction (ED) and its treatment with Viagra (sildenafil) and other phosphodiesterase-5 (PDE-5) inhibitors (i.e., Levitra and Cialis). The prevalence and etiology of ED, in comparison to the normal changes associated with aging, are presented. Misconceptions about Viagra and other PDE-5 inhibitors, as well as these drugs' mechanism of action, clinical efficacy, side-effects, and contraindications are discussed, and the impact of these male enhancement drugs upon sexual partners, their possible use among women, and the influence of extensive product marketing campaigns are addressed. The potential for gerontechnology to assist men with treatment of ED via health education, e-health information, and concurrent sex therapy is highlighted. The overarching goal is to assist men and their partners in making informed decisions about appropriate performance enhancement drug use, as well as avoiding its potential misuse.

Keywords: Gerontechnology, sexual behavior, erectile dysfunction, older adults

Studies from a variety of countries and cultures indicate that most adults sustain moderate to high levels of interest in sexual activity throughout the life span^{1,2} and that most men view sexuality as an important part of their lives^{3,4}. Factors that diminish participation in sexual activity among men with advancing age include the presence of a willing or able partner and impaired health status or problems such as erectile disorder or dysfunction (i.e., ED)^{1,5}. Additional studies show that when unable to engage in or perform sexual activities including penetrative sex, men can experience guilt, anger, a decline in self-esteem, and even clinical depression⁶. Relationships with partners also may suffer negative consequences. Interestingly, however, less than 50% of the men given a prescription for Viagra, the now infamous male performance enhancing drug with demonstrated safety and efficacy for treatment of ED in large scale clinical trials⁷, will refill their prescription⁸.

Gerontechnology is an interdisciplinary field devoted to the support of active aging, in which individuals throughout their life span can enjoy a sustained quality of life and continued participation in social, economic, cultural, spiritual, and civic affairs⁹. Within this context, in which aging is viewed as an interpersonal process involving colleagues, neighbors, friends, and family members, one could also conclude that gerontechnology can help provide aging adults with continued participation in an active romantic or sex life. This paper is designed to review the current information available regarding Viagra (sildenafil) and other phosphodiesterase-5 (PDE-5) inhibitors including Levitra (vardenfil) and Cialis (tadalafil) for treatment of ED, and articulate the role that gerontechnology can play regarding these drugs' most effective use as well as the avoidance of their potential misuse.

The first portion of this review is designed to present general information about the preva-

lence and etiology of ED, as well as the medicalization of typical changes associated with the male sexual response cycle in relation to aging. Subsequent sections will discuss Viagra and other PDE-5 inhibitors in terms of their mechanism of action, clinical efficacy, side-effects, and contraindications, as well as some popular but critically important misconceptions about these pharmaceutical agents as a treatment for ED. For example, simply popping a Viagra pill alone does not guarantee an erection; sexual arousal and often additional, direct physical stimulation is required^{10, 11}. Additional information will be presented regarding the impact of these male enhancement drugs upon typically overlooked sexual partners (including women and male partners of men who have sex with men), increased risk factors for HIV/AIDS and other STDs, their possible use among women, differences among brand name, generic, and black-market varieties, and the impact of extensive product marketing campaigns.

The final portion of this paper is designed to highlight the unique opportunity of gerontechnology to assist older men with treatment of ED via the promotion of health education regarding ED and PDE-5 inhibitors such as Viagra among medical professionals and individual patients and among affected couples. The use of sex therapy as a beneficial co-therapy and the availability and type of e-health information also will be discussed. In sum, the intersection between various disciplines within gerontology (for instance, clinical and social psychology; medicine) and technology (for instance biochemistry; information communication) will be identified as a potential agent of change in order to help men better identify and treat ED, as opposed to normal, typical changes associated with aging, if they so choose.

ERECTYLE DYSFUNCTION

Previously referred to as impotence, the currently used and presumably less pejorative term ED has been defined by the U.S. National Institutes of Health as "an inability of the male to achieve an erect penis as part of the

overall multifaceted process of male sexual function¹². A similar definition is advanced by the UK's Sexual Dysfunction Association, in which ED represents "the persistent or recurrent inability to attain or maintain an erection sufficient to complete sexual intercourse or another chosen sexual activity"¹³. The central focus of these definitions appears to be upon a man's inability to maintain or sustain an erection sufficient enough to engage in some kind of penetrative sexual activity.

Estimates suggest that ED affects more than 150 million men worldwide, including European nations, the United States, Asian, and developing countries^{3,14,15}. By midlife 40% of all men are expected to experience ED¹⁶, whereas by age 70 up to 67% may experience ED¹⁷. Additional reviews suggest that the vast majority of men with ED never seek or receive a diagnosis of ED¹⁸. To complicate matters further, few men or their health care providers broach the topic on a regular basis^{5,11}.

A variety of factors and health conditions, including prostate enlargement or cancer, depression, anxiety, substance abuse, diabetes and other endocrine disorders, heart disease (for instance, high blood pressure; hardening of the arteries; stroke), Parkinson's disease, spinal cord or other physical injuries, and prescription and over-the-counter drugs' side-effects, among others, can lead to or exacerbate ED¹⁹. This list of health-related concerns is certainly not meant to be exhaustive and increased levels of overall stress, fatigue, and distraction can also play a significant role. It also is important to note the complicated etiology of ED in many cases. For example, a man might be clinically depressed and as a result develop ED. Yet, when his depression is resolved successfully with a prescribed selective serotonin reuptake inhibitor (SSRI) such as Prozac, he finds that an unwanted side-effect of his medication itself is ED²⁰.

It also is essential to note that ED is not a normal or typical part of aging, but that vari-

ous changes in the male sexual response are normal within the context of increased age. For example, natural changes with aging can include andropause in which men tend to produce less testosterone with age, and overall decreases in vascularization occur throughout the body with age⁵. By the time men reach age 40, more than 90% experience at least one erectile failure. Such transient inability to attain or sustain an erection represents a normal part of aging, and not a sign of ED¹⁰.

With increased age also comes a typically longer response time between sexual arousal and the development of an erection, a typically increased need for physical stimulation to produce an erection, erections that are less firm than those produced in early adulthood, a longer time period required to reach orgasm, less intense ejaculations, and a longer refractory period¹¹. One unfortunate aspect of widespread Viagra use and other male performance enhancing drugs is that the typical changes associated with the slowed (but still equally pleasurable and enjoyable) sexual response cycle with age is its medicalization. In medicalization, a previous non-medical problem or normative physiological change (i.e., slower sexual response or occasional problems obtaining or sustaining an erection with age) becomes viewed and treated exclusively as an illness or disorder²¹.

VIAGRA AND OTHER PDE-5 INHIBITORS

In the early 1990's, treatment of ED was typically invasive, relatively expensive, and carried the risk of significant long-term side-effects with only limited efficacy. Treatment options included injections directly into the base of the penis, surgical implants, and externally applied vacuum pumps¹². Viagra, the first non-invasive (oral) treatment for ED was introduced by Pfizer in 1998. Initially developed for the treatment of angina or chest pain, Viagra failed to reduce chest pain but was surreptitiously discovered to increase blood flow to the penis and hence significantly increase the likelihood of an erection.

Viagra, as well as the later introduced Levitra and Cialis, all work by inhibiting the body's PDE-5 enzyme. A primary function of the PDE-5 enzyme is to metabolize or break down the neurotransmitter cyclic guanosine monophosphate (cyclic GMP), which helps relax smooth muscle tissue. When PDE-5 is inhibited, more cyclic GMP remains available in the body which causes the walls of smooth muscle tissue, including arterial blood vessels, to relax and expand. With PDE-5 located primarily in the nose, skin, and penis, blockage of PDE-5 leads to an increase in cyclic GMP and related blood flow to those areas, leading to an increased likelihood of erection. With Viagra, men are typically instructed to take the 'little blue pill' approximately one hour before intending to engage in sexual activity with the expectation that an erection can be obtained within the next four hours⁸.

Levitra was introduced next by Bayer in 2003 as a more selective PDE-5 enzyme inhibitor requiring a smaller dose of medication when compared to Viagra. Erections can sometimes be obtained within 30 minutes²², and users typically do not have dietary restrictions as cautioned with Viagra (Fatty foods and alcohol can slow the absorption of Viagra into the bloodstream⁸). Cialis was brought to the market shortly after in 2003, and this PDE-5 inhibitor from Lilly offers an extended half-life when compared to its competitors. Specifically, a man who ingests Cialis has a 36 hour window in which the drug remains in his blood stream long enough to help obtain an erection. Thus, Cialis is sometimes referred to as the "weekend [sex] pill"^{23,24}.

So, which PDE-5 inhibitor is best? Although this question is complex and truly answered by individual examination, diagnosis, and consultation with a trained health care professional, some facts are available for general consideration. Viagra has been on the market for more than a decade, with long-term data available regarding its efficacy and overall safety, whereas Cialis is the newest to

market and does not offer the same wealth of empirical data. Levitra requires a lower dose than Viagra, and can be effective for men who have achieved only limited success with Viagra. Although Cialis offers the longest window of action for obtaining an erection, allowing for greater spontaneity in the initiation of sexual activity, the lengthiest terminal half life of this PDE-5 inhibitor also means that any side-effects also are likely to last longer²⁴. Similarly, side-effects from Levitra may persist longer than those experienced with Viagra. A recent meta-analysis of clinical trials among the three available PDE-5 inhibitors taken at their maximum recommended dosages revealed that Viagra, Levitra, and Cialis each demonstrated significant clinical efficacy in improving erectile function when compared to placebo²³. However, not all men in all trials with these medications were able to achieve an erection; they were highly effective with most men *on average*.

Similarly, both large scale clinical trials^{7,23} and smaller clinical practice studies of Viagra²⁵ indicate that Viagra improved erections by 71% to 95%. Closer examination of the results, however, reveal that men with ED with minimal dysfunction, who could occasionally have erections firm enough for penetration, had a significantly better response to the drug than men with more moderate or severe ED who had partial or no erections. In addition, men who had their prostate surgically removed did not respond as well to PDE-5 inhibitors, although some men who had the surgery in conjunction with a nerve-sparing procedure had greater success achieving an erection with treatment (40%)²⁵. Overall, the greater the severity of ED, irrespective of its underlying etiology, the less likely the desired response to treatment with the drug. Not surprisingly, the more severe the ED, the less likely the patient was to continue treatment with Viagra²⁵.

Additional factors that may account for the fact that less than half of all men refill their prescription for PDE-5 inhibitors such as

Viagra include general disappointment with the effects, feelings that treatment is 'unnatural', attempting to achieve an erection too soon after ingestion, having insufficient arousal or physical stimulation, and the experience or fear of side-effects^{7,26}. Identified side-effects among the PDE-5 inhibitors are similar, including headache, stuffy or runny nose, flushing, nausea, muscle aches, photosensitivity, vertigo, and visual disturbances (for instance, blue or green tinted vision)²³. In some men, the incidence of such side-effects may diminish with use over time⁸.

Men taking PDE-5 inhibitors are advised to seek medical help immediately if they experience a sudden loss of vision or hearing, a painful erection or one that lasts for more than four hours (i.e., priapism), heart palpitations, chest pain, or breathing difficulties. Various reports exist of men suffering heart attacks while using Viagra and other PDE-5 inhibitors⁷, but researchers caution that statistically similar numbers of men suffer heart attacks during sexual activity without the use of the medications. Although rare, such adverse effects, and even fear of them, can be disconcerting. Contraindications for use of this class of drugs include the presence of heart disease, recent stroke or heart attack, and high or low blood pressure. Men taking nitroglycerine or other nitrate based medications also are advised to avoid PDE-5 inhibitors²⁶.

CORRECTING MYTHS AND MISCONCEPTIONS

Misconceptions about use of Viagra and other PDE-5 inhibitors for male performance appear common²⁷, and can lead to lower clinical efficacy, frustration or discomfort, and even potentially dangerous or fatal outcomes. For example, many men and women are unaware that Viagra, Levitra, and Cialis have no (i.e., zero) impact whatsoever on sexual desire⁷. In other words, these PDE-5 inhibitors are not aphrodisiacs in and of themselves. A man must first become sexually aroused, which causes his brain to release nitric oxide from specialized cells. In turn, this nitric oxide causes the for-

mation of cyclic GMP. Only after the man's sexual arousal is great enough to initiate the cascade of nitric oxide to the formation of sufficient amounts of cGMP will the PDE-5 inhibitors help allow the blood vessels in the penis to relax and become filled with blood, causing an erection. Thus, if a man has low sexual desire or interest, Viagra and the other PDE-5 inhibitors are essentially rendered ineffective.

Even when a man who takes Viagra or other PDE-5s drugs becomes sexually aroused, additional physical stimulation, for a relatively long period of time when compared to previous sexual encounters before the experience of ED, may be required for the production of an erection. Because many health care providers fail to relay this vital information about the drug's method of action, requiring heightened emotional or psychological sexual arousal as well as direct stimulation of the penis in many cases, many consumers may become frustrated or disillusioned¹⁰. Pfizer itself recommends that men try Viagra up to four different times before deciding to abandon use of the drug⁸.

The quality of an erection associated with male enhancement performing drugs also differs from that produced prior to the time a man experienced ED. Erections produced with PDE-5 inhibitors are generally not as firm as the erections men typically experience in young adulthood. In other words, the erections produced with the assistance of Viagra and other PDE-5 inhibitors typically become firm enough to engage in intercourse, but they are not the 'rock hard' erections that many men (or their partners) might expect when taking the drugs.

Another misconception with dangerous and even fatal consequences is that Viagra and other enhancement drugs provide protection against sexually transmitted diseases including HIV/AIDS. Understanding that PDE-5 inhibitors provide no protection whatsoever against STDs is particularly important for men and women over the age

of 50, who typically do not see themselves as susceptible to infection⁵. Because older adults are typically less familiar with HIV, less likely to have their health care providers talk to them about HIV, less likely to use condoms due to decreased fears of pregnancy, and more susceptible to HIV per exposure due to age related declines in their immune systems, some researchers suspect that increased numbers of HIV infection among older adults can be linked, to some extent, with the use of PDE-5 inhibitors^{5,11}.

Unfortunately, studies suggest that the recreational use of PDE-5 inhibitors among men who have sex with men (MSM) in urban cities is increasingly common, and is associated with a greater likelihood of unprotected intercourse, illicit drug use, diagnosis of an STD in the past year, and sex with multiple partners²⁸. All of these aforementioned activities represent increased risk factors for contracting HIV/AIDS. Although such studies provide vital information about increased risk factors among certain segments of the population, it is important to note that virtually no data exists regarding prevalence or attitudes toward ED among aging gay and bisexual men, much less the use of PDE-5 inhibitors among MSM who are in long-term committed or monogamous relationships. Although some qualitative studies suggest that aging gay men face considerable social pressure to maintain a more youthful physical appearance and consistent level of sexual functioning²⁹, it is essential not to generalize these emergent trends regarding recreational PDE-5 use and high risk behaviors among promiscuous MSM in US urban centers members to the entire MSM, gay, or male bisexual community worldwide.

Another misconception is that men without ED who take Viagra and other PDE-5 inhibitors will heighten their sexual prowess, experience firmer erections, or avoid premature ejaculation. For men with normal erectile function, the recreational use of PDE-5 inhibitors does not produce any of these effects. Rather, the likely result of

recreational use of these drugs is the development of a headache or becoming flushed. Taking above the maximum recommended dose of PDE-5 inhibitors in hopes of 'extreme enhancement' or even a more pronounced therapeutic effect also appears ineffective⁷; the result appears to be even longer lasting side-effects. Thus, the use of Viagra and related male enhancement drugs among otherwise healthy men with normal erectile function for 'extreme enhancement' or partying is certainly ill-advised.

IMPACT UPON PARTNERS

A vital, typically overlooked aspect of PDE-5 use is that of male users' partners. Efficacy studies typically involve heterosexual couples and suggest that female partners generally concur with their male partners' and physicians' ratings of the drugs' effectiveness⁷. However, little is known regarding female and male *partners' perceptions* of the drug and its effects within the context of their own experience or relationships. Qualitative analyses of older women's interview responses regarding ED and Viagra reveal recurrent themes including the desire to expand the focus to male and female sexual pleasure, a sense of sexual obligation in long-term relationships with men, the unfortunate equation of sexuality with masculinity, and continued surprise about the prominence of sexuality in Western culture³¹.

Many older women interviewed about Viagra use mentioned that if the drug was not obtained in consultation with them, as the primary partner, many felt angry or obligated to engage in sexual intercourse when it was no longer that important to them or their sense of the relationship³¹. These comments are consistent with general advisories for older women to communicate openly with their male partners about their feelings when Viagra or other PDE-5 inhibitors are introduced into the relationship, and for men and women to employ additional foreplay, lubricants, and a slower pace if sexual intercourse has not been a typical part of their sexual relationship to avoid discomfort⁵.

Still other women expressed frustration when their male partner expected them to provide additional physical stimulation of the penis to achieve an erection, particularly when they had become accustomed to greater cuddling and non-genital foreplay during the untreated periods of ED³¹. Yet other women were thrilled with the resultant changes in their partner's ability to engage in intercourse, as well as their sense that their male partners felt more positive about themselves. In sum, it appears that female partners have both positive and negative responses to Viagra as a treatment for ED, and that communicating clear expectations for both emotional and physical responses and expectations between male and female partners is essential for a more positive outcome. In essence, sexual intercourse or activity with or without Viagra does not occur in a vacuum; it occurs within the context of a relationship.

VIAGRA USE AMONG WOMEN

A recent area of exploration is the use of PDE-5 inhibitors in the treatment of sexual dysfunction among women. Phosphodiesterase type enzymes can be found in the smooth muscle of a woman's clitoris, and there is some evidence that cyclic GMP plays a similar role in sexual arousal for both men and women³². Despite these similarities, earlier controlled studies examining the efficacy of Viagra as a treatment for sexual arousal disorder among women provided negative results, Pfizer stopped seeking FDA approval in the US for its use with women³³.

Because many women are also adversely affected by the sexual side-effects of various medications, including SSRIs such as Prozac for the treatment of clinical depression, additional trials were conducted to examine whether Viagra could alleviate some of those negative sexual side-effects including inability to reach orgasm. Although the study size was small, including less than 50 premenopausal women, clear efficacy was demonstrated for the ability of Viagra to increase the women's ability to reach orgasm

when compared to a placebo³⁴. Thus, Viagra was effective in offsetting the sexual side effects of the women's antidepressant SSRI. Women in both the treatment and placebo groups had no difference in their level of depression, although those treated with Viagra did report minimal side-effects such as headache, flushing, and upset stomach.

In sum, although Viagra and other PDE-5 drugs do not appear helpful in the treatment of general sexual dysfunction or arousal disorder among women, their use may be beneficial in the amelioration of negative sexual side-effects caused by other medications. Many individuals discontinue their use of certain medications due to unpleasant sexual side-effects, so the development of useful alternatives that allow women (and men) to better tolerate such drugs can only be beneficial. Additional research is required to examine the potential use of each PDE-5 drug, including Levitra and Cialis, more carefully among more women.

DRUG OPTIONS AND MARKETING

Another confounding factor in the treatment of ED with Viagra and related medications is the ability of many men (and their partners) to obtain the drug. Individual factors include ease of purchase, cost, and quality. Viagra and the other PDE-5 inhibitors can be obtained only by prescription in some countries (for instance, the UK and the USA), but can be readily purchased over-the-counter in others (for instance, Brazil). Even in countries that require a prescription for purchase at a pharmacy, some people turn readily to internet pharmacies or other sources to obtain the medication. The approximate cost per pill of PDE-5 inhibitors at their maximum recommended individual dose is between US \$18 and \$19 for Viagra, Levitra, and Cialis. An additional concern exists regarding the presence of generic, knock off, or black-market version, which happen to cost significantly less. Although generic or non brand name drugs are expected to be of identical content and produced with similar levels of quality control as their brand name cousins,

studies of confiscated drugs from domestic households, including those labeled as Viagra and Levitra, suggest that up to 25% of knock off or black market drugs deviate significantly from the expected content or concentration³⁶. Many such off market drugs for ED also come in nearly identical packaging that is quite difficult to identify as counterfeit. 'Herbal' or 'natural' forms of Viagra also fail to contain the necessary active chemical ingredients, and may introduce their own series of adverse or side-effects.

The mass marketing of Viagra and other PDE-5 inhibitors, with budgets approaching one million US dollars, and the formation of a 'medical market' itself presents interesting subjects for analysis. One primary concern relevant for gerontechnology is that in a free market consumers are expected to be informed about the products available, be aware of differences in product quality, have inherent bargaining power, and have the freedom to purchase what they desire. In a medical market, these assumptions are typically violated³⁶. Advertisers typically play upon men's fears about ED and associated perceived failures (for instance, inability to have an erection 'on demand' either automatically or by strength of one's will) to please a stereotypically heterosexual partner. Academic symposia, including published journal supplements, are even likely to be funded by the very pharmaceutical companies who produce these drugs, offering what could easily be construed as a conflict of interest³⁷.

Direct-to-consumer advertising of these male performance enhancing drugs only available by prescription in certain markets (for instance, the USA) also provides inherent challenges in the ability of potential consumers to arrive at the medically appropriate decision to seek treatment³⁷. Male patients may be more likely to breach the subject with their health care provider, but physicians may then spend most of their time with that patient explaining why that advertised medication is not an appropri-

ate choice for them. In contrast, men (and women) who purchase PDE-5 inhibitors via the internet or over-the-counter, without the benefit of a medical exam and consultation, may inadvertently miss a valuable opportunity to detect and treat a serious, underlying cause for ED such as prostate cancer or diabetes.

Advertisements for Viagra and other brand name PDE-5 inhibitors, which boast annual marketing budgets approaching hundreds of millions of U.S. dollars annually, also tend to portray healthy sexual activity as a significant source of male prowess and identity. Linking Viagra with male spokespeople including presidential candidates and professional athletes in soccer, baseball, and race car driving as well as 'ordinary' men fosters stereotypes and inappropriate expectations that the ability to engage in heterosexual intercourse is inexorably linked to a man's value and worth. Such advertising also promotes misconceptions that even normal, occasional difficulties with an erection represents ED, a purely medical disorder that can afflict even the young, healthy, rich, and famous, and thus certainly the average man. The focus of these advertisements appears exclusively upon a singular, apparently malfunctioning body part rather than the status of an entire person, much less the emotional and dynamic interaction between two people^{10,37}. These drugs also are portrayed as the only viable solution to ED, which typically represents a symptom of a more complex, underlying health or relationship problem.

OPTIMAL TREATMENT OUTCOMES

Advertisements for male enhancing drugs virtually always fail to mention that optimal treatment outcomes are more likely to occur when men with ED receive both pharmaceutical agents and couples based sex therapy^{38,39}. Specifically, treatment of ED with both Viagra and sex therapy has been shown to provide increased erectile function and marital satisfaction when compared to treatment with Viagra alone⁴⁰. Relapse prevention also appears to be enhanced when

treatment with a PDE-5 inhibitor is coupled with sex therapy. With the help of a trained therapist, men and their partners can become educated about positive, realistic expectations regarding the sexual response cycle of each partner, both with and without the use of drug enhancement. Therapists can also employ cognitive-behavioral techniques to help both partners view sexual activity as occurring within the context of a relationship rather than an isolated physical event revolving entirely around the ability to produce and sustain an erect penis.

In sex therapy, men and their partners can be helped to learn that periodic erectile failure, experienced both with and without the use of Viagra and other PDE-5 medications, is natural and to be expected. Once both partners have realistic expectations and view occasional disruptions and changes in the sexual response cycle as merely variations rather than cause for anxiety or alarm, they can be helped to plan for flexible and variable options in an expanded repertoire of sexual activity including intimacy, eroticism, and mutual and self-stimulation. Men with ED can also use Viagra and other male enhancement drugs as an aid to masturbation. Experimenting with self-stimulation both with and without these drugs can help men regain a sense of confidence that can then transfer to sexual expression with a partner. Viewing a partner as a source of enjoyment and various forms of pleasure rather than a simple demand for an erection also is advised. Such an expanded perception of realistic and enjoyable sexual activity lends itself to enhanced relapse prevention of ED¹⁰.

Even if men with ED do not seek out formal sex therapy in combination with PDE-5 treatment, general education about the sexual response cycle alone in relation to increasing age delivered through formal workshops and even simple written materials appears to significantly increase the likelihood of help seeking behavior, communication among partners, and increased sexual satisfaction^{23,41}. Physicians, other health care

providers, sex educators, and even advertisers can be advised to include access to at least written material in conjunction with PDE-5 use. For health care providers who feel they do not have sufficient time or the personal inclination to discuss such matters at length with their male patients, results from these studies suggest that offering written materials to their patients would provide at least some benefit. Certainly, a primary goal is to encourage physicians and other health care providers to garner some level of comfort in discussing sexual activity regularly with their male and female patients^{11,19}.

THE ROLE OF GERONTECHNOLOGY

Another popular source of information regarding health information, including ED and PDE-5 inhibitors, is the internet⁴². This form of technology allows individuals who may feel otherwise embarrassed or anxious to find health information about potentially sensitive topics, at any time of day or night, often in the privacy of their own homes⁴³. Various populations, including older adults and aging 'Baby Boomers' in North America, have a great interest in obtaining health related information⁴⁴. In the US, for example, more adults seek e-health information per day than those who visit their doctor in person⁴⁵.

To complicate matters further, the quality and accuracy of available e-health information is limited^{42,46}. A myriad of internet sources, with various levels of quality, exist for information regarding ED and PDE-5 inhibitors including articles from academic journals, postings from national and international health organizations (for instance, the World Health Organization; the US Federal Drug Association), educational institutions, paid advertisements, other organizational and private web sites, social networking sites, blogs, list-serves, chat rooms, and even YouTube.com.

Despite the variability in the accuracy of e-health information, not all citizens have equal access to internet technology. In de-

veloping countries approximately 2% of the populace are internet users, whereas approximately 33% of the populace, on average, in economically developed countries are internet users⁴⁷. And, within the context of economically privileged countries such as the United States and European nations, studies indicate that adults who are elderly, with limited economic resources, with a lower level of education, immigrants, refugees, unemployed, minority group members, or female are significantly less likely to have internet access.

In addition, simply having a physical internet connection does not translate into the assimilation of accurate health information. Many older adults with internet access in their own homes find that their use of this technology is limited due to gender expectations (for instance, men are better using computers than women), lack of experience or confidence, problems with software or hardware, or competition for the use of the computer from younger members of the household⁴². It also appears that older adults, particularly those who are unfamiliar with the internet, are significantly more likely to utilize this technology to access and learn to sort through and identify more accurate sources of e-health information under the initial guidance of a readily available, in-person, identified expert⁴⁸. Young or middle-aged adult children, other relatives, adept peers, librarians, social workers, and counselors, among others, can serve as such an informal expert.

CONCLUSION

An overarching, potential problem with the widespread use of Viagra and other such male enhancement drugs (along with their mass advertising) is the implicit--or explicit--expectation that penetrative sex or intercourse is the only valid type of sexual activity among partners. In other words, if a man can not have an erection firm enough for penetration, his ability or right to engage in sexual activity becomes null and void, or is at least considered substandard. Within the

context of such exclusive, unrealistic expectations for automatic arousal and associated penetrative sex, a man's sense of masculinity and even self worth certainly may be at risk. In some instances, community-living men feigned that they had no knowledge of ED and options for its treatment (for instance, Viagra), related to fears that making such a confession would damage their sense of masculinity²⁷.

It also is important to note that some men in study samples have expressed sadness²⁷, anger, and frustration in relation to what they perceive as society's medicalization of sex, coupled with the typically unrealistic expectation that penetrative intercourse must be achieved "at any cost-- at any age"⁴⁹. Similarly, other reports indicate that some men feel as though they have been robbed of the opportunity or choice to age naturally⁵, and

fully enjoy other types of sexual activity⁴⁹. Although PDE-5 inhibitor use, including Viagra, Levitra, and Cialis, is associated with significant clinical efficacy and safety in the treatment of ED, its use and avoidance of its potential misuse, can be guided in part by various aspects of gerontechnology.

The various subdisciplines of the field, including clinical and social psychology, medicine, and communication sciences can work in consort to help educate men and women across the life span about the true nature of ED as well as methods to learn about and begin to assess available treatment options. It appears essential to help men and their partners understand and appreciate potentially positive changes in sexuality with aging. As noted by one older male participant in a recent study, "I suppose it's like a good wine, [for me sex] improves with age"⁴⁹.

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