

The International Index of Erectile Function: A Methodological Critique and Suggestions for Improvement

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The International Index of Erectile Function is a well-worded and psychometrically valid self-report questionnaire widely used as the standard for the evaluation of male sexual function. However, some conceptual and statistical problems arise when using the measure with men who are not sexually active. These problems are illustrated using 2 empirical examples, and the authors provide recommended solutions to further strengthen the efficacy and validity of this measure.

The International Index of Erectile Function (IIEF) is a psychometrically valid and reliable multidimensional self-administered questionnaire widely used for the evaluation of male sexual function (Rosen et al., 1997). It was developed in 1996–1997 as an adjunct to the Sildenafil Clinical Trial Program and was developed primarily for use as an efficacy endpoint in randomized controlled clinical trials of erectile dysfunction. It has since been adopted as the standard measure for assessing erectile dysfunction, has been shown to be psychometrically sound, cross-culturally valid, and has been linguistically validated in at least 32 languages (e.g., Rosen, Cappelleri, & Gendrano, 2002). The IIEF has been acclaimed as the “gold-standard treatment outcome measure for clinical trials in erectile dysfunction, regardless of the type of

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treatment intervention or study population under investigation” (Rosen et al., 2002, p. 226). Between its inception in 1997 and Rosen et al.’s state-of-the-science review in 2002, the IIEF had been used in more than 50 clinical trials, with study populations ranging from men with diabetes (Penson, Wessells, Cleary, & Rutledge, 2009) to posttraumatic stress disorder (Safarinejad, Kolahi, & Ghaedi, 2009) and spinal cord injury (Alexander et al., 2009). The Sexual Health Inventory for Men (SHIM; Rosen, Cappelleri, Smith, Lipsky, & Peña, 1999), an abridged five-item version of the IIEF that focuses on the erectile function domain only, was developed for use as a quick diagnostic tool that could be used in the primary care setting to test for presence and severity of erectile dysfunction. This short version is widely used, objective, and is considered an efficient measure of erectile dysfunction (Rosen et al., 1999). In a recent article comparing health-related quality of life measures for men receiving treatment for prostate cancer, Hedgepeth and colleagues (Hedgepeth, Labo, Zhang, & Wood, 2009) revealed an important limitation of the SHIM (also known as the “five-item version of the IIEF-5”; Rosen et al., 1999)—that it “may underestimate erectile function in men who do not attempt to achieve sexual intercourse” (p. 225). Specifically, men who reported having had no recent sexual activity showed a significantly lower correlation between scores on the SHIM and the sexual function domain of the Expanded Prostate Cancer Index (Wei, Dunn, Litwin, Sandler, & Sanda, 2000) compared with those who reported having recently engaged in sexual activity, prompting Hedgepeth et al. (2009) to suggest that, at least when compared with the Expanded Prostate Cancer Index, the SHIM may not provide an adequate description of anatomical erectile function in men who are not currently engaging in sexual intercourse with a partner, but who may still have some measurable degree of erection. We suggest that one possible explanation for this finding could be attributed to the SHIM’s polarization of item scores toward the erectile dysfunction pole in men who are not sexually active.

The SHIM produces one total score on the basis of five items, and each item is scored on a 5-point ordinal scale, with lower responses indicating poorer sexual functioning. Thus, an item response of “1” is considered the least functional, a response of “5” considered the most functional, and full-scale scores range from 5 to 25 accordingly. According to Hedgepeth et al. (2009), SHIM scores reflect erectile functioning as follows: total score greater than 21 = good function, 17 to 21 = mild erectile dysfunction, 8 to 16 = moderate erectile dysfunction, and less than 8 = severe erectile dysfunction. Rosen et al. (1999) suggested that when considering men who report having no sexual activity in a study using the SHIM, “the severest category of erectile dysfunction be graded from 1 to 7, instead of 5 to 7, provided that they had clinically diagnosed erectile dysfunction or were involved in a stable relationship with a female partner” (p. 325). Those individuals who had not attempted sexual activity are given the option to choose “0 – no sexual

activity” on four of the five items on the SHIM. Thus, those four items that can be reasonably answered only if sexual activity had been attempted are now scored from 0 to 5, instead of 1 to 5. This addition of a “no sexual activity zero category” creates an item even lower than the least sexually functional score of one, and increases the range of full scores to 1–25. However, there are many reasons why a man in a relationship might not be engaging in sexual activity, and absence of intercourse or nonintercourse sexual activity is not unequivocally attributable to problems with erectile function. These men can meaningfully answer only Item 1, which queries confidence in maintaining an erection and does not depend on sexual activity, and are now assigned a score on remaining items that places them in the most severe category of erectile dysfunction. This artificial inflation of the erectile dysfunction score is present in the original version of the IIEF, and is especially salient when studying certain populations of (non–sexually active) men.

The IIEF creates parallel problems to those highlighted with the SHIM. Items on the IIEF are measured on a 5-point Likert-type scale, ranging from 1 to 5, indicating variations in sexual function, satisfaction, frequency of activity, and desire over the preceding month (Rosen et al., 1997). The IIEF assesses five domains of male sexual function: erectile function (six items), orgasmic function (two items), sexual desire (two items), intercourse satisfaction (three items) and overall satisfaction (two items). As with the SHIM, a score of “1” on a particular item of the IIEF denotes low sexual functioning, whereas “5” depicts the highest level of sexual functioning for that item. Most items on the IIEF also include a zero category, which is conceptually distinct from the 5-point Likert-type scale, indicating “no sexual activity” in two items, “did not attempt intercourse” in six items, and “no sexual stimulation/intercourse” in two items. Five items (Items 11–15) do not have a zero category; those items pertaining to sexual desire (Items 11 and 12), overall satisfaction (Items 13 and 14), and confidence of erectile ability (Item 15, included in the erectile function domain), none of which depend on sexual activity to meaningfully answer, are scored from 1 to 5.

Domain scores on the IIEF are calculated by summing the scores for individual items in each domain (Rosen et al., 1997), such that the zero category is included as a low point in each item’s score, so that the erectile function domain has possible scores ranging from 1 to 30, orgasmic function domain scores from 0 to 10, sexual desire scores from 2 to 10, intercourse satisfaction scores from 0 to 15, and overall satisfaction from 2 to 10. This process leads to statistical and conceptual problems because the zero category is not part of the item response scales. For example, on Item 2 (“[Over the past 4 weeks,] when you had erections with sexual stimulation, how often were your erections hard enough for penetration?”), the participant can meaningfully rate his erections from being sufficiently erect from 1 (*almost never/never*) to 5 (*almost always/always*) only if he had experienced some level of sexual activity or stimulation in the previous 4 weeks. If he

had not experienced any sexual activity, he is instructed to select 0 (“no sexual activity”). There are many reasons why someone might not have had any sexual activity in the previous 4 weeks that are unrelated to erectile dysfunction, including lack of partner or illness. However, this method of calculating subscale domains creates an index of dysfunction even lower than 1 (*almost never/never*) and potentially erroneously pulls the mean for that domain toward the dysfunctional pole.

A potential solution to this pathologizing of scores has been raised by Meyer-Bahlburg and Dolezal (Meyer-Bahlburg & Dolezal, 2007) in response to the analogous conceptual and statistical issues with the scoring of the female equivalent of the IIEF, the Female Sexual Function Index (Rosen et al., 2000). They noted that it is appropriate to categorize these zero scores as “not applicable” or “missing values,” rather than interpreting them as extreme scores of sexual dysfunction. This reasoning applies to all other IIEF items that have a zero category, including those that include the response option 0 (“did not attempt intercourse”), because there may be many reasons (aside from sexual dysfunction) why a participant has not attempted intercourse in the past month, while still engaging in other nonintercourse sexual behaviors and being sexually satisfied. Some researchers have attempted to avoid this problem by requiring that research participants be in a relationship to be eligible for the study (e.g., Goldstein et al., 2002); however, sexual activity is not routinely an inclusion criterion, and it is possible that men in a relationship are not engaging in recent sexual activity.

The IIEF was originally developed as an efficacy measure in clinical trials of erectile dysfunction (Rosen et al., 2002); however, over time it has been used in many studies of sexual function in special populations, for example, individuals who identify as asexual (who do not experience sexual attraction toward anyone at all (Brotto, Knudson, Inskip, Rhodes, & Erskine, 2010), and men undergoing treatment for illnesses that increase the likelihood of erectile dysfunction (i.e., in men undergoing treatment for prostate cancer; Davison, Elliott, Ekland, Griffin, & Wiens, 2005). Within these groups, men are especially unlikely to be sexually active (Bogaert, 2004; Brotto et al., 2008; Stanford et al., 2000), and special care should be taken to avoid an unwarranted sexual dysfunction score that may occur from the selection of the zero option.

According to Meyer-Bahlburg and Dolezal’s excellent analysis of the statistical and conceptual problems of the comparable Female Sexual Function Index, the inclusion of these zero categories in the scoring of each item has the following consequences (adapted from Meyer-Bahlburg and Dolezal, 2007):

1. At the item level, treatment of the zero category as an extreme dysfunction pole of the response scale increases the item score range and item

- variance in comparison with the treatment of zero categories as “missing values.”
2. On the full scale score, treatment of the zero categories as valid responses will also bias the domain scores toward the sexual dysfunction pole and increase the domain score variance.
 3. Analogous effects are also apparent on the total score level.

The goal of the present article was to compare scoring algorithms of the original IIEF and a proposed modification in the scoring of the IIEF to examine effects on overall domain means.

METHOD

Data were obtained from two separate studies in which participants who were especially likely to not have engaged in sexual activity in the previous 4 weeks completed the original (15-item) IIEF. Data were retrieved from Davison et al.'s (2005) study on 155 men with prostate cancer attending a sexual rehabilitation center and from Brotto et al. (2010)'s study on 51 asexual men. IIEF scores of sexually inactive men were adjusted so that all items requiring sexual stimulation or intercourse were assigned a missing value score (dummy coded as “99”) instead of a zero. In this way, we excluded these items from subsequent subscale analyses. For men who had indicated a zero score for fewer than 5 of the first 10 items in the original IIEF, zero scores were reconsidered as missing data, and when possible, missing answers were replaced with averaged scores from other items in the missing item's domain. Men who indicated that they were sexually active (by answering Items 1–2 and 9–15 in the original IIEF with a non-zero response), but who indicated a zero response (“did not attempt intercourse”) for those items pertaining to sexual intercourse only (Items 3–8), received a missing value (“99”) score for those six items.

Prostate Cancer Population

Because illness and treatment-related sexual concerns may lead a number of men with prostate cancer to abstain from sexual activity, we reanalyzed the results of a study investigating men with prostate cancer (for the original description, see Davison et al., 2005) following changes suggested by Meyer-Bahlburg and Dolezal (2007) for the Female Sexual Function Index, as outlined earlier. Participants were 155 men with prostate cancer who completed the IIEF immediately before a visit to a sexual rehabilitation clinic. Of these men, 89 also completed a follow-up IIEF 4 months following the clinic visit. Of the 244 men who completed IIEF questionnaires, 105 (43.0%) indicated having engaged in sexual activity, 88 (36.1%) indicated no sexual activity

TABLE 1. Sexual Activity Status of Men with Prostate Cancer Completing the International Index of Erectile Function

Status	<i>n</i> (%)
Sexually active	105 (43.0)
No sexual activity	88 (36.1)
Sexually active, but not engaging in intercourse	36 (14.8)
Inconsistent responses (sexually active & sexually inactive)	15 (6.1)

in the previous month by selection of the zero category (“no sexual activity,” “did not attempt intercourse,” or “no sexual stimulation/intercourse”) for some or all of Items 1–10 (selection of the zero category for greater than 5 of these questions was taken to designate “no sexual activity”), and 36 (14.8%) indicated sexual activity without sexual intercourse by selection of the zero category (“did not attempt intercourse”) for Items 3–8, while endorsing categories that require sexual activity for some or all of Items 1–10. Fifteen men (6.1%), responded inconsistently and indicated “no sexual activity” on half of the items or less, while responding to the other questions as though they had been sexually active (Table 1).

Using the recommended scoring key for the IIEF, this led to 235 men with an erectile function domain score. However, on the basis of our reasoning indicated earlier, in that only those 99 sexually active men have erectile function item scores that are based on actual sexual activity, this led to a significantly different erectile function domain score. In the former case, the mean was 6.31 ($SD = 7.14$); however, when zero responses were treated as missing values, the mean rose to 11.89 ($SD = 8.14$), elevating the erectile dysfunction scores from “severe” (erectile function score of less than 8; (Hedgepeth et al., 2009)) to “moderate” (erectile function score between 8 and 16). This increase in erectile function domain scores reflects the effect that a diagnosis of prostate cancer can have on decreasing sexual behavior and intercourse frequency in men. Further, when zero scores were included, erectile function domain scores ranged from 1–30, creating a unimodal frequency distribution, with the large proportion of scores clustered at the low end of the scale (Figure 1). When zero items were scored as missing values, the distribution, while remaining unimodal, ranged from 6 to 30, and the mean increased by five points (Figure 2). This pattern held for all domains of the IIEF, except for sexual desire and overall satisfaction, the two domains that are not dependent on sexual activity (Table 2).

Asexual Sample

Again using the steps suggested by Meyer-Bahlburg and Dolezal (2007) and outlined in detail earlier, we compared responses to the IIEF among 51 asexual men recruited from the Asexuality Visibility and Education Network

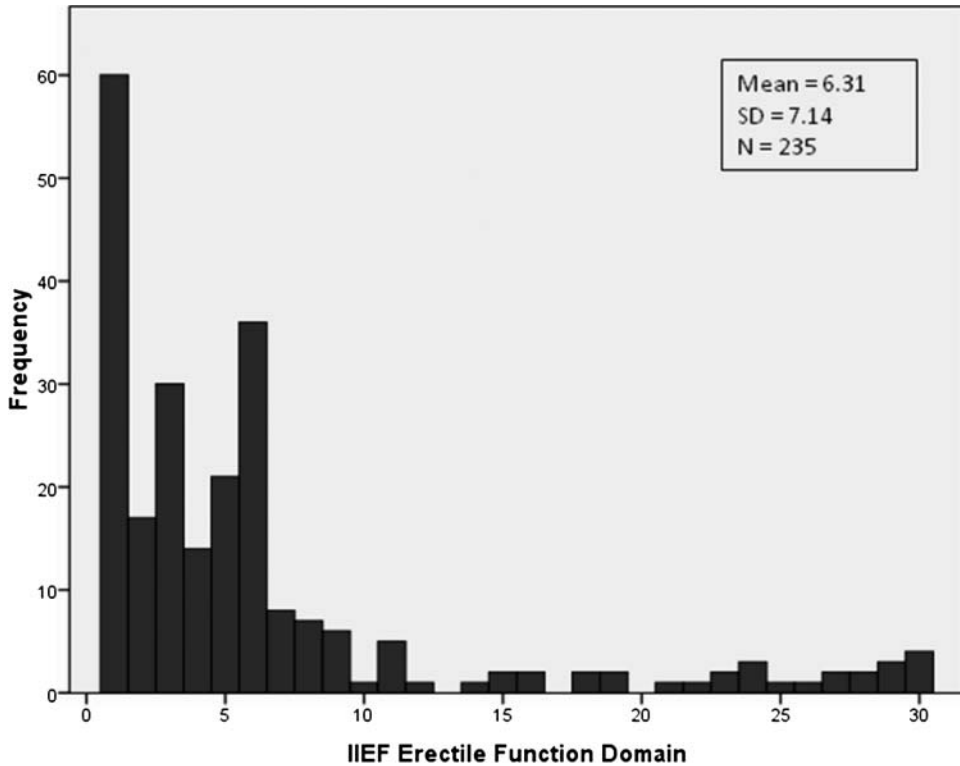


FIGURE 1. Distribution of erectile function domain scores when zero-category responses are included.

who completed online questionnaires as a part of a larger study assessing psychological and psychosexual correlates of asexuality (see (Brotto et al., 2010) for a complete description). Table 3 compares IIEF domain scores according to the recommended IIEF score key and after application of the suggested revisions. A comparison of columns 3 and 6 show a significant

TABLE 2. IIEF Domain Scores for the Original IIEF and According to Suggested Revisions for a Sample of 155 Men with Prostate Cancer

Domain	<i>n</i>	Original IIEF		<i>n</i>	Revised IIEF	
		<i>M (SD)</i>	Range		<i>M (SD)</i>	Range
Erectile function	235	6.31 (7.14)	1–30	99	11.89 (8.14)	6–30
Orgasmic function	240	3.63 (3.21)	0–10	147	5.43 (2.59)	2–10
Sexual desire	244	5.88 (2.12)	2–10	244	5.86 (2.13)	2–10
Intercourse satisfaction	240	2.86 (3.87)	0–14	101	6.79 (3.28)	3–14
Overall satisfaction	234	4.39 (2.32)	2–10	238	4.31 (2.32)	2–10
Total score	226	23.46 (15.29)	5–71	96	36.43 (14.82)	15–71

Note. IIEF = International Index of Erectile Function.

Source: Davison, B. J., Elliott, S., Ekland, M., Griffin, S., & Wiens K. (2005).

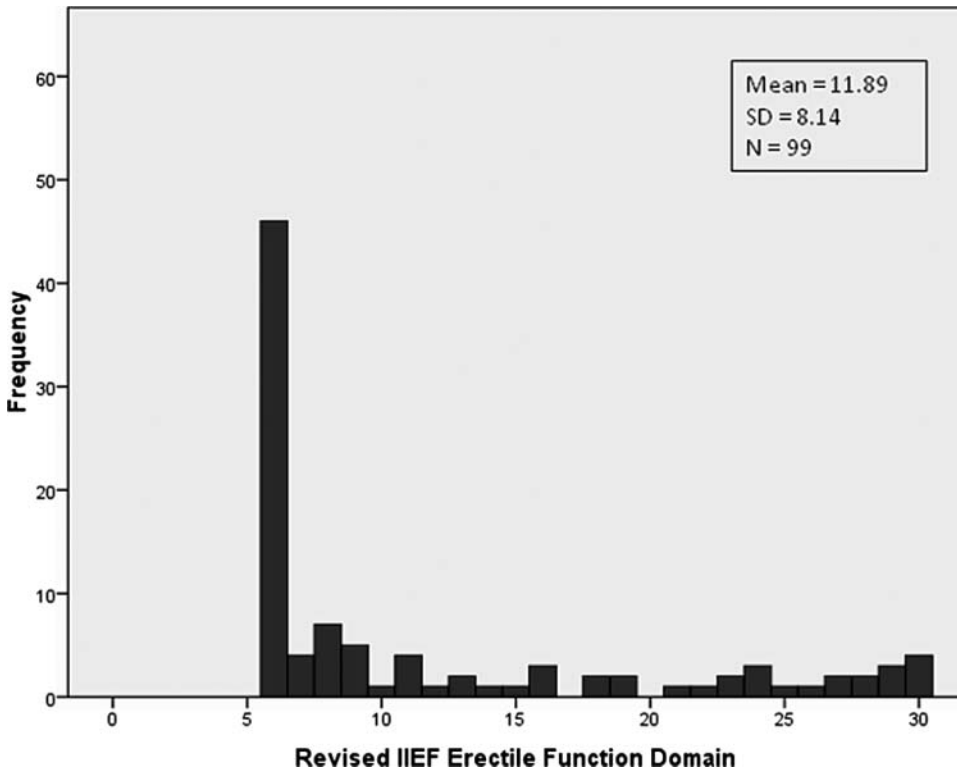


FIGURE 2. Distribution of erectile function domain scores when zero-category responses are excluded.

difference in the IIEF scores for several domains; which increased 12 units, orgasmic function, which increased three units, and intercourse satisfaction, which increased five units. As predicted, there was no change in the domains of sexual desire or overall satisfaction.

TABLE 3. IIEF Domain Scores for the Original IIEF and According to Suggested Revisions for a Sample of 51 Asexual Men

Domain	<i>n</i>	Original IIEF <i>M</i> (<i>SD</i>)	Range	<i>n</i>	Revised IIEF <i>M</i> (<i>SD</i>)	Range
Erectile function	45	7.84 (7.44)	1–30	9	19.55 (7.18)	12–30
Orgasmic function	49	3.46 (4.09)	0–10	12	6.42 (2.68)	3–10
Sexual desire	49	3.02 (1.59)	2–8	49	3.02 (1.59)	2–8
Intercourse satisfaction	49	1.39 (3.33)	0–15	10	6.70 (4.42)	0–15
Overall satisfaction	26	6.92 (2.88)	2–10	26	6.92 (2.88)	2–10

Note. IIEF = International Index of Erectile Function.

Source: Brotto, L., Knudson, G., Inskip, J., Rhodes, K., & Erskine Y. (2008).

DISCUSSION

In consideration of the thoughtful modifications Meyer-Bahlburg and Dolezal (2007) proposed to improve the Female Sexual Function Index, and the re-analysis of data presented earlier, we recommend that equivalent modifications be made to the IIEF to avoid the inaccurate inflation of erectile dysfunction scores. Specifically, we suggest that Items 11–15, all of which can be answered without having had any sexual activity in the previous 4 weeks, be moved to the beginning of the questionnaire (Item 11 becomes Item 1, Item 12 becomes Item 2, and so on; see the Appendix), and a new response category (“no partner”) be added to Item 15 (now Item 5). A new item (now Item 6) should be inserted after the first five items, asking,

Over the past 4 weeks, did you engage (or attempt to engage in) sexual activity of any kind with a partner and/or by yourself (masturbation)? Please remember that sexual activity can be any sort of sexual touching, including foreplay, oral sex or intercourse.

Response options: 0 = “no sexual activity (neither with a partner nor by myself)”; 1 = “sexual activity with a partner only”; 2 = “sexual activity by myself only”; 3 = “sexual activity with both a partner and by myself.” Those who selected “0” would then be instructed to skip the remaining items on the questionnaire. Participants who have been sexually active may continue on to complete the remaining items (Items 7–16). Those who have been sexually active, but have not attempted intercourse in the past month should receive missing value scores for the appropriate items (Items 9–14), as they should on Item 5 if they do not currently have a partner. We suggest that these missing value scores be denoted by an “X” in the revised questionnaire in order to avoid the possibility that the lack of sexual partner or sexual activity in the past month be entered as a zero-value during data entry, inaccurately polarizing the item’s score to the dysfunctional pole.

In regard to the SHIM, we similarly recommend to exercise caution when studying samples of men who may not be sexually active, as well as the addition of a new item assessing the status of the participant’s sexual activity, and the exclusion of any zero-categories for Items 2–5 in favor of a “missing-variable” option, as outlined earlier. It is important to note that the treatment of zero categories as “missing values” in the IIEF and the SHIM raises the issue of whether to forfeit the calculation of the domain score in question, or to replace the missing values with an estimated score based on other valid items in the same domain, as is often done for other scale scores based on multiple items. This is particularly problematic in the domains that are comprised of a small number of items, and especially, in this case, for the erectile function domain, which consists of five items containing the zero category, and only one that does not require sexual activity (Item 15: “How do you rate your confidence that you could get an erection?”).

Epidemiological studies have reported a wide range of male sexual dysfunction prevalence rates between 5 and 40% (Kubin, Wagner, & Fugl-Meyer, 2003; Laumann et al., 2004; Moreira, Lisboa Lobo, Villa, Nicolosi, & Glasser, 2002). These rates vary according to methodological differences between studies, and estimates tend to be much higher when assessed using questionnaires than when evaluated using self-report or interview format (Kubin et al., 2003). A recent study comparing prevalence rates of erectile dysfunction in 255 healthy Brazilian men found some degree of erectile dysfunction in 31.9% of participants when erectile dysfunction was defined by the IIEF, whereas prevalence of erectile dysfunction identified via interview in the same participants was only 3.1% (Dos Reis & Abdo, 2010). Participants in this study were required to be in a stable partnership of at least 6 months, however recent sexual activity was not an inclusion criterion. This pattern was also evident in several studies that indicated a greater prevalence of erectile dysfunction as assessed by the IIEF or IIEF-5, when compared with assessment by self-report or interview (see Martin-Moralez et al., 2001; Wu et al., 2007). It is possible that the use of measures that assign a sexual dysfunction score to individuals who are sexually inactive—such as the IIEF or SHIM—in large-scale epidemiological studies may increase the risk of inflation in estimation of population prevalence rates, underscoring the importance of ensuring that an accurate assessment of erectile function is obtained when using these measures. Removal of the zero-category for men who are not sexually active may be a step toward increasing the accuracy in prevalence estimates of erectile dysfunction. We encourage further testing of our observations and recommendations and hope that the developers of the IIEF consider adopting these revisions and seeking to establish the psychometric properties of this revision.

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APPENDIX

Revised International Index of Erectile Function

- Q1. Over the past 4 weeks, how often have you felt sexual desire?
- 1 = Almost never or never
 - 2 = A few times (much less than half the time)
 - 3 = Sometimes (about half the time)
 - 4 = Most times (much more than half the time)
 - 5 = Almost always or always
- Q2. Over the past 4 weeks, how would you rate your level of sexual desire?
- 1 = Very low or none at all
 - 2 = Low
 - 3 = Moderate
 - 4 = High
 - 5 = Very high
- Q3. Over the past 4 weeks, how satisfied have you been with your overall sex life?
- 1 = Very dissatisfied
 - 2 = Moderately dissatisfied
 - 3 = About equally satisfied and dissatisfied
 - 4 = Moderately satisfied
 - 5 = Very satisfied
- Q4. Over the past 4 weeks, how do you rate your confidence that you could get and keep an erection?
- 1 = Very low or none at all
 - 2 = Low

- 3 = Moderate
 4 = High
 5 = Very high
- Q5. Over the past 4 weeks, how satisfied have you been with your sexual relationship with your partner?
- X = No partner
 1 = Very dissatisfied
 2 = Moderately dissatisfied
 3 = About equally satisfied and dissatisfied
 4 = Moderately satisfied
 5 = Very satisfied
- Q6. Over the past 4 weeks, did you engage (or attempt to engage) in sexual activity of any kind with a partner and/or by yourself (masturbation)? Please remember that sexual activity can be any sort of sexual touching, including foreplay, oral sex and intercourse.
- 0 = No sexual activity (neither with a partner nor by myself)
 1 = Sexual activity with a partner only
 2 = Sexual activity by myself only
 3 = Sexual activity both with a partner and by myself
- If you selected “0 = No sexual activity (neither with a partner nor by myself)” on Question 6 above, please skip the remaining questions on this questionnaire. If you selected any other response, please continue.**
- Q7. Over the past 4 weeks, how often were you able to get an erection during sexual activity?
- X = No sexual activity
 1 = Almost never or never
 2 = A few times (much less than half the time)
 3 = Sometimes (about half the time)
 4 = Most times (much more than half the time)
 5 = Almost always or always
- Q8. Over the past 4 weeks, when you had erections with sexual stimulation, how often were your erections hard enough for penetration?
- X = No sexual activity
 1 = Almost never or never
 2 = A few times (much less than half the time)
 3 = Sometimes (about half the time)
 4 = Most times (much more than half the time)
 5 = Almost always or always
- Q9. Over the past 4 weeks, when you attempted sexual intercourse, how often were you able to penetrate (enter) your partner?
- X = Did not attempt intercourse
 1 = Almost never or never
 2 = A few times (much less than half the time)
 3 = Sometimes (about half the time)

- 4 = Most times (much more than half the time)
- 5 = Almost always or always

Q10. Over the past 4 weeks, during sexual intercourse, how often were you able to maintain your erection after you had penetrated (entered) your partner?

- X = Did not attempt intercourse
- 1 = Almost never or never
- 2 = A few times (much less than half the time)
- 3 = Sometimes (about half the time)
- 4 = Most times (much more than half the time)
- 5 = Almost always or always

Q11. Over the past 4 weeks, during sexual intercourse, how difficult was it to maintain your erection to completion of intercourse?

- X = Did not attempt intercourse
- 1 = Extremely difficult
- 2 = Very difficult
- 3 = Difficult
- 4 = Slightly difficult
- 5 = Not difficult

Q12. Over the past 4 weeks, how many times have you attempted sexual intercourse?

- X = No attempts
- 1 = One to two attempts
- 2 = Three to four attempts
- 3 = Five to six attempts
- 4 = Seven to 10 attempts
- 5 = More than 11 attempts

Q13. Over the past 4 weeks, when you attempted sexual intercourse, how often was it satisfactory to you?

- X = Did not attempt intercourse
- 1 = Almost never or never
- 2 = A few times (much less than half the time)
- 3 = Sometimes (about half the time)
- 4 = Most times (much more than half the time)
- 5 = Almost always or always

Q14. Over the past 4 weeks, how much have you enjoyed sexual intercourse?

- X = No intercourse
- 1 = Not enjoyment
- 2 = Not very enjoyable
- 3 = Fairly enjoyable
- 4 = Highly enjoyable
- 5 = Very highly enjoyable

Q15. Over the past 4 weeks, when you had sexual stimulation or intercourse, how often did you ejaculate?

- X = No sexual stimulation/intercourse
- 1 = Almost never or never
- 2 = A few times (much less than half the time)
- 3 = Sometimes (about half the time)
- 4 = Most times (much more than half the time)
- 5 = Almost always or always

Q16. Over the past 4 weeks, when you had sexual stimulation or intercourse, how often did you have the feeling of orgasm or climax?

- X = No sexual stimulation/intercourse
- 1 = Almost never or never
- 2 = A few times (much less than half the time)
- 3 = Sometimes (about half the time)
- 4 = Most times (much more than half the time)
- 5 = Almost always or always