PSYCHOMETRICS

A Modified Procedure to Diagnose Erectile Dysfunction Using the International Index of Erectile Function (IIEF-6) Combined With the Premature Ejaculation Diagnosis Tool (PEDT) via an Internet Survey

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ABSTRACT

Background: The reliability of the International Index of Erectile Function (IIEF-5) in diagnosing erectile dysfunction (ED) is significantly decreased for the population with premature ejaculation (PE).

Aim: We aimed to illustrate a better way of diagnosing ED among the general population through a web survey study.

Methods: We collected online surveys from 2,746 men between the ages of 18 and 65. Two methods were used to determine the prevalence of ED, and these 2 methods were compared. Additionally, we divided our sample into 2 equally sized groups by median age and repeated the analyses for each group. In Method I (M I), men with an IIEF-5 score $\leq$ 21 were diagnosed with ED. In Method II (M II), PE was defined as a PEDT score $\geq$ 9, and no-PE was defined as a PEDT score $\leq$ 8. We used an IIEF-6 score cutoff of $\leq$ 24 among the PE population and a cutoff of $\leq$ 25 among the no-PE population to diagnose ED.

Main outcome measures: We examined the results from the IIEF-5, PEDT, and IIEF-6.

Results: Of the 2,746 men, 1,540 were in a stable heterosexual relationship, and the prevalence of ED among these men was determined. The prevalence of ED, as measured by Method I, was significantly higher than that measured by Method II. The kappa coefficients between the 2 methods were 0.595, 0.704, and 0.430 for the overall, no-PE, and PE populations, respectively. The internal consistency of the IIEF-5 for the PE population increased if Question 5 (intercourse satisfaction) was removed. Similar trends were observed for the groups, and there were no substantial differences.

Clinical implications: Our research suggests that before using the erectile function assessment scale to evaluate erectile function, ejaculatory function should be assessed with the PEDT.

Strengths and limitations: This was the first study to highlight the importance of evaluating ejaculatory function using the PEDT before diagnosing ED via an internet survey. There may have been recruitment bias because our study was an internet survey.

Conclusion: Establishing the prevalence of ED by using a combination of the IIEF-6 and PEDT was more reliable than using the IIEF-5 alone. Further validation of the modified procedure, especially regarding the effects of age on the results, in future studies is required. **Wang C, Zhang H, Liu Z, et al. A Modified Procedure to Diagnose Erectile Dysfunction Using the International Index of Erectile Function (IIEF-6) Combined With the Premature Ejaculation Diagnosis Tool (PEDT) via an Internet Survey. Sex Med 2022;10:100506.**

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Key Words: Erectile Dysfunction; IIEF-5; IIEF-6; Premature Ejaculation Diagnostic Tool (PEDT)

INTRODUCTION

Erectile dysfunction occurs when a man's ability to attain or maintain a sufficient erection to enjoy a satisfactory sex life is impaired.[1] The prevalence of erectile dysfunction is high worldwide, ranging from 3%-76.5%.[2] A global-scale study revealed that the prevalence of ED in 8 countries was 37%-49%.[3] Erectile dysfunction has significant adverse impacts, such as low self-esteem, depressive symptoms, low confidence, unsatisfying sexual experiences, and poor sexual relationships, on the physical and mental health of males and their sexual partners.[4-7] Accurately establishing the prevalence of ED among the general population would be beneficial for medical policy decision-making. Male sexual dysfunction is a sensitive topic, and face-to-face information collection may lead to bias; therefore, an anonymous internet survey is a convenient and effective means of collecting data.[8-11]

According to previous reports, within the category of male sexual dysfunction, premature ejaculation is relatively common, with a prevalence of 5%-35%.[12-24] However, these data regarding the prevalence of PE are doubtful. Comparatively, approximately 5% is a more reliable number, which was proposed by Althof et al. in 2014 based on the International Society for Sexual Medicine (ISSM) definition.[25] The discrepancies among different studies are primarily the result of the lack of an accurate definition of PE.[26] To date, a generally accepted definition of PE, put forth by the ISSM in 2014, makes reference to 3 dimensions, namely, a short intravaginal ejaculatory latency time (IELT), a loss of control, and distress.[25] In primary PE, the IELT is always or nearly always within approximately 1 minute.[25] In secondary PE, the IELT is significantly reduced to approximately 3 minutes or less.[25]

The International Index of Erectile Function (IIEF) and the Premature Ejaculation Diagnostic Tool (PEDT) are the most commonly used scales for diagnosing ED and PE, respectively.[27,28] Both the IIEF-6 and IIEF-5 are abridged versions of the IIEF-15, and they are effective tools for diagnosing ED.[29,30] The IIEF-5 consists of Items 2, 4, 5, 7, and 15 from the IIEF-15.[29] Item 7 evaluates intercourse satisfaction experienced by men.[27,29] For men, satisfying intercourse at least involves normal erectile and ejaculatory function[31,32]; therefore, patients with premature ejaculation score lower on this item.[33,34] Although some PE patients have normal erectile function, they achieve a low total scale score[34,35]; they are diagnosed with ED by the IIEF-5, leading to a false-positive diagnosis of ED.[34-36] According to our previous study, the specificity of the IIEF-5 was only 36% for PE patients.[33] In Tang's study, the specificity of the IIEF-5 was only 0.6% for primary PE patients.[34] However, the specificity of the IIEF-6 at the new cutoff of 24.5 was 80.7% for PE patients.[33] With increased internet usage, internet survey research has become very common, and many web survey studies have evaluated erectile function using only the IIEF-5.[37-39] Investigating the prevalence of ED among the general population using only the IIEF-5 is far from sufficient.

Overall, it is necessary to develop a modified procedure for the precise diagnosis of ED via an internet survey. In diagnosing erectile dysfunction, is a modified procedure superior to using the IIEF-5 alone?

MATERIALS AND METHODS

The Web Questionnaire

The beginning of the anonymous questionnaire contained the study protocol and informed consent information. Topics covered by the questionnaire included demographic characteristics, PEDT, IIEF-5, and IIEF-6 scores, and information concerning sexual intercourse and sexual partner relationships. The PEDT and IIEF-15 have been translated into Chinese and are well understood by Chinese people.[40,41] The link to the questionnaire was published on social media platforms in China (such as WeChat, version 7.0; Tencent, Shenzhen, China).

Sample Recruitment

Only men between the ages of 18 and 65 were allowed to complete the questionnaire and the reasons were as follows: First, our questionnaire involved some sensitive information, so we did not allow minor participants aged <18 to participate in this study. Second, older people may use the internet less often than younger people. For this reason, the data we collected regarding older men may be limited, which could lead to low reliability. People were able to complete the questionnaire after providing informed consent and understood that their participation was voluntary. Between December 9, 2020, and April 18, 2021, 2,743 people completed the questionnaire. The Ethics Committee of the Third Affiliated Hospital of Sun Yat-sen university approved the study (trial registration number: 02-042-01).

Two Methods of Diagnosing ED

Given that the IIEF-5, IIEF-6 and PEDT are used to evaluate men in a stable and heterosexual relationship,[28-30] we only included men who were in a stable and heterosexual relationship during the past 6 months in the analysis. To assess whether the modified procedure works equally well regardless of age, we divided the sample into 2 equally sized groups by median age; we repeated the analyses for each group, compared the results, and reported the main findings. In Method I (M I), men with an IIEF-5 score of 21 or less were diagnosed with ED.[29] In Method II (M II), PE was defined as a PEDT score ≥ 9, and no-PE was defined as a PEDT score ≤ 8.[41] We used an IIEF-6 score cutoff of ≤ 24 for the PE population and a cutoff of ≤ 25 for the no-PE population to diagnose ED.[33] The specific procedure used for the 2 methods is shown in Figure 1.

What was the basis for dividing the overall population into individuals with no-PE and PE? First, PE patients have low scores on Question #6 (Q6, erection confidence) of the IIEF-6, which lowers the specificity of ED diagnosis.[36] The optimal
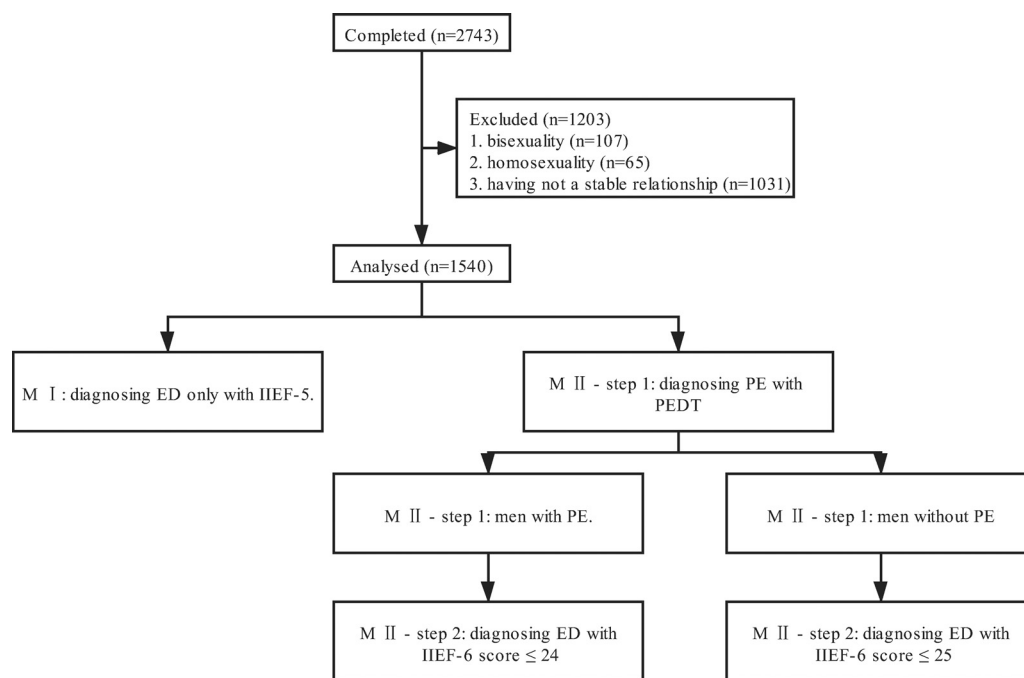
Figure 1. The specific procedure used by the two methods.

cutoff value of the IIEF-6 is different for individuals with PE and no-PE.[36] Second, PE can lead to low intercourse satisfaction. Question #5 (Q5) of the IIEF-5 evaluates intercourse satisfaction, so PE patients may have low scores for this item, which leads to a false-positive diagnosis of ED.[34] Therefore, the discrimination between PE and no-PE is necessary. In addition, a previous study demonstrated that the PEDT can effectively separate the overall population into PE and no-PE individuals.[41]

Since every item of the IIEF-6 is specifically focused on erectile function, the reliability of the IIEF-6 in diagnosing ED is only rarely affected by PE.[36] However, Q5 of the IIEF-5 is associated with sexual satisfaction.[34] PE can lead to low sexual satisfaction.[25] The area under the receiver operating characteristic (ROC) curve of the IIEF-6 is higher than that of the IIEF-5.[36] The reliability of the IIEF-6, with an adjusted cutoff value for the PE population, was significantly higher than that of the IIEF-5.[36] Therefore, we used the IIEF-6 in M II instead of the IIEF-5. Among the PE population, the IIEF-6, with the amended cutoff value of 24.5, had a higher specificity than the original cutoff value of 25.5. After the cutoff value of the IIEF-6 was adjusted to 24.5 for the PE population, the specificity increased to 80.7%, and the sensitivity was 100%.[36] For these reasons, we used different cutoff values in Method II. However, it should be noted that participants needed to have at least 1 episode of intercourse during the past 4 weeks before evaluating erectile function with the IIEF-6.[30]

Statistical Analysis

All analyses were performed using SPSS 26.0 (SPSS, Inc., Chicago, IL, USA). All quantitative data are presented as the mean ± standard deviation. All qualitative data are presented as frequencies and proportions. The differences between the diagnostic results of the 2 methods were tested by the McNemar test. We used the kappa test to evaluate the consistency of diagnosis between the 2 methods. Cronbach's alpha was used to evaluate internal consistency. The significance level was set as a 2−tailed P value < .05 in all data analyses.

RESULTS

The survey completion rate was 97.48%. Seventy-one questionnaires did not include data regarding age and characteristics. Participants needed approximately 10 minutes to fill out the questionnaire. A total of 2,743 participants between 18 and 65 years of age completed the questionnaire. Among those men, 56.1% (n = 1,540) were in a stable heterosexual relationship during the past 6 months and had vaginal intercourse at least once in the past 4 weeks. Ultimately, 1,540 individuals were included in the analysis (Figure 1) and divided into 2 equally sized groups by median age (38 years): Group A (18-38 years) and Group B (38-65 years).

Demographic Characteristics

The demographic characteristics of all participants included in the analysis are shown in Table 1.

The Results From Method I and Method II

Among the overall population, 59.8% (n = 921) and 40.1% (n = 617) of the participants were diagnosed with ED by Methods I and II, respectively (Table 2). Among the no-PE
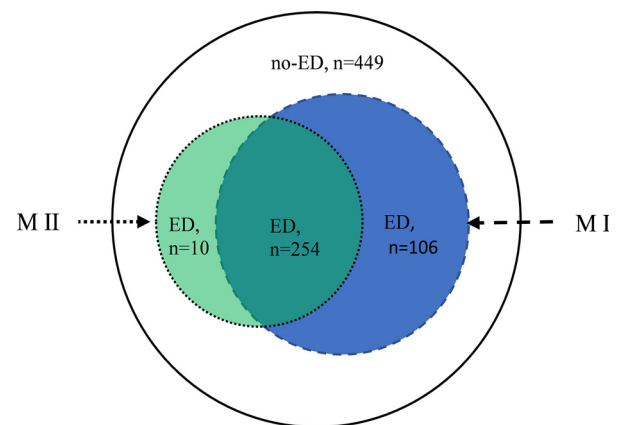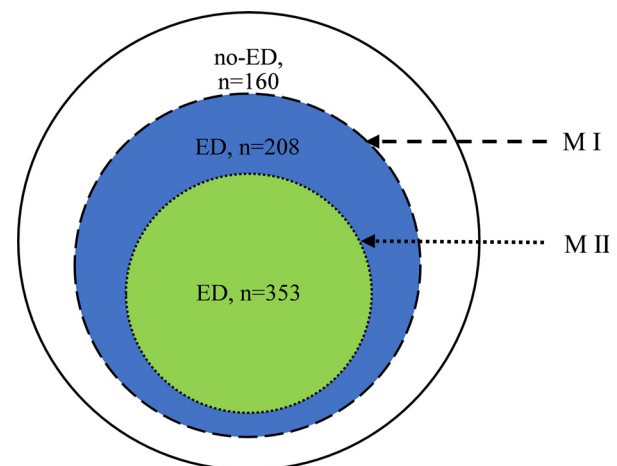
Table 1. Demographic characteristics.

	All (n = 1540)
Age, years (mean ± SD)	38.04 ± 8.76
BMI, (mean ± SD)	24.29 ± 3.61
Sexual orientation	heterosexual
Marital status	
Unmarried, n (%)	148 (9.6)
Married, n (%)	1365 (88.6)
Divorced, n (%)	18 (1.2)
Widowed, n (%)	9 (0.6)
Educational status	
Junior high school and below, n (%)	330 (21.4)
Senior school or technical secondary school, n (%)	469 (30.5)
Junior college and university, n (%)	741 (48.1)
Income level, yuan	
Less than 5 thousand	529 (34.4)
Five thousand - ten thousand	748 (48.6)
Ten thousand - twenty thousand	181 (11.8)
More than twenty thousand	82 (5.3)
Frequency of vaginal intercourse, times/ month (mean ± SD)	5.91 ± 5.83

Figure 2. The results in no-PE population (n = 819).

Figure 3. The results in PE population (n = 721).

population, 43.9% (n = 360) and 33.2% (n = 264) of the participants were diagnosed with ED by Methods I and II, respectively (Table 2). Among the PE population, 77.8% (n = 561) and 49.0% (n = 353) of the participants were diagnosed with ED by Methods I and II, respectively (Table 2). The diagnostic results are presented in Figures 2 and 3. The kappa coefficients between the 2 methods were 0.595, 0.704, and 0.430 for the overall, no-PE, and PE populations, respectively (Table 2).

In Group A, the kappa coefficient was 0.387 among the PE population (Table 4). In Group B, the kappa coefficient was 0.465 among the PE population (Table 5). In Group A, 73.9% and 40.4% of the PE population were diagnosed with ED by M I and M II, respectively (Table 4). In Group B, 82.0% and 58.0% of the PE population were diagnosed with ED by M I and M II, respectively (Table 5).

Internal Consistency of the IIEF-5

Cronbach's α coefficients were 0.850, 0.815, and 0.838 for the overall population, no-PE population, and PE population, respectively (Table 3). After Q5 (intercourse satisfaction) of the IIEF-5 was removed, Cronbach's α coefficients were 0.861,

0.810, and 0.861 for the overall population, no-PE population, and PE population, respectively (Table 3).

In Group A, Cronbach's α coefficients were 0.806, 0.710, and 0.796 for the overall population, no-PE population, and PE population, respectively (Table 4). After Q5 (intercourse

Table 3. Internal consistency of IIEF-5 among various populations.

	All (n = 1540)	No-PE (819)	PE(n = 721)
Cronbach's coefficient α	0.850	0.815	0.838
Cronbach's coefficient α (Q5 excluded)	0.861	0.810	0.861

Table 2. The differences in diagnostic results and consistency between the 2 methods.

	All (n = 1540)		P	No-PE (n = 819)		P	PE (n = 721)		P
	M1	M2		M1	M2		M1	M2	
ED (n, %)	921 (59.8)	617 (40.1)	P < .001	360 (43.9)	264 (33.2)	P < .001	561 (77.8)	353 (49.0)	P < .001
Kappa	0.595		P < .001	0.704		P < .001	0.430		P < .001

Table 4. Group A (aged 18-38): the differences and consistency between M1 and M2, and the internal consistency of IIEF-5.

	All (n = 770)		P	No-PE		P	PE		P
	M1	M2		M1	M2		M1	M2	
ED (n, %)	421 (54.7)	245 (31.8)	P < .001	147(36.8)	95 (23.8)	P < .001	274 (73.9)	150 (40.4)	P < .001
Kappa	0.523		P < .001	0.616		P < .001	0.387		P < .001
Cronbach's coefficient α	0.806			0.710			0.796		
Cronbach's coefficient α (Q5 excluded)	0.827			0.715			0.838		

satisfaction) of the IIEF-5 was removed, Cronbach's α coefficients were 0.827, 0.715, and 0.838 for the overall population, no-PE population, and PE population, respectively (Table 4).

In Group B, Cronbach's α coefficients were 0.877, 0.858, and 0.865 for the overall population, no-PE population, and PE population, respectively (Table 5). After Q5 (intercourse satisfaction) of the IIEF-5 was removed, Cronbach's α coefficients were 0.878, 0.841, and 0.879 for the overall population, no-PE population, and PE population, respectively (Table 5).

DISCUSSION

Rosen RC et al. developed the IIEF-5, a concise, effective, and self-administered diagnostic tool, to diagnose ED.[29] The IIEF-5 has been translated into a variety of languages and is well validated in many countries.[42-45] With the rising popularity of the internet, the number of internet surveys is increasing. Especially for private matters such as sexual dysfunctions, an anonymous online questionnaire survey has great advantages.[8,9] In many web survey studies, the IIEF-5 has been used as the crucial means of diagnosing ED.[46,47] However, several studies have found that the specificity of the IIEF-5 among the PE population is concerning.[34-36]

What are the reasons leading the decreasing specificity of the IIEF-5 in the context of PE? According to previous studies, Q5 of the IIEF-5 lowers the total scores and further leads to false-positive diagnoses of ED.[34,36] Q5 is used to evaluate sexual satisfaction, which involves multiple dimensions of sexual life, involving at least male sexual function, female sexual function, and partner relationships. For men, normal erectile function and ejaculatory function are the basic guarantees of a satisfactory sexual life. PE is a relatively common male sexual dysfunction[48] leading to low sexual satisfaction.[22,23] The internal consistency analysis

of the IIEF-5 contributes to the further exploration of the cause of this phenomenon. In our study, removing Q5 resulted in decreased internal consistency for the no-PE population but improved internal consistency for the overall and PE populations. These results indicated that Q5 lowered the reliability of the IIEF-5 in diagnosing ED among the PE population.

The differences between the diagnostic results of the 2 methods were significant for the 3 populations, especially for the PE population. In the general population, the prevalence of ED measured by Method I was 19.7% higher than that measured by Method II. Among the PE population, the prevalence of ED measured by Method I was 28.8% higher than that measured by Method II. The consistency between the 2 methods was the worst for the PE population. In contrast, the consistency between the 2 methods was the best for the no-PE population. These results further indicated that PE could affect the reliability of the IIEF-5 in diagnosing ED.

Both PE and ED tend to be affected by or at least associated with age. Therefore, to assess whether the modified procedure works equally well regardless of age, we divided the sample into 2 equally sized groups by median age and compared the 2 methods. In both Groups A and B, the differences in the diagnostic results were the most significant among the PE population, and consistency between the 2 methods was the worst. Conversely, the concordance between the 2 methods was the best among the no-PE population, regardless of the group. Among the PE population, Cronbach's α coefficient was improved after excluding Q5. The same trends were obtained in both Groups A and B. Although there were no substantial differences between Groups A and B, we still could not rule out the effects of age on the proposed approach. Future studies are required to further examine this issue.

Table 5. Group B (aged 38-65): the differences and consistency between M1 and M2, and the internal consistency of IIEF-5.

	All (n = 770)		P	No-PE		P	PE		P
	M1	M2		M1	M2		M1	M2	
ED (n, %)	500 (64.9)	372 (48.3)	P < .001	213(50.7)	169 (40.2)	P < .001	287 (82.0)	203 (58.0)	P < .001
Kappa	0.655		P < .001	0.763		P < .001	0.465		P < .001
Cronbach's coefficient α	0.877			0.858			0.865		
Cronbach's coefficient α (Q5 excluded)	0.878			0.841			0.879		

Because PE and ED are common male sexual dysfunctions,[48,49] the prevalence of ED should be investigated in the context of PE rather than assuming that all people are members of the no-PE population.

For the above reasons, we developed this modified procedure (Method II) for diagnosing ED.

There are some limitations in our study. There may have been recruitment bias because older people are likely to use the internet less often than younger people. We collected data on the coronavirus disease 2019 (COVID-19) pandemic. Many recent studies have indicated that the ongoing pandemic has significantly affected human health and mental well-being.[50] A certain proportion of adult males experienced decreased sexual function during the COVID-19 pandemic,[50] for reasons including poorer mental health status and decreased frequency of vaginal intercourse.[50] However, unfortunately, we have no measures evaluating the impacts of this in our questionnaire. Future investigations with larger samples are needed to replicate our findings and address these limitations.

CONCLUSION

Compared with the use of the IIEF-5 alone, this modified procedure could significantly improve the reliability of diagnosing ED via a web survey. The prevalence of ED among the general population, as measured by the IIEF-5, was 19.7% higher than that measured by the modified procedure. This discrepancy was mainly due to the worse reliability of the IIEF-5 among the PE population. Larger studies are needed to replicate these results. Establishing the prevalence of ED among the general population can be helpful for decision-making regarding medical and health policies.

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