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OBJECTIVE MEASUREMENT OF EFFECTIVENESS OF PSYCHOLOGICAL CONSULTING SERVICES

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We investigated whether or not physiological signals reflect the effectiveness of a psychological consultation. Participants (N = 108 college students) rated the quality of a consulting service. We recorded their vital signs before and after the consultation session, and eye-related signals during the consulting process. Results of paired samples t tests showed that body temperature, heart rate, and blood pressure had changed significantly after the consultation and degree of the changes was closely correlated with the participants' subjective ratings. Further, results of a 1-way analysis of variance showed that the change in eye-blinking rate and frequency of pupil size fluctuation were aligned with the consulting session outcome. Our results indicate that vital signs and eye-related signals are effective measures to evaluate the effectiveness of psychological consulting services.

Keywords: psychological consulting effectiveness, vital signs, eye-related signals, psychological consulting services, physiological signals.

In recent times, Chinese college students' psychological issues have become increasingly serious. In a study conducted at a university in Shanghai, Qu and Tang (2010) found that about 20% of the students suffered from interpersonal sensitivity, obsessive-compulsive disorder, unhealthy fixations, depression, and feelings of inferiority. Some of them were only mildly affected, but others had serious psychological issues. According to a report based on data from Shanghai, about 90,000 of 433,000 students had psychological difficulties, such as affective issues, interpersonal relationship problems, study pressure, family-related distress, anxiety regarding their career path, and feelings of inferiority (Lin, Tao,

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& Wang, 2015). At 16 universities in Beijing, around 17% of student suspensions and 65% of dropouts were found to be due to poor psychological health (Yi, Zhong, & Peng, 2015). As a result of China's one-child policy, children are dependent, sensitive, less social, and feel more helpless and lonely when they leave home, leading to some extreme behavior (Fang, Jing, & Wang, 2010).

When many college management departments realized the serious situation of students' psychological health more than 10 years ago, they set up consulting centers to help students with psychological problems. Psychological consultation became a very important way to help the students, who hoped that the psychological counselor would solve their problems. High-quality consulting services thus became a pressing need, but there have been a number of complaints about the effectiveness of these services (Liu, 2014). To improve their quality, it is essential to measure the change in customers' psychological status during the consultation, but measurement of the effectiveness of a consultation poses a technical challenge.

Previous researchers have evaluated the quality of psychological consultation with subjective questionnaires. Abdi, Faraji, and Abasi (2012) used a personal profile questionnaire and a sexual satisfaction questionnaire to determine the impact of counseling on the sexual satisfaction of infertile women who had been referred to infertility clinics in Tabriz. They found that psychological consultation had a significant effect on the sexual satisfaction rate of infertile women. Abdi et al. also found that the subjective evaluation was closely related to the women's level of cooperation and their attitude. MacLeod, Jones, Somers, and Havey (2001) used a retrospective survey of participants' perceptions to evaluate the effectiveness of school-based behavioral consultation. However, it was unclear how well the teachers who were the respondents represented all those who had experienced school-based behavioral consultation. The teacher sample was small and only teachers with favorable impressions completed and returned the surveys. Kratochwill and Van Someren (1995) reported some barriers in behavioral consultation, including the lack of standardization of consultation, specific training, and objective evaluation. They stated that each of these areas needed to be addressed in future research.

Recent researchers have put great effort in searching for reliable objective measures to evaluate psychological status. Phitayakorn, Minehart, Hemingway, Pian-Smith, and Petrusa (2015) compared physiological and psychological anxiety assessments in operating room teams during simulated events. Participants completed the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) and wore a galvanic skin response sensor, after which differences in STAI scores and galvanic skin response levels were analyzed. All groups showed a significant increase in galvanic skin response, with senior practitioners and residents having a higher level of baseline trait anxiety. Operating room team

training resulted in physiological signs of anxiety that were not correlated with self-reported psychological measurements. It is unclear why this happened, but it is possible that many interfering signals made assessment inadequate.

Otabe, Kaneda, Yoshikai, and Tokuyasu (2014) proposed an objective assessment for the process of psychophysiological recovery from psychological damage. They used an electroencephalogram (EEG) and an electrocardiogram (ECG) to investigate individuals' physiological response to a series of stress stimulations that might engender recall of negative experiences. They attached electrodes to their participants to record an EEG and an ECG, which allowed them to assess the participants' physiological response. However, as the attached electrodes were inconvenient and distracting for the participants, this limited the practical clinical application of the method. Naschitz et al. (2002) used fractal analysis and recurrence quantification analysis for diagnosing chronic fatigue syndrome, based on the individual's heart rate and pulse transit time. They found that these vital signs reflected the syndrome accurately. Wang and Duan (2011) found that patients' anxiety and depression before a surgical operation were closely correlated with their heart rate and blood pressure. Psychological intervention alleviated anxiety and depression before the operation and the patients' vital signs became more stable.

Previous researchers have illustrated how eye movements are related to psychological status and cognition (Arai, 2015; Susac, Bubic, Kaponja, Planinic, & Palmovic, 2014). Arai (2015) found a strong relationship between psychological status and eye movements through experiments involving reading of different types of documents and also playing games. Psychological status was monitored with an EEG sensor and eye movements were monitored with cameras with a near-infrared light emission diode. EEG signals are interrupted by noise, but these eye movements were recorded without any noise. Psychological status was thus monitored with eye-movement detection instead of EEG signal acquisition. Susac et al. (2014) found that the measurements derived from eye-movement data were more objective and reliable than were the participants' reports. These results indicate that the measurement of eye movements provided insight into otherwise unavailable cognitive processes. However, analysis based on image signals was easily affected by the respondents' facial expressions and unrelated eye movements.

Results from other studies further indicate that personal cognition, concentration, and eyestrain are related to eye-blink and pupil-size fluctuation. Chen and Epps (2013) proposed an eye-based automatic cognitive load measurement system and investigated three types of eye activity: pupillary response, blink, and eye movement (fixation and saccade). The performance of the cognitive load level prediction was close to the eye activity features for near real-time cognitive load measurement. Jang, Mallipeddi, Lee, Kwak, and Lee (2014) cited the

salient features of the eye, such as fixation length, fixation count, and pupil size variation, as the inputs to evaluate a person's implicit intention, and they proposed a novel approach for a person's implicit intention recognition based on eyeball-movement pattern and pupil-size variation. Their experimental results showed that the proposed model achieved plausible recognition performance. Lee, Ojha, and Lee (2015) monitored the concentration level of learners by analyzing their pupillary response and eye-blinking pattern when they performed an online task on a computer. They used a low-priced web camera to detect the eye-blinking pattern and a portable eye tracker to detect pupillary response. Their experimental results showed that the proposed concentration level monitoring system performed well, suggesting that it could be used for various real-world applications. E. C. Lee and Park (2009) and E. C. Lee, Park, Wang, and Min (2009) developed a method for evaluating human eyestrain by calculating the eye-blinking rate and frequency of pupil size fluctuation while participants were watching liquid crystal display and plasma display panel devices.

In summary, evaluation by means of a subjective questionnaire is more suitable for qualitative investigation as it is closely related to participants' attitudes; disadvantaged by the possibility of incorrect understanding, untruthful answers, and respondents' bias; and also requires a great deal of time training respondents to eliminate these influences.

Although some subjective evaluation issues are avoided by the use of objective measures, it is important to select the right objective measures. For example, galvanic skin response sensors and image signals are easily disturbed by interfering signals, such as participants' facial expressions and unrelated eye movements. In addition, an ECG and an EEG can reflect the individuals' psychological status, but are inconvenient because they are noisy and the attached electrodes limit their practical clinical application. Thus, we did not use these measures in this study.

As vital signs, such as heart rate, blood pressure, and pulse transit time, can reflect respondents' psychological status accurately, they can be regarded as alternative objective variables to measure the effectiveness of psychological consultation. Eye-related signals have also been used to estimate psychological status, cognition, concentration, and eyestrain. Valuable data from eye-related action can be used to evaluate personal psychological status, with an eye-tracking system recording eye movement automatically without any invasiveness. Thus, eye-related signals can also be regarded as alternative variables for evaluating the effectiveness of psychological consultation.

In our study, our criteria were that a feasible measurement framework must be effective, easy to operate, and noninvasive, therefore, we selected the vital signs of blood pressure, heart rate, and body temperature. Researchers have shown that vital signs, such as heart rate and blood pressure, successfully reflected

individuals' psychological status (Naschitz et al., 2002; Susac et al., 2014). Because consulting effectiveness is closely related to participants' psychological change, changes in vital signs can reflect the effectiveness of psychological consultation. Therefore, we proposed the following hypothesis:

Hypothesis 1: The vital signs of the individual will relate to psychological consulting effectiveness in that, if the consultation is effective, blood pressure and body temperature will become lower, and the heart rate will become slower, as anxiety and depression levels will change from high to low.

Eye-related signals are another form of objective measurement. We believed that a consulting service would be more effective if respondents concentrated more during the consultation. Previous researchers have shown that human concentration and cognition are related to the eye-blinking rate and frequency of pupil size fluctuation (Chen & Epps, 2013; Jang et al., 2014; G. Lee et al., 2015), with the eye activities reflecting the degree of concentration and cognition. Therefore, we proposed the following hypothesis:

Hypothesis 2: Eye-related signals will relate to psychological consulting effectiveness such that, if the consultation is effective, the individual's eye-blinking rate will decrease and the fluctuating frequency of his/her pupil size will increase.

Method

Participants and Procedure

We conducted our study at East China University of Science and Technology, which is a university with about 24,800 students in Shanghai, China, where one of the authors is employed as a special psychological counselor. We distributed a six-item survey (the Psychological Health Questionnaire; see Appendix), with responses rated on a 5-point Likert scale ranging from 1 = *none* to 5 = *severe*, to 800 students to assess their psychological health. The items for the survey were developed in a Chinese context and related to affective issues, interpersonal relationship problems, study pressure, family-related distress, anxiety regarding their career path, and feelings of inferiority. The response score for each item was recorded as a subjective measurement of the degree of each of six kinds of psychological problem, with a higher score indicating a more serious problem. From the 736 effective samples that were obtained, we selected 25 students according to their score for each item in relation to each kind of psychological problem, and asked if they wished to join the experiment. We screened 18 students for each kind of psychological problem. With six kinds of problem, 108 participants were thus selected.

The 108 participants comprised 54 men and 54 women aged from 18 to 22 years ($M_{age} = 20$, $SD = 1.8$), who were physiologically healthy aside from psychological issues in one of six areas. All participants provided written informed consent

prior to taking part in the experiment. The Institutional Ethics Committee of East China Normal University gave their approval for the study.

Measures

We conducted a psychological consulting experiment to identify objective measurement signals in a one-on-one consultation. To evaluate psychological consulting effectiveness we used a subjective questionnaire, the Consulting Evaluation Questionnaire (CEQ; see Appendix). Simultaneously, measuring devices were used to record vital signs and eye-related signals. The physiological data were then analyzed to test the hypotheses, and correlation analysis was performed to identify the relationship between physiological symptoms and scores on the subjective scale. If the physiological signs were closely related to the respondent's subjective evaluation, it meant that the physiological signs could accurately reflect participants' psychological status. The consultation experiment process is shown in Figure 1.

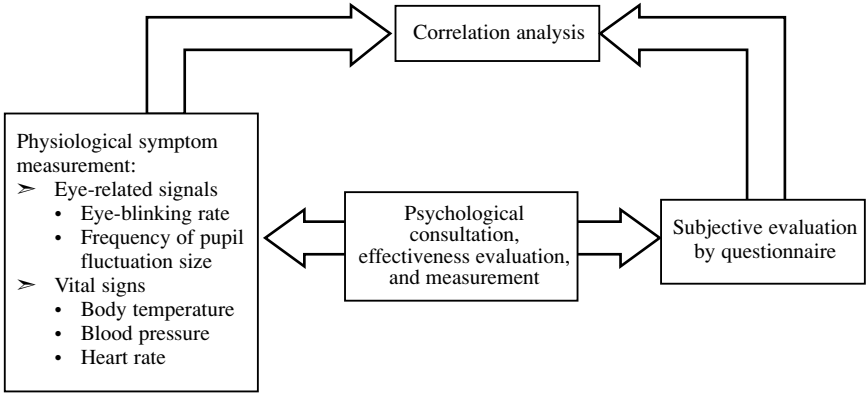

Figure 1. *Model for the psychological consultation session experiment.*

Objective measurement apparatus, monitor, and meter. We used an eye-tracking system (SMI RED5 Eye Tracking Device, H-RED-05.01-HS) to record participants' eye-blinking rate and frequency of pupil size fluctuation that occurred automatically during the experiment. A blood pressure monitor (Oregon Scientific BPW810N) was used to measure blood pressure and heart rate. Body temperature was measured with a thermal meter (Domotherm 0860 OT In-Ear Thermometer Infra-Red).

Consulting Evaluation Questionnaire. We designed a 10-item consulting evaluation survey with responses rated on a 5-point Likert scale ranging from 1 = *none* to 5 = *severe*. The scale was developed in a Chinese context. The total score

for the CEQ was recorded as the participants' subjective evaluation of the degree of consulting effectiveness, with a higher score indicating greater effectiveness. The α coefficient of the CEQ was .74, and internal consistency was .70.

Procedure

Prior to the consultation, participants had a 5-minute training session about the experiment, after which they completed the CEQ and their vital signs were measured over a period of 8 minutes. Subsequently, they took part in a 25-minute consulting session, involving four steps, each taking 6 minutes. In Step 1, the relationship between counselor and participant was established and the counseling program was designed. We asked participants for basic information, such as major, grade, class, family information, and psychological problems that they were facing, although we had already obtained this information when we recruited and screened them. In Step 2, we addressed participants' key conflict and its root cause by bringing their subconscious conflict to conscious expression. In Step 3, we helped participants improve their positive cognition and alleviate their psychological conflict, so that they could actively face studying and life in general. In Step 4, psychological consulting effectiveness was evaluated through the participants' self-assessment and counselor review. This completed the consultation, during which participants' eye-blinking rate and fluctuation frequency of pupil size were recorded via the eye-tracking system. Then the participants completed the CEQ again and their vital signs were measured over a period of 7 minutes. The entire session lasted 45 minutes.

Data Analysis

SPSS version 19.0 and G*Power Version 3.1.2 were used to analyze the data. A paired samples *t* test was used to compare the mean of each item in the CEQ before and after the experiment, and the effect size (Cohen's *d*) was calculated to verify the effect of the paired samples *t* test by G*Power.

A paired samples *t* test was also used to compare the mean of each vital sign before and after the consultation session, and the effect size (Cohen's *d*) was calculated. The test result indicated that the vital signs reflected the effectiveness of psychological consultation.

Differences in vital signs before and after consultation, and blinking rate and frequency of pupil size data were recorded automatically during the consultation session. Thus, one-way analysis of variance (ANOVA) was used to compare the mean of the eye-blinking rate and frequency of pupil size fluctuation at multiple time points during the consultation session and the effect size was calculated. The test result indicated that the eye-blinking rate and frequency of pupil size fluctuation could significantly reflect the effectiveness of the psychological consultation.

Simple correlations were used to examine the relationships between vital signs, eye-blinking rate, frequency of pupil size fluctuation, and the CEQ. Spearman's rank-order correlation coefficients were used to test the significance of the correlation coefficients between the subjective CEQ and the objective measurements of vital signs and eye-related signals.

Results

Consulting Evaluation Questionnaire

Subjective ratings before and after the consultation session are shown in Figure 2. As the overall rating scores significantly increased from 0.92 ± 0.86 to 3.28 ± 0.84, $t(107) = -50.73$, $p < .001$, Cohen's $d = 6.90$, the effectiveness of the 25-minute consultation session was significant.

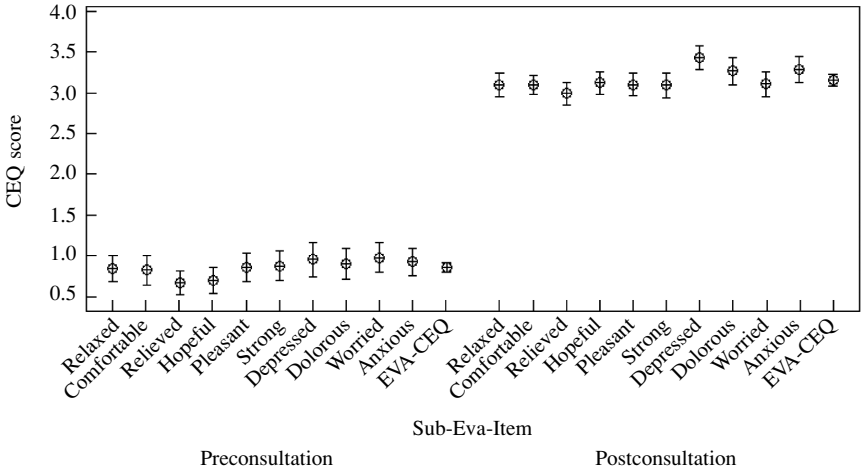

Figure 2. *Consulting Evaluation Questionnaire item scores preconsultation and postconsultation (Mean values and 95% confidence intervals).*
Note. Sub-eva-item = subjective evaluation item; EVA-CEQ = the combination variable for relaxed+comfortable+relieved+hopeful+pleasant+strong+depressed+dolorous+worried+anxious.

Vital Signs

Four vital signs, namely, systolic blood pressure, diastolic blood pressure, heart rate, and body temperature, were recorded before and after the consultation session, and they all showed a clear decline over that period (see Figures 3a to 3d). Systolic blood pressure decreased from 117 ± 7.84 to 108 ± 7.59, $t(107) = 8.86$, $p < .001$, Cohen's $d = 1.20$, and diastolic blood pressure decreased from

73.7 ± 8.92 to 68.3 ± 8.21, $t(107) = 4.63$, $p < .001$, Cohen's $d = 0.63$. Heart rate changed from 82.66 ± 6.64 to 74.68 ± 6.78, $t(107) = 8.74$, $p < .001$, Cohen's $d = 1.19$, and body temperature decreased after the consultation, namely, preconsultation: 36.89 ± 0.36, and postconsultation: 36.09 ± 0.34, $t(107) = 16$, $p < .001$, Cohen's $d = 2.18$.

According to Hypothesis 1, the effectiveness of the consultation would be closely related to the change in participants' psychological status, with the vital signs becoming more stable. Thus, Hypothesis 1 was supported.

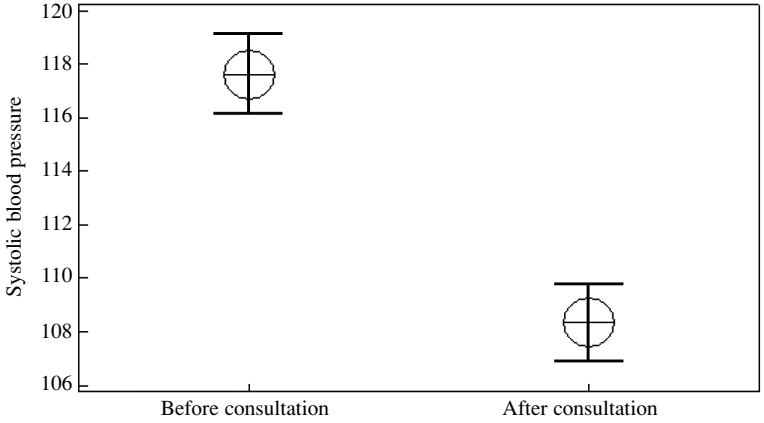

Figure 3(a). *Systolic blood pressure (Mean values and 95% confidence intervals).*

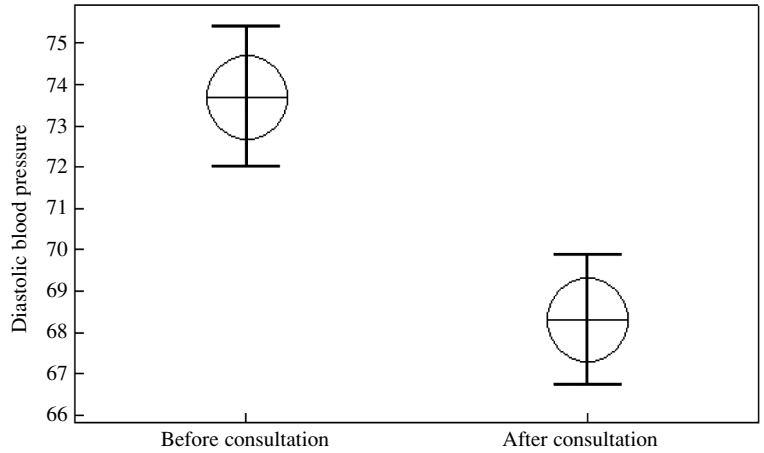

Figure 3(b). *Diastolic blood pressure (Mean values and 95% confidence intervals).*

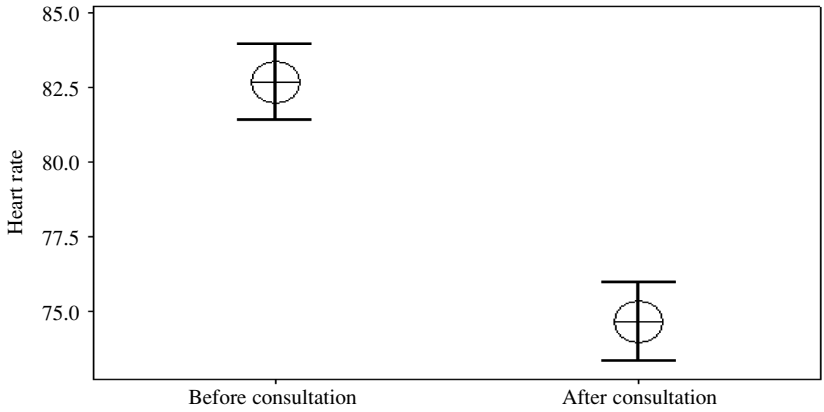

Figure 3(c). *Heart rate (Mean values and 95% confidence intervals).*

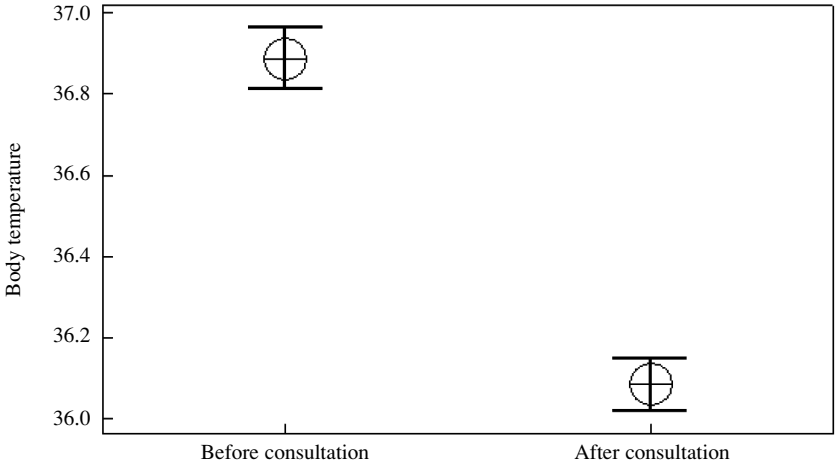

Figure 3(d). *Body temperature (Mean values and 95% confidence intervals).*

Eye-Related Signals: Eye-Blinking Rate and Frequency of Pupil Size Fluctuation

The eye-blinking rate and frequency of pupil size fluctuation showed significant shifts during the consultation. The eye-blinking rate decreased from 33.9 ± 5.26 to 15.1 ± 5.14, $F(7) = 208.4$, $p < .001$, effect size = 6.60, and the frequency of pupil size fluctuation increased from 135.48 ± 29.63 to 175.73 ± 29.62, $F(7) = 48.67$, $p < .001$, effect size = 15.22. A one-way ANOVA result showed a significant change in eye-blinking rate and frequency of pupil size fluctuation during each time period from the beginning to the end of the experiment and the

effect size ANOVA results indicated that the eye-blinking rate and frequency of pupil size fluctuation were useful objective measures of the effectiveness of the psychological consultation.

Therefore, the eye-related variables reflected the effectiveness of the consultation session. That is, when participants concentrated more during the psychological consultation, their eye-blinking rate would decrease and their frequency of pupil size fluctuation would increase, and the consultation would be more effective. Thus, Hypothesis 2 was supported (see Figures 4a and 4b).

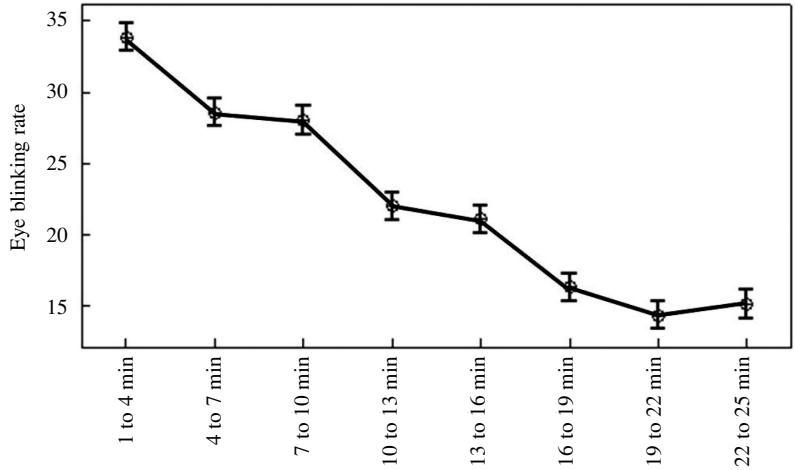

Figure 4(a). *Eye-blinking rate (Mean values and 95% confidence intervals).*

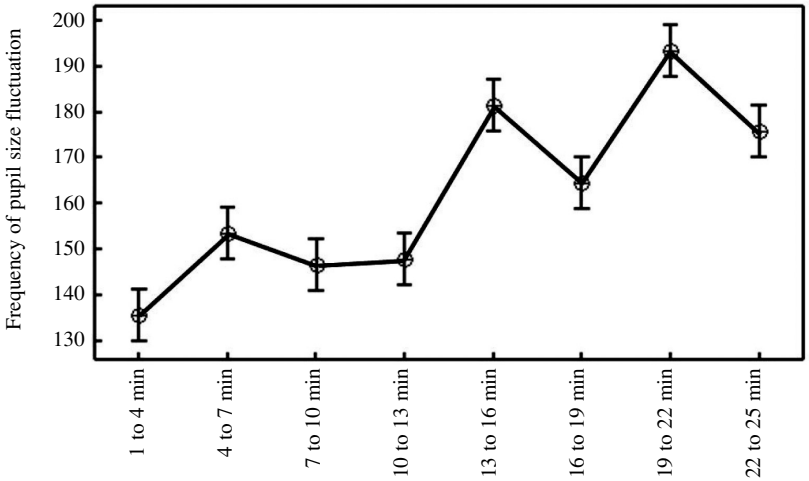

Figure 4(b). *Frequency of pupil size fluctuation (Mean values and 95% confidence intervals).*

Correlation Between the Consulting Evaluation Questionnaire and Objective Measurements

We used two kinds of measurement to evaluate the effectiveness of the consultation: a subjective evaluation with the CEQ and objective measurement of vital signs and eye activity. Correlation analyses were conducted between the subjective CEQ and the objective variables, for which there are scatter diagrams in Figures 5a–5f.

There was a significant correlation between the objective variables and the subjective CEQ, indicating that the vital signs and eye-related signals were valid objective measures of consultation effectiveness (see Figures 5a–5f).

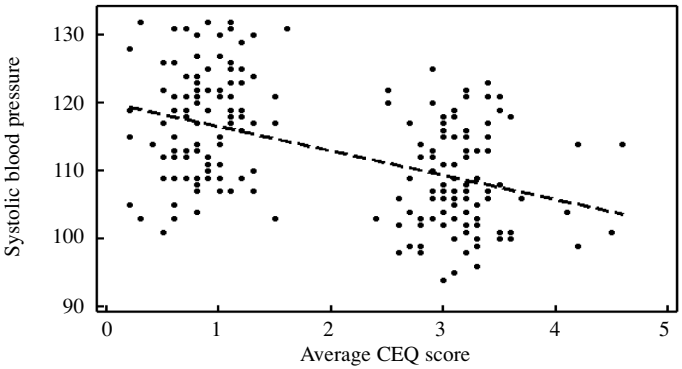

Figure 5(a). *Systolic blood pressure and Consulting Evaluation Questionnaire scores.*
Note. Spearman's rho = -.401; $p < .001$.

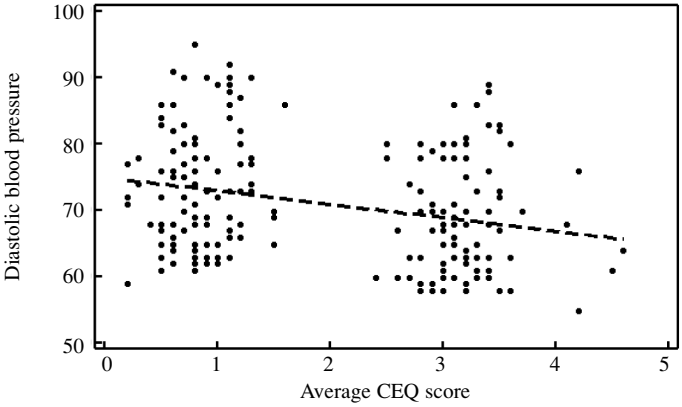

Figure 5(b). *Diastolic blood pressure and Consulting Evaluation Questionnaire (CEQ) scores.*
Note. Spearman's rho = -.222; $p < .001$.

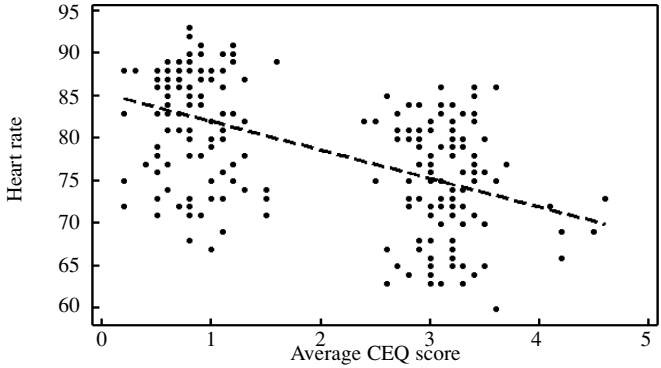

Figure 5(c). *Heart rate and Consulting Evaluation Questionnaire scores.*
Note. Spearman's rho = -.476; $p < .001$.

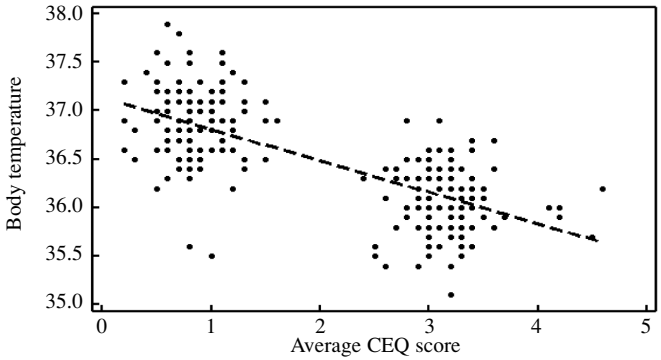

Figure 5(d). *Body temperature and Consulting Evaluation Questionnaire scores.*
Note. Spearman's rho = -.680; $p < .001$.

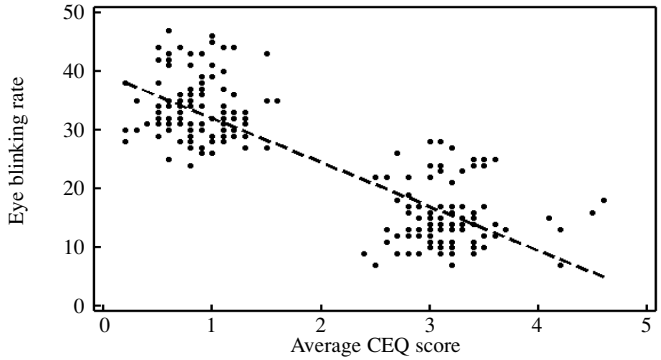

Figure 5(e). *Eye-blinking rate and Consulting Evaluation Questionnaire scores.*
Note. Spearman's rho = -.747; $p < .001$.

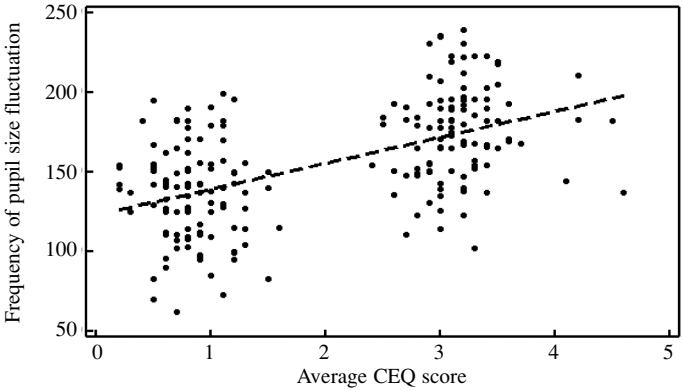

Figure 5(f). *Frequency of pupil size fluctuation and Consulting Evaluation Questionnaire scores.*
Note. Spearman's rho = .522; $p < .001$.

Discussion

Our aim in this study was to identify objective measures to evaluate the effectiveness of a psychological consultation session. Previous researchers have indicated that some physiological symptoms reflect psychological status and the effectiveness of consultation. For example, galvanic skin response reflected the anxiety of participants in operating room teams during simulated events (Phitayakorn et al., 2015), but there was interference from many disturbing signals. Phitayakorn et al. (2015) used the subjective STAI to evaluate the participants' psychological activity to supplement a shortage of galvanic skin response sensors.

Criteria for a feasible measurement framework are to be effective, easy to operate, and noninvasive. Thus, we did not use galvanic skin response sensors, ECG, or EEG. Use of these measuring devices could become effective methods to assess psychological status in the future, if there were no need to attach electrodes.

Instead we built on the work of researchers who have reported finding that vital signs indicated the seriousness of symptoms of illness or the level of anxiety of their participants. Naschitz et al. (2002) had found that the vital signs of heart rate and pulse transit time accurately reflected the seriousness of chronic fatigue syndrome, an illness that is sometimes closely related to personal psychological issues. However, these researchers did not use these vital signs to measure their participants' mental health status. Wang and Duan (2011) found that patients' levels of anxiety and depression were closely related to changes in their heart rate and blood pressure. However, these researchers used psychological intervention

only to relax patients in preparing them for surgical treatment and to calm their vital signs. They did not use vital signs to evaluate their patients' psychological status.

In our study, we found that vital signs could reflect the effectiveness of a psychological consultation session through the measurement of change in psychological status by vital signs. Many individuals who need psychological consulting services suffer from issues such as nervousness and excessive worrying, so their vital signs are intensified, in that their heart rate quickens, their blood pressure is raised, and their body temperature is higher than usual. Psychological consultation sessions can relieve their psychological problems and stabilize their vital signs. The more significant the improvement is in vital signs, the more effective is the psychological consultation. The main problem with using vital signs for measurement of an individual's psychological status is that the signs can be used only to measure change in an individual's psychological status before and after the consultation. They cannot measure the change process of psychological status in real time and, thus, cannot measure the effectiveness of the consultation during the time that it is taking place.

Other researchers have used eye-related signals to estimate psychological status and reactions by using different tools and methods to acquire the eye-related signal data. Arai (2015) used near-infrared cameras to record eye-gaze shift to evaluate psychological status. G. Lee et al. (2015) combined many eye-related movements in a video to evaluate psychological status and concentration, but these researchers did not use the eye-blinking rate and frequency of pupil size fluctuation to measure consulting effectiveness. However, as image signals analysis is easily affected by participants' facial expressions and unrelated eye movements, data collection and analysis were a lengthy process, and so the eye-related signals were not taken into account preferentially in these studies.

We proposed that the eye-blinking rate and frequency of pupil size fluctuation could be used as a measure of the effectiveness of a psychological consultation session. In our experiment, the eye-blinking rate declined and the frequency of pupil size fluctuation increased, which are results congruent with the findings of G. Lee et al. (2015). The finding also verified our proposal that when the individual in the session was concentrating harder, this would result in a more successful consultation.

In addition, an eye-tracking system records and analyzes participants' eye movements automatically without any invasiveness and distractions. Eye-related signals can also reflect a respondent's psychological status in real time, making this a more effective and accurate way to evaluate human psychological health and the effectiveness of psychological consultation than are the other methods that have been commonly used.

Researchers had not previously specifically examined the use of vital signs and eye-related signals to measure the effectiveness of psychological consultation. Therefore, first we still had to determine the effectiveness of the psychological consultation session by using subjective evaluation, because this method had already been verified as effective (Abdi et al., 2012; Kratochwill & Van Someren, 1995; MacLeod et al., 2001). Thus, we could identify the relationship between the effectiveness of the consultation session and physiological symptoms, which we could then address to measure the session's effectiveness.

Researchers had reported finding that the accuracy of subjective evaluation was impaired by participants' incorrect understanding of information, by untruthful answers, and by bias (Abdi et al., 2012; MacLeod et al., 2001). In order to ensure accuracy of the results, it also takes a great deal of time to train participants in making a subjective evaluation (Kratochwill & Van Someren, 1995). Hence, we designed a concise series of items with which to evaluate consulting effectiveness, and we took time to train the respondents. The results of analysis of responses to the CEQ showed that the psychological consultation was effective to a level of significance. However, it took us much time to control for participants' personal attitudes and possible bias toward the questionnaire. Moreover, the CEQ is a qualitative rather than a quantitative evaluation.

There are several limitations in this study. Our investigation of objective measurement of the effectiveness of a psychological consultation session was still based on a subjective evaluation tool. If a subjective error were not eliminated, this would lead to inaccurate evaluation of effectiveness and incorrect determination when assessing the objective measure. Although we designed and planned our experiment carefully and carried out screening to select the participants, there was still the possibility of an error from subjective evaluation. Further investigation is needed to verify the validity of the objective measure methods we used.

We utilized objective measures of vital signs and eye-related signals, but as vital signs can be measured only before and after psychological consultation, the change process in participants' psychological status is not reflected when this method is used. Thus, this is not the optimum way to measure the effectiveness of psychological consultation services in real-world daily living.

We did not have set mediator variables in the psychological experiment. We set up a common psychological consultation for participants and measured their psychological status change with selected physiological signals. Although we found that the eye-related signals changed during the consulting process, we did not examine the relationship between eye-related signals and psychological status. We used only one-way ANOVA to test the significance of the eye-blinking rate and frequency of pupil size fluctuation. Future researchers should design a specific psychological experiment with control mediator variables that

are involved in psychological consultation. A series of hierarchical multiple regression analyses could then be performed to examine the variance in the relationship between psychological status and eye-related signals. The control variables (i.e., age, gender, birthplace, and seniority) that could affect the results would be added to the hierarchical regression equation in the next step.

In conclusion, we used vital signs, eye-blinking rate, and frequency of pupil size fluctuation as objective measures to reflect the effectiveness of a psychological consultation session. We determined that the objective measures were more effective than was the subjective CEQ in evaluating the effectiveness of the session. Although our findings will help consultants to improve their psychological consulting services, researchers who are conducting further studies to assess the effectiveness of psychological consulting services should use more quantitative methods to investigate the factors influencing the effectiveness of psychological consultation.

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Appendix

Psychological Health Questionnaire

Thank you for filling in the questionnaire. The survey is anonymous and your answers are confidential; there are no right or wrong answers. The results will be used only for statistical analysis. Please rate the following items and indicate the correct level for each item according to your feelings. Thank you for your cooperation.

Item	Rate your feelings (1 = *none*, 2 = *slight*, 3 = *moderate*, 4 = *markedly*, 5 = *severe*)
1. I am troubled by affective problems.	
2. I am troubled by interpersonal relationship problems.	
3. I am troubled by study pressure.	
4. I am troubled by family relationship difficulties.	
5. I am troubled by problems in my career development.	
6. I am troubled by feelings of inferiority.	

Consulting Evaluation Questionnaire

Please rate the following items and indicate the correct level for each according to your feelings.

Item	Rate your feelings (1 = *none*, 2 = *slight*, 3 = *moderate*, 4 = *markedly*, 5 = *severe*)
1. I feel relaxed.	
2. I feel comfortable.	
3. I am relieved.	
4. I feel hopeful.	
5. I feel pleasant.	
6. I am strong.	
7. I am not depressed.	
8. I am not dolorous.	
9. I don't worry.	
10. I don't feel anxious.	