The role of the sexual partner in managing erectile dysfunction

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Abstract | Erectile dysfunction (ED) has detrimental social and psychological effects on the quality of life of affected individuals and their sexual partners. When medical intervention is introduced to treat ED, physicians, nurses, and clinical educators should consider this disorder as a shared health problem for the men with ED and their sexual partners. New therapeutics such as phosphodiesterase-5 inhibitors improve erectile function in affected men, and the ultimate goal of medical intervention for ED should be achievement of a satisfactory sex life for couples engaged sexual relationships. Sexual partners of men with ED have an important role in its management and improvement in quality of sex life; therefore, they should be involved in assessment of, diagnosis, education, counselling, and choice of therapy. This sexual-partner-engaged approach might assist treatment and rehabilitation, helping the couples affected by ED to achieve a high-quality sex life.

Erectile dysfunction (ED) is a common problem affecting >150 million men worldwide; this figure is expected to double by 2025 (REF. 1). ED has biological, psychological, and social effects on the quality of life (QOL) of affected individuals and their sexual partners. Several studies have provided evidence that ED can cause frustration, anxiety, and depression for couples, potentially resulting in separation and/or divorce[2–6]. The WHO defines sexual health as a state of physical, emotional, mental, and social well-being in relation to sexuality, ED has, therefore, become a measurable health disorder, which requires medical and public health interventions.

One aspect of medical intervention is the development of effective drugs to treat ED, and phosphodiesterase-5 inhibitors (PDE5is) have proven to be the first-line therapy of choice[7]. Appropriate therapy using a PDE5i can restore erectile function and improve social and family relationships. Unfortunately, withdrawal from PDE5i treatment is high (48.9%); the main reason for discontinuing therapy has been reported to be ineffective treatment (36%); however, 9.3% of men report relationship or interpersonal issues to be the reason for withdrawal[8]. Another aspect of medical intervention is identification of the risk factors that potentially contribute to ED development and interfere with compliance to the therapeutic regime. These risk factors include unhealthy lifestyle, drug use, chronic diseases (such as diabetes and coronary heart disease), psychological problems, and unstable marital or sexual relationships[9]. A good understanding of these risk factors will help clinicians to choose appropriate treatment approaches relevant to the individual with ED. A multidisciplinary, collaborative approach, including andrologists, educational programmes, and psychological counselling as well as urologists can provide assistance in order to mitigate some of these risk factors and improve therapeutic outcomes. However, even if a functional erection is acquired by oral medication, satisfactory sexual activity from the partner's perspective might not be achieved. The results of one study demonstrated that the satisfaction rates of men treated with sildenafil were: 50% very satisfied, 22% satisfied, and 14% somewhat satisfied for the patients; but only 22%, 22%, and 14%, respectively, for the patients' sexual partners. The satisfaction rate was significantly lower for the partners than for the men with ED (P<0.01) and some patients (13%) withdrew from treatment owing to unsatisfactory outcomes[10]. Restoration of erectile function and re-establishment of a satisfactory sex life are two different milestones in successful treatment of ED. When a satisfactory sex life is not achieved, patients might discontinue treatment or reject further PDE5i therapy.

A significant correlation between female sexual function and male erectile function has been reported (P < 0.01), based on scores from the Female Sexual Function Index (FSFI) and the International Index of Erectile Function (IIEF)[11]. Women who had partners who were affected by ED scored lower on FSFI than women whose partners did not have ED. Among the women whose partners were reported to have mild to moderate ED (15.0%), 42.9% had sexual difficulties and the odds ratio of the risk factors associated with female sexual difficulty in the aspects of arousal, orgasm,

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Key points

- Erectile dysfunction (ED) is a common sexual health problem affecting >150 million men worldwide
- ED is a shared sexual disorder for both the men with ED and their sexual partners, but this fact is not well understood by affected couples or treating physicians
- The relationship between the patient with ED and his sexual partner should be comprehensively assessed
- Lack of active involvement of the partner in current medical treatment might contribute to a low recovery from, and unsatisfactory rehabilitation of ED
- An indispensable role for the sexual partner exists in the assessment of, diagnosis, education, counselling, and choice of therapy for ED
- The sexual-partner-engaged approach might assist couples affected by ED to achieve a high-quality sex life and social life

sexual satisfaction, and sexual pain were relatively high (2.5–3.3).

Interestingly, reports exist indicating that men with ED are unlikely to discontinue medication or withdraw from assistance programmes when their sexual partners are actively involved in the treatment regime[8,12]. Thus, a sexual-partner-engaged approach to treatment might improve outcomes for ED treatment. The involvement of sexual partners in the assessment, diagnosis, education, counselling, choice of therapy, rehabilitation, and follow-up assessment of men with ED — if this approach is not against the patient's wish — is suggested (FIG. 1). However, current guidelines in the Diagnostic and Statistical Manual of Mental Disorders from the American Psychiatric Association do not specify a role for a sexual partner in the clinical intervention of ED, focusing specifically on the individuals that are affected by ED[13]. Thus, a knowledge gap exists in clinical practice with regards to treating ED, and the proposed sexual-partner-engaged assistance programme could be a critical aspect of ED treatment. This Review highlights evidence for the effect of ED on sexual partners and vice versa, emphasizing the important role of the sexual partner in managing ED.

The effect of ED on sexual partners

Partners might be aware of the problem first

According to the European Association of Urology guidelines on male sexual dysfunction, ED is a persistent inability to attain and maintain an erection sufficient to allow satisfactory intercourse[14]. That ED has a subjective component is generally accepted, as the acknowledgement of the presence of ED mainly depends on the perspective of the individuals and/or their sexual partners. Subtle changes in sexual behaviour or discordance during intercourse can be noticed and raised by sexual partners before they are acknowledged by the patients. One reason for partners raising the issue earlier might be that the affected men tend to avoid or ignore the problem, or are unwilling to accept the reduction in their sexual ability. In a survey on the marital happiness of middle-aged Chinese couples, more of the women (52%) than the men (25%) believed that their sexual behaviour as a couple was not perfect, and 43% of the women reported that they suffered from sexual discordance caused by ED, compared with <30% of men (P<0.01). Of the respondents, >80% of couples indicated that sexual satisfaction had direct influence on their marital happiness; approximately one-third of the couples considered their marriage unhappy (H. Li, unpublished work). This internet-based study indicates that women express more interest than men regarding the quality of sexual life.

Partner sex-life quality is reduced by ED

Many studies on ED have focused specifically on the patients' point of view, such as awareness of ED, adverse effects, and effects of ED on sex life and sexual relationships. However, the effects of ED on the partners are strikingly similar to the effects on the patient, 87.6% of patients with ED and 82.8% of their sexual partners rated sexual intercourse and open discussion of ED as important for maintaining a good relationship[15,16]. A high level of mutual understanding of ED was also rated as important for maintaining stable marital status by participating couples in the men's attitudes to life events and sexuality study[17]. These studies provide evidence that ED has negative effect on the quality of sex life for both partners in a relationship.

Effects of ED on different aspects of sex-life quality have been noted, including reducing intimacy (including caressing, kissing, touching and foreplay), and causing sexual unhappiness and female sexual problems associated with ED, among others. A lack of sexual engagement over a long period of time might negatively affect the intimacy of couples. Riley and Riley[18] studied a cohort of 128 men (median age 57 years) with ED and their sexual partners (median age 54 years) and found that only about 10% of couples had engaged in kissing and/or caressing in the 4 weeks before the man presented with ED at the clinic, and almost half the couples had not had experienced sexual activity for ~2.5 years. A lack of sexual intimacy such as kissing or oral or manual sexual stimulation for between 26 months and 32 months before the couples visited the ED clinic was also reported. In an investigation involving the female partners of men with ED (n=293), Fisher *et al.*[19] reported that frequency of engagement in sexual activity was significantly decreased after ED developed (P<0.001). A large number of women in the group in which partners developed ED described decreases in sexual impetus after their partners developed ED, such as a decrease in sexual desire from 74% before to 47% after, sexual arousal from 75% to 46%, and orgasm during intercourse from 64% to 33%, leading to discontentment within the relationship (from 85% to 39% being contented). Frequency of female orgasm is correlated with the severity of ED, with 74%, 50%, and 32% of women achieving orgasm during intercourse when their partners have mild, moderate, and severe ED, respectively. Jiann *et al.*[11] conducted a survey using self-administrated questionnaires, in which 2,159 female employees from two hospitals in southern Taiwan and their male partners were included. The results showed that nearly all the FSFI and IIEF scores were significantly correlated (P<0.01). ED was a significant risk factor for female sexual problems including arousal disorder, orgasm difficulty, and sexual pain (OR 2.5–3.3, P<0.01)). Similarly, 62 (55%)

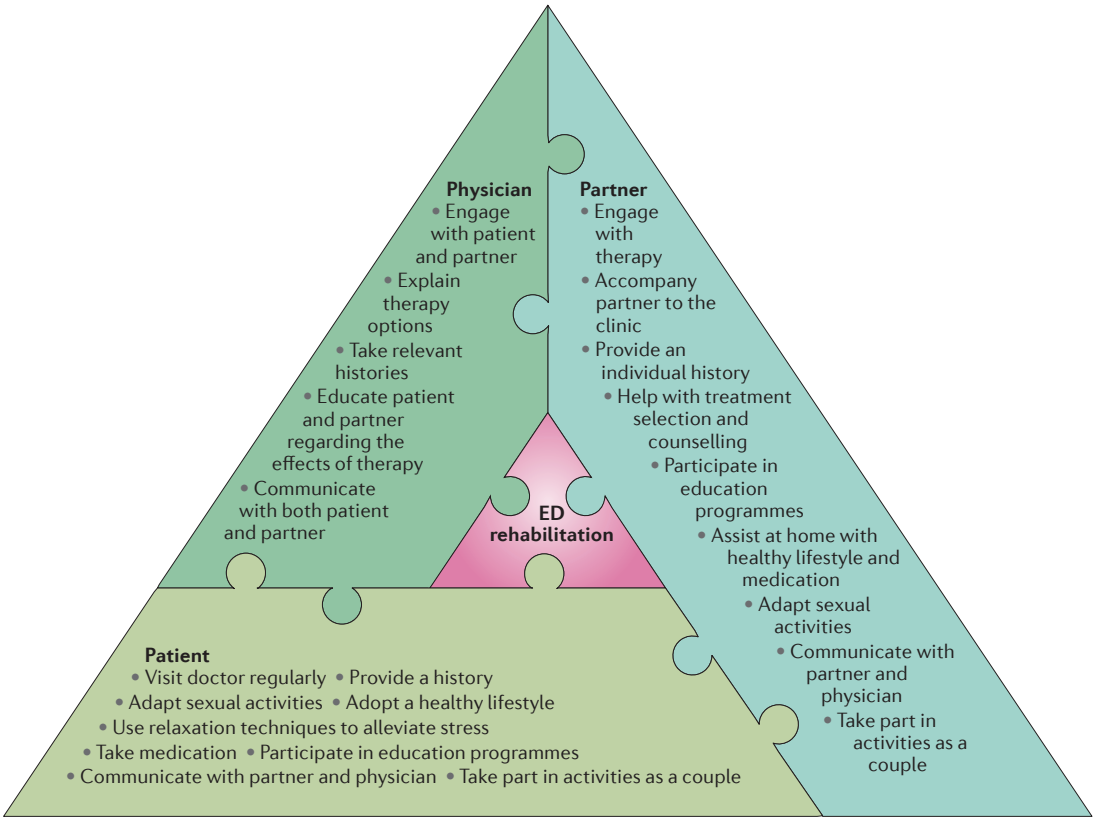

Figure 1 | **The sexual-partner-engaged approach for the treatment and rehabilitation of patients with erectile dysfunction (ED).** Collaborative efforts are required from the physician in sexual medicine clinic, the patient with ED and his sexual partner, who all have different roles. Interaction and communication between the partner and patient should start as early as possible when a noticeable change in sexual behaviour occurs. The partners should not only encourage the patient with ED to visit the sexual medicine clinic and accompany them, but should also consult with their physician regarding health issues that might affect their partners' ED themselves. Open discussion and exchange of ideas on sex-related issues and therapy-related problems between the patient and the sexual partner are equally important for the patient seeking advice from his doctor. The partner and patient are highly recommended to take part in sex-related activities as well as social events as a couple to increase intimacy and relieve psychological distress. The ultimate goals of this approach are to achieve complete recovery from ED and re-establish a satisfactory sex life for the couple. The engagement of the three participants — the patient, the partner, and the physician — offers a comprehensive approach that provides an effective intervention and rehabilitation.

of 113 female partners of men with ED self-classified as having female sexual dysfunction (FSD)[20]. The quality of the sex life of 152 women whose male partners developed post radical prostatectomy erectile dysfunction (pRPED) and were treated with intracavernous alprostadil injections was investigated in a retrospective study using an index of sexual life questionnaire[21]. The results showed that, overall, QOL index scores for these women were low, including the measures for the women's sex-life satisfaction, sexual drive, and general-life satisfaction. The Index of Sexual Life (ISL) scores were strongly correlated with IIEF-15 domains, mainly with erectile function ($r > 0.41$, $P < 0.001$) and intercourse satisfaction ($r > 0.27$, $P < 0.005$). The changes in scores correlated highly with the therapeutic response of the patients with pRPED. A high prevalence of sexual problems (62%) has been observed in female partners of men with ED and most symptoms (92%) developed after the onset of ED[22]. Furthermore, a study found that 33% of female sexual partners >46 years old of men with ED had genital atrophy — the majority of them having not had sex for many years — or experienced painful intercourse[18]. Thus, outcomes from studies provide strong evidence that ED has a considerable degree of physiological and psychological influence on a couples' sex life.

That ED affects the quality of sex life for both the men and their sexual partners is well known. However, even if an erection has been re-established after therapy, a satisfactory sexual relationship might not be achieved. Psychological effects and the presence of FSD in a female partner are important factors in the development and treatment of ED.

Psychological effects on sexual partners

Understanding the psychosocial effects of ED on patients and their sexual partners is important for diagnosis, and for the development of a practical therapeutic approach. Once ED is diagnosed it can have a negative

psychological effect on the couple, and the sexual partner might have negative thoughts of their own. Changes in a man's sexual behaviour could cause confusion for their partner and even lead to concerns that he could be having an affair and/or the belief that he is losing interest. Partners might also worry that their men are potent with other people, leaving them with feelings betrayal and suspicions infidelity[23–25]. These anxious thoughts usually influence their self-esteem and feelings of attractiveness, as the partners might measure their self-esteem, and desirability by how their man responds to their sexual approaches. Sometimes these thoughts are voiced and can have a damaging effect on the relationship. One study was conducted that included the sexual partners of men with ED, focusing particularly on sexual experiences, relationship satisfaction, and communication[26]. Among 100 women interviewed, some expressed a sense of hopelessness in their sexual lives, whereas others made efforts to improve nonphysical intimacy and sexual communication with their partners. Psychological menopausal symptoms were also observed frequently in those middle-aged women whose partners had developed severe sexual dysfunction. In 404 menopausal women surveyed, the menopause rating scale scores were high for those whose partners had ED (23.8%) or premature ejaculation (21.2%). Lack of communication in the relationship, partner-role failure, and sexual dissatisfaction were considered to be contributing aggravating factors for psychological menopausal symptoms[27]. A better understanding of these adverse psychosocial effects on sexual partners will help the clinical management of ED.

Sexual disorders of partners of men with ED

The partner's sex-associated health issues have drawn increasing attention in the management of ED and a correlation between FSD and ED has been reported[11]. Early identification of sexual problems, associated diseases, and age-related developmental issues of female partners, such as FSD, diabetes, pituitary tumours, depression, and menopause-associated conditions, might help physicians to manage both ED and women's health issues effectively.

FSD is an age-related disorder that has a definite negative effect on the quality of a women's life. The classification of FSD includes sexual desire disorders (hypoactive desire, aversion, and hypersexuality), arousal and orgasmic disorders, and sexual pain (dyspareunia, vaginismus, and non-contact dyspareunia). Each individual could have a particular disorder or a combination of several. Among a total of 586 Chinese women (aged from 22 to 60 years), the incidence of FSD, low desire, arousal disorder, lubrication disorder, orgasmic disorders, and sexual pain were observed to be 37.6%, 23.6%, 25.4%, 36.8%, 30.6%, and 21.8%, respectively[28]. Zhang *et al.*[29] reported that the prevalence of FSD was lower in young and middle-aged women (aged 19 to 49 years) in China than those in the United States and other Asian countries. However, 37.9% of middle-aged Chinese women still had at least one disorder associated with FSD. Shaeer *et al.*[30] conducted the Global Online Sexuality Survey Arabic Females of 2,920 women of reproductive age (average 28.9 ± 5.9 years, range 18–53 years; 93.9% 18–39 years; 5.5% 40–49 years; and 0.6% 50–59 years). In total, 344 participants completed all the questions and the average FSFI score was 23 ± 6.5 (mean ± SD), and 59.1% of respondents were at risk of FSD. The different educational and/or cultural background regarding sexuality of Chinese and Arabic populations from people in western countries might mean that the prevalence of FSD in Chinese and Arabic women is underestimated.

Salonia *et al.*[10] observed that of the 29% of Italian women who were not satisfied with oral sildenafil treatment for their partners' ED, 75% reported some sexual abnormalities including hypoactive desire and decreased arousal. A survey of 113 female partners of men with ED who visited a sexual medicine clinic regularly showed that, of the 62 respondents (55%), 40 (65%) had complained of more than one sexual issue; these problems included decreased sexual desire (35 women, 56%), arousal disorders (23 women, 37%), lack of orgasm (39 women, 63%), dyspareunia (19 women, 31%), and vaginismus (3 women, 5%), according to the international classification of FSD[20]. Vaginismus and dyspareunia in female partners of men with nonorganic ED have been observed to occur before the onset of ED[31]. Psychosexual effects and relatively high levels of sexual desire in the female partners possibly contribute to these dysfunctions, leading to development and/or exacerbation of ED. Postmenopausal vaginal atrophy with symptoms of vaginal dryness, soreness, itching, burning, and dyspareunia has an adverse emotional and physiological effect on women and their partners and the authors recommended open and frequent communication about vaginal atrophy between the couples[32]. Thus, the potential contribution of FSD to ED development is not negligible and both male and female sexual problems should be considered together, in the same clinic, for evaluation and treatment of ED.

Acknowledgment of female sexual health issues might provide an alternative approach for treatment and prevention of ED that has an FSD component. Few studies exist examining the interaction between FSD and ED. The lack of knowledge on the fundamental physiological pathway of female sexual responses, especially in those who have been through the menopause, makes the rationale for medical intervention uncertain. In fact, a great number of physicians are unaware of FSD and other chronic and developmental conditions being an essential part of the sexual history for patients with ED. In most circumstances, the diagnostic testing specific for evaluation of male sexual problems is designated to the men who are seeking medical help. Thus, specialists often neglect important information and histories of the partners' disorders and associated examinations[33].

Effects of inadequate sexual history of partners

Anxiety and concerns about sexual activities are commonly shared by both sexual partners. However, male physicians might be particularly uncomfortable when they are interviewing women concerning their sexual history and vice versa. Evidence exists that sexual concerns and problems of female partners were not asked

about or recorded, either intentionally or unintentionally, leading to delay in diagnosis and treatment of ED[34]. Questionnaires were sent to 131 physicians including obstetricians and gynaecologists, family practitioners, internists, paediatricians, and surgeons to ask them to rank their discomfort levels during an interview with patients of opposite gender and their perception on patients' discomfort levels as well. The results showed that most clinicians were uncomfortable obtaining a detailed sexual history. A significant difference was observed ($P<0.05$) between the responses of male and female physicians when they took sexual histories from their patients of the opposite gender. The discomfort rates were reported to be 19% and 35% for male physicians, and 50% and 12% for female physicians when interviewing male and female patients, respectively. The establishment of educational programmes regarding sexual medicine for clinicians have been proposed, such as short training courses on ED management, in order to improve clinician communication with patients and/or their partners, and promote the patient–partner centralized attitude to sexual issues[35].

The acquisition of sexual history has two aspects; the standard methods employed by the physician and comprehension of the potential for bias caused by a gender difference between clinician and patient. When the sexual history of the patient is acquired, it is necessary for clinicians to understand clearly the patient's and their partner's goals and reasons for seeking medical attention. For example, it should be established whether the patient's visit is self-motivated or has been requested by their sexual partner, whether the problem has led to anxiety or stress for them or their partner, whether the patient just needs to clarify a few questions with their doctor to determine if their current sexual activity is considered normal, and whether the patient is willing to receive medical treatment for their problems. Furthermore, gynaecological and obstetrical problems, surgical history, mental-health history, sexual behaviour, and social factors should be collected when acquiring a women's sexual history.

Effects of partners' understanding of ED

Under most circumstances, the partner's attitudes to and knowledge of sexual disorders have a critical role in facilitating men to seek medical help for these issues. Understanding the potential benefits of sexual partners' engagement is important for treating physicians. During the course of diagnosis and treatment of men with ED, their sexual partners' support and needs should be taken into consideration and acknowledged, especially during recovery of couples' sexual activities[36]. Unsuccessful medical interventions might be caused by the sexual partner's problems and/or difficulties in the couple's relationship. The attitude, behaviour, and understanding of the sexual partner are important influential factors in the decision-making process of the patient, influencing decisions such as whether they are ready to seek medical advice or receive medical therapy for their ED.

A lack of an adequate level of knowledge of male sexual disorders sometimes compels the sexual partner to have a negative response to the development of ED, which might alter the motivation or willingness of the man with ED to seek medical help. Inappropriate perspectives or assumptions from the partner can change the attitude to medical therapy of the man with ED. For example, the partner might think that ED is not a crucial issue in the couple's personal life or relationship, that the loss of erection is permanent and irreversible, that clinicians are not the right people to help, or that taking drugs to improve erectile function is risky and/or harmful. Tomlinson and Wright[37] investigated the perceptions of 40 men with ED and found that nine patients believed that they were letting down their partners, six were anxious that their partners might go elsewhere, and 15 felt unable to discuss their problem with their partner. In another survey of 441 Australian men with ED, almost all men (94%) felt their partner's support was important. The reaction of the female partner was considered negative by 22% of men (who expressed themselves as disappointed, shattered and/or frustrated)[38]. Sexual partners have been categorized into four groups based on their attitudes and actions towards the man's ED: supportive/acceptable to ED (optimistic), supportive/unacceptable, non-supportive/acceptable, and non-supportive/unacceptable (pessimistic)[12]. Fisher *et al.*[15,16] reported that for those men with ED who had not received any medical help, 34% expressed that they would be willing to visit a doctor if their sexual partners asked them to do so. With comprehensive education and counselling from nurses specializing in urology, the pessimistic attitudes of female sexual partners towards their partner's ED changed to optimistic. However, negative attitude is a common response of a female sexual partner, and can manifest as disappointment and result in refusal to discuss the issue and a desire to end the relationship[39]. One study showed that only 42.8% of female partners of men with ED had encouraged them to visit a doctor, and only 33.1% of the couples wished to work together to tackle the problem[40]. A survey of female partners who took part in the female experience of men's attitudes to life events and sexuality (FEMALES) study, which assessed their understanding of ED, found that 86.44% of participants believed that ED was permanent, 63.78% thought it was a functional impairment, 28.52% thought it was linked to another physical problem, and 11.65% believed it to be a psychological problem. Furthermore, 9.81% thought ED had unclear aetiology, and 9.03% of women felt "His ED has been devastating for me in some ways". Of all FEMALES participants, 2.54% considered ED to be less serious than other issues and 6.23% of women did not consider clinicians the appropriate people to deal with their partner's ED, with only 20.36% of women reporting satisfaction with how their doctor dealt with their concerns[40]. Educational resources to help partners obtain knowledge of ED are clearly lacking. Given the fact that the partner's attitude and knowledge have a key role in both diagnosis and drug therapy, we highly recommend that they should be involved from an early phase of ED treatment, in order to improve prognosis.

The initial motivations for men with ED to pursue medical attention have been reported to include

self-motivation, partner encouragement, doctors' recommendation, friends' suggestion, advertising, and family members' advice[10]. This study came to the conclusion that female partners were a major driving force for medical assistance of ED. However, the educational levels and living standards of surveyed partners were not reported and might influence participant response. A continuing effort should be made to educate the sexual partners as well as the men with ED concerning this issue.

Sexual-partner assistance

The involvement of sexual partners in medical intervention of ED is essential. Derogatis *et al.*[41] observed that the sex drive of female partners of men with ED was considerably lower than those whose male partners did not have ED. Sexual partners have a critical role in achieving long-term relief of ED after treatment[42] and their attitudes, beliefs, and sexual experience are important in the prognosis of ED. The attitude of men with ED regarding the acceptance or rejection of treatment protocols can be changed by their sexual partners[40]. If drug therapy is preferred by the couples it will have a role in the couples' sexual behaviour, as well as affecting the patient's erectile function[17,28]. Most patients with ED consult their clinicians in absence of their partners; therefore, active engagement of sexual partners in therapeutic intervention for ED is still a challenge in current clinical practice.

Partner-engaged aid for mild symptoms at home

For those patients who have mild ED or are reluctant to accept treatment in the clinic, they could attempt to treat their ED at home, with support from their sexual partner. Partner-engaged aid requires great effort and input from the couple. Anxiety and stress could be relieved through partner-initiated conversations or partner-accompanied activities to improve intimacy in a relaxed atmosphere. Specifically, we would suggest that the couple should cooperate in adapting sexual techniques, communicate regarding satisfaction with sexual activity and experience, work together to maintain exercise and medication regimes, and continue visits to professional counselling if necessary. However, partner-engaged support can be fragile in many circumstances and the physical and psychological tolerance of ED by sexual partners is an important factor in continuing support. If the partner is overwhelmed by the stress caused by ED, the aid might be withdrawn, resulting in adverse effects on the patient who is in need of support. Men with ED might also choose to end their relationship with their current partner if support is not forthcoming[9].

Partner involvement in assessment and therapy

Men with ED can regain adequate erections by using PDE5is, derivatives thereof, intracavernous injections, vacuum erection devices, and inflatable penile prostheses. However, sexual intercourse might not be satisfactory even with sufficient erection rigidity, and counselling might be required to help the couple to rebuild intimacy[18]. Effective communication and cooperation between the patients, their sexual partners, and clinicians are very important for achieving good treatment results. If ED is concealed from the partner and/or clinician, or the partner refuses to be involved in the medical or counselling process, re-establishing a satisfactory sexual life will be difficult.

Understanding the different perspectives and responses of men with ED and their partners to the results of treatment and recovery of sexual function is very important. During a treatment course, the patients are usually focusing on whether erection can be regained, whether the rigidity of the erectile is adequate, and whether they can engage in sexual intercourse. However, partners are usually focusing on whether the quality of their sex life is good, and whether their partners' orgasm has met with expectations[22]. In a study of 128 men with ED and their partners investigating the importance of intercourse, Riley and Riley[18] showed that sexual intercourse was rated as very important or somewhat important by 83.7% of the men but only 20.2% of their partners. Similar results were obtained in another investigation, in which sexual intercourse was believed to be highly important by 47.6% of the men with ED, whereas only 20.2% of their sexual partners felt it was important. Both emotional and physical withdrawal of their partners as a result of sexual issues were felt by many women and 41% felt responsible. When partners of men with ED were asked about the most enjoyable aspect of sex, 37% of chose intercourse, whereas 60% liked foreplay. These different emotional and psychological reactions are frequently seen in a dyadic relationship regardless of the aetiology of ED[43].

A discrepancy of opinions exists between men and women regarding the success of ED treatment. Conaglen *et al.*[44] investigated the driving force behind the couples' decision to continue, interrupt, or discontinue PDE5is by studying 155 men with ED who received treatment for at least 1 year. Their female sexual partners perceived that partner issues (such as separation, alcohol abuse, lack of communication, loss of confidence, and fear of failure during intercourse) were likely the reasons for discontinuing PDE5is, whereas the patients seldom reported partner issues as the reason, 44% of men who reduced their use reported decreased need and 38% cited cost as the issue.

Engagement of the sexual partner of the man with ED in drug and therapeutic protocol selection has a substantial effect on the maintenance of an effective treatment regime. The treatment regime of PDE5is requires regular and repeated oral intake, which seems to be a challenge for patients, and interruption of treatment dosing has been reported[40]. In the FEMALES study, a woman's perceptions on the nature and cause of her partner's ED were significantly associated with the man seeking consultation and trying medication ($P<0.001$). A correlation was observed between the women's satisfaction with intercourse before ED presented and the man mentioning the issue to their doctor. Men with ED were also more likely to consult their doctor or try PDE5is if their partner felt ED was

having a negative effect on their quality of life, had a desire to deal with ED, believed that medical treatment was a good thing, and had experienced a satisfactory consultation regarding their own FSD with their doctor themselves.

Timed intercourse can cause increased anxiety and stress levels with regard to sex, and is potentially associated with ED and ejaculatory dysfunction. Byun *et al.*[45] studied 439 men assigned to undergo timed intercourse, 188 of whom (42.8%) experienced newly acquired ED and 26 (5.92%) developed ejaculatory dysfunction. Timed intercourse was acknowledged to have detrimental effects on men as well as their sexual partners, likely resulting from real functional disorders. Men are recommended to avoid anti-ED drugs with a known timed-intercourse effect to relieve psychological pressure on the couples to have intercourse during a specific time period. In a series of randomized, double-blind and placebo-controlled trials, Brock *et al.*[46] performed integrated analyses on the efficacy and safety of tadalafil as an ED treatment and observed a high success rate. Successful intercourse rates of 73%, 80%, 80% and 79% within 0.5 h to 4 h, 4 h to 12 h, 12 h to 24 h, and 24 h to 36 h, respectively, were reported after an oral dose. Tadalafil, with its broad window of therapeutic responsiveness and no restrictions on food or alcohol intake, offers more convenience and is in tune with patient lifestyle needs. These needs might include the requirement for spontaneous, rather than timed intercourse, which tadalafil could enable. The long half-life (17.5 h) of tadalafil also meant that patients and their female partners were more satisfied with this drug than the short half-life (3.8 h) sildenafil.[47,48] Understanding of the underlying reasons for a treatment preference is also important for improving treatment outcomes (discussed elsewhere)[47,48]. These preferences have been investigated in several comparative studies on short-acting versus long-acting PDE5is. Sexual satisfaction results were better in the groups of men who received a long-acting drug (tadalafil) than those who received a short-acting one (sildenafil) in functional and psychosocial assessments[49–52]. One of the factors in selecting a treatment is partner preference, with 10.7% of men citing this reason as an influence on their choice[47].

Sexual function, relationship and psychological, and other characteristics, such as demography, age, and health, are critical predictors of sexual and relationship satisfaction[53]. The sexual relationship between the patient and their sexual partner should be assessed regularly during a course of treatment. To evaluate the satisfaction with sex experienced by couples after treatment with oral PDE5is for 3 months, 161 men with ED and their partners were interviewed using separate questionnaires[54]. Of these couples, 111 returned the forms and the data revealed that the men were more satisfied with treatment results than their partners. The female partner's happiness regarding sexual activity has been shown to be considerably and consistently correlated with treatment-related improvements of the man's erection. Administration of PDE5is resulted in improvement of the female partners' sexual experience compared with women whose partners did not receive treatment, including sexual desire (54% versus 43%), sexual arousal (56% versus 40%), orgasm (46% versus 30%) and reduction in intercourse-related pain (7% versus 2%)[15]. The proportion of female partners who experienced sexual desire, arousal, and orgasm "almost always" or "most times" was significantly higher ($P>0.05$) for those whose partners were currently using PDE5is than those whose partners were not[19]. Based on international assessment criteria for ED treatment, the sexual satisfaction and QOL of female sexual partners improved considerably when their partners were receiving PDE5is[55]. The investigators acknowledged the importance of involving both partners in the management of ED, which could be achieved using an algorithm such as a sexual-partner-engaged approach (FIG. 1).

Sexual rehabilitation is an essential component in managing ED, which is aided by active involvement of the partner. At least one-third of patients with prostate cancer have ED at diagnosis[56], and after receiving androgen deprivation therapy (ADT) and radiotherapy for their cancer. Evidence has accumulated indicating that ADT and radiotherapy for prostate cancer can impair erectile function[57]. Even though many therapies (including PDE5is, intracavernosal injections, and vacuum constriction devices,) have improved the erection firmness of men who have had prostate cancer and have ED, sexual rehabilitation is needed to help the patients achieve a satisfactory sex life. A couple-based approach to treatment has been recommended, in which the clinician is encouraged to identify the couple as the patient and couples are encouraged to broaden their sexual repertoire, and incorporate erection-independent sexual activities[12,58] The delivery of information and proven treatment methods to the patient during ED rehabilitation are important[59]. One study suggested that a 3.5 h workshop offered to patients and their partners in which the man with prostate cancer had received treatment within the last 5 years was feasible and acceptable; significant improvements in sexual interest ($P=0.008$) and sexual function ($P=0.011$) were also reported by partners[60]. Walker and colleagues[61] reported that couples who received educational intervention in the form of a booklet and follow-up session concerning the possible effects of ADT had more success in maintaining sexual activity than those who did not. Chambers *et al.*[62] found that telephone-delivered intervention by either peers or nurses could promote use of medical treatments for ED in men who had received surgery for prostate cancer; however the interventions did not affect sexual function, sexuality needs, sexual self-confidence, or marital satisfaction or intimacy[62]. Recommendations for improving the QOL of the men treated with ADT and that of their partners have been proposed by the ADT Survivorship Working Group. For example, doctors should provide detailed information about the side effects of ADT before treatment and refer the patients to psychologists for counselling and support for post-therapy sexual dysfunction. Psychological interventions for sexual sequelae need to be offered and

individualized to the men with ED and their partners[63]. These recommendations could also be a valuable reference for rehabilitation of men with ED that has been caused by other conditions.

The role of male sexual partners

ED in men who have sex with men

Sexual dysfunction encountered specifically by men who have sex with men (MSM) has been studied, and data show that the prevalence of ED in MSM is similar to that observed in men who are in heterosexual relationships[64–66]. No comprehensive epidemiological survey has been conducted, but Hirshfield *et al.*[67] reported that 79% of 7,001 American MSM who completed an online cross-sectional survey had one or more symptoms of sexual dysfunction, including erection problems, low sexual desire, and sexual performance anxiety. In a study involving 72 Belgian MSM who self-reported as HIV$^+$, 56% were found to have mild-to-severe ED[68]. General well-being, chronic conditions (such as diabetes, high blood pressure, heart disease, and metabolic syndrome) as well as oral or anal intercourse are all considered as contributing factors to ED in MSM, as they are in heterosexual men. General predictors for ED development or development of sexual problems have been reported to be frequent masturbation, frequent sex, use of erectile-enhancement drugs, having a passive role in sex, not having a steady relationship, poor general health, interpersonal isolation, adoption of stress-avoidance strategies, sexual risk-taking in casual encounters, and the use of antidepressants. HIV$^+$ men have been reported to be at increased risk of multiple sexual problems[68,69]. A significant correlation between HIV/AIDS and ED has been reported ($P = 0.006$)[70]. Hart *et al.*[71] found that ED was more prevalent in MSM who were HIV seropositive (21%) than men who were HIV seronegative (16%); however, data regarding the prevalence of ED in HIV$^+$ heterosexual men is scarce. Occurrence of ED was more commonly observed in those HIV$^+$ men receiving active antiretroviral therapy and with raised serum estradiol levels than those with normal serum estradiol levels[72]. High doses of active antiretroviral therapy could reduce libido, which might result in decreased sexual desire in men with raised serum estradiol[73].

Unprotected anal intercourse has been reported as a risk factor for ED development; physiological damage and psychological anxiety over contracting HIV or other sexually transmitted diseases are thought to contribute to its development[74]. A systematic review and meta-analysis of global data showed that the relative risk of contracting HIV incidentally was 6.2-fold (95% CI 3.3–11.8) and 6.6-fold (95% CI 3.8–11.7) higher in MSM who received anal intercourse and the MSM who engaged in both insertive and receptive anal intercourse, respectively, than the relative risk in the MSM who engaged in insertive anal intercourse only[75]. Among 1,752 MSM surveyed in Belgium, 45% reported having different degrees of ED, the odds ratios being much lower in those who were in a stable relationship (OR = 0.59, $P < 0.0001$) than those who were not in a steady relationship (OR = 1.22, $P < 0.0001$)[76]. Another non-negligible aspect of ED prevalence in MSM is the relatively high frequency of prescription and nonprescription drug use[72]. Multiple drug use is often observed in MSM who are HIV$^+$. In 1,138 drug users surveyed, 529 (46.5%) used three or more drugs and 241 (21.1%) used five or more drugs[77]. Some studies indicate that MSM who use drugs, including prescribed or nonprescribed anti-ED medications and illegal substances (such as ecstasy, γ-hydroxybutyric acid, marijuana, and cocaine) might put their own and their partners' health at risk, the effects of drug use on the occurrence of ED in MSM are discussed elsewhere[78,79]. MSM are more likely to use anti-ED medications such as PDE5is recreationally than heterosexual men[72,80], therefore, they might need a specially designed treatment regime if they require therapy for ED. The sexual behaviour, frequent drug use, and high prevalence of HIV, mean that MSM are more susceptible to the development of ED than heterosexual men and are also more likely to not comply with medical intervention. Thus, further research is important for the development of effective treatment regimes and for the promotion of male-partner-engaged approach.

Male-partner-engaged intervention: considerations

Use of anti-ED medications is relatively common in MSM, mainly to enhance sexual pleasure[81]. However, MSM who experience sexual problems need to find an understanding clinician who will be sensitive to their specific needs[65]. Engagement of male sexual partners in treatment and counselling of ED or other sexual disorders for MSM is equally as important as the role of female partners of heterosexual men with ED. Thus, the male partners of MSM with ED are highly encouraged to work together with physicians, nurses, and their partners in the sexual medicine clinic to create a supportive environment in order to promote sexual health and acquire improved quality of sex life in their relationship. Further studies are needed concerning particular aspects of MSM relationships for a specific guideline for the clinical treatment of ED in this circumstance but the sexual-partner-engaged approach can be implemented as a promising starting point.

Conclusions

ED is no longer considered as a simple or specifically male disorder, but is regarded as a measurable disorder of the body and mind for a couple in either a heterosexual or a homosexual relationship. Combined efforts from men with ED and their sexual partners are encouraged during treatment. Both female and male sexual partners of men with ED have a considerable role as they are both affected by ED and benefit from its treatment. The concept of treating the couple together is increasingly accepted and has become a common practice in a many sexual medicine clinics. Evidence supports that sexual-partner-engaged intervention should be implemented at an early stage in the treatment process in order to achieve an optimal outcome. Combined efforts from physicians, nurses, clinical educators, social workers, patients, and their partners are essential for treatment success.

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H.-J. L. researched data for and edited the article before submission, H.-J. L. and T. G. wrote the article, and H.-J. L., T. G. and R. W. discussed content, for the article.

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The authors declare no competing interests.