On the qi deficiency in traditional Chinese medicine

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Abstract

Objective: Qi deficiency (QD), one of the most common disorders in Traditional Chinese medicine (TCM), is relevant to many disorders in obstetrics and gynecology. This study aimed to identify the common processes and criteria for diagnosing QD among contemporary proficient TCM practitioners.

Materials and methods: Steps of decision tree analysis and modified Delphi method were merged together into four-round postal questionnaires to collect qualitative and quantitative data. Open-ended questions and content analysis were used to explore the proficient TCM practitioners’ cognitive activities used for diagnosis. The statements obtained from the qualitative responses were used to develop the items for subsequent questionnaires. Based on the TCM practitioners’ responses, the diagnostic processes and criteria for making diagnosis were generated.

Results: Twenty-eight out of the 30 participants completed all four questionnaires from June 2007 to January 2010. The 11 diagnostic procedures identified in the returned first round of questionnaires were used as the alternatives to select and rank for all the steps to diagnose QD. After three more rounds of postal surveys, an algorithm with a five-stage diagnostic process as well as sets of decision criteria were identified. Although the priorities of procedures and descriptions of reasoning were varied, the content revealed the major themes in the model. The criteria to differentiate signs and symptoms (S/S) included five principles for correlating S/S with QD, and 17 S/S should be differentiated carefully.

Conclusion: The results demonstrate that the TCM practitioners precisely diagnosed QD using a number of specific procedures and criteria that could be used as a reference to understand women complaining of QD that could be similar to QD.

Introduction

Traditional Chinese medicine (TCM) is used worldwide. Diagnosis accuracy depends on the rational inferences made by TCM physicians and directly affects the therapeutic results of certain diseases [1–3]. Exactly how TCM physicians integrate a large amount of information to reach a specific diagnosis during clinical encounters warrants further study. This article intends to present the rational diagnostic processes used in TCM.

Having a consensus on guidelines is vital to quality assurance in clinical practice. Over the past 3 decades, efforts to develop TCM diagnostic guidelines have focused on identifying a list of signs and symptoms (S/S) for specific diseases. Despite using four diagnostic methods and eight principles of differentiation, similar clinical expressions can still result in misdiagnosis in TCM [3]. The methods used to identify a better diagnostic model are computer-mediated document analysis, clinical manifestation survey, exploration of objective biological markers, creation of animal models, identification of interrelationships among diagnostic indicators, and a hybrid of these methods [2]. Some methods have focused on the magneto-electric expression of the human body [4].

Research guided by the reductionist approach has substantially increased and been recognized as successful in TCM [2,5]; however, the relevant published literature seldom describes the diagnostic
processes used by TCM physicians. The diagnostic processes were divided into 2–5 stages, based on the content and theories of diagnosis rather than the thinking processes [6–8]. In reality, those descriptions were not only inadequate for representing the complex interactions among different body parts, but also incapable of associating the human physiological and psychological information.

Qi deficiency (QD), one of the most common disorders in TCM, is relevant to many disorders in obstetrics and gynecology, including endometriosis, postmenopausal osteoporosis, anovulation, abortion, and insufficient milk production [9–15]. In recent years, studies have employed several quantitative and technological methods to detect the characteristics and applications of QD. They have addressed certain manifestations, locations, risk factors, and physiological characteristics as the criteria used to diagnose QD [4,10,16–19]. For example, defining qi as the collective behavior of neuromuscular activities interpreted and quantized by temporal fractal dimensions and surface electromyograms, Chang [4] identified QD as the collectively weak and incoherent intensities of all electromyograms as indicated by their fractal dimensions, and the overall loss of synchronization in rhythms. Defined as a lack of strength to empower the whole body, QD causes dysfunction in different parts of the body, affecting daily activity, respiration, perspiration, bodily waste elimination, verbal performance, tongue appearance, and complexion, as well as pulsation. Some lifestyles and histories of illness are cited as risk factors for QD, including aging, diet, work, and frequent sickness or sickness for an extended period of time [16]. Some published standards for contemporary TCM practices have included QD [20,21]; they addressed the “number” of certain manifestations as the only criterion for diagnosing QD. Chang [19] extracted 10 common manifestations of QD by combining literature reviews, expert meetings, and surveys. The clinical manifestations included fatigue, lack of strength, spontaneous sweating, dizziness, blurred vision, low voice, shortness of breath, laziness to speak, pale tongue, and vacuous pulse. However, the experts in Chang’s [19] research offered diverging opinions on the application of these manifestations for diagnosis. We conducted this study to identify the common processes and criteria used to diagnose QD among contemporary proficient TCM practitioners.

Materials and methods

As an integral part of clinical decision making, diagnosis is a cognitive process in which physicians match a set of alternatives with knowledge, and then select the preferred options or actions. Researchers have attempted to understand how health personnel make clinical decisions in the real context by ethnographic decision analysis for years [22–24]. The methods of modeling decision tree were divided into two phases and four steps. The first phase, model building, is an inductive process consisting of the following three steps: elicit decision criteria, develop individual decision trees, and form a combined decision model from a group of informants. The second phase, model validation, uses a separate small group of participants from the same population to test the model [23,25].

Incorporating individual decision models into a graphical representation based on logic and a time sequence, ethnographic decision analysis can facilitate an in-depth and complete understanding of the variables that influence decision making for a specific issue. The continuous interaction between analyzing the interview data and developing a related model can produce complete and valid criteria based on statements from decision makers instead of a research framework [25,26]. Nevertheless, as with other methods, ethnographic decision analysis has certain limitations; for example, it is time consuming, relies on retrospective memory, and has limited applicability. Focusing on the experience of the decision maker, modeling the decision making of a group of people, using emic information, as well as testing with negative cases, and a parallel sample are recommended to overcome these limitations [23,25].

The Delphi technique can provide evidence-based decision making by extracting indicators of quality assessment, diagnostic components, and refining the treatments from a group of experts [27]. In addition to offering a transregional interactive platform that allows experts to express their opinions freely [22,23,27], this technique asks experts to refer to the opinions of others, reconsider, and then resubmit their opinions through a series of questionnaires. These strengths of the Delphi technique may offset the threats to the reliability and validity of the results. Therefore, this study integrated the first stage of Gladwin’s decision modeling and Delphi method to represent the physician’s experience for diagnosing QD.

Participants

A list of 53 experts was suggested by TCM professors from mainland China and from major TCM institutions in Taiwan. Thirteen TCM physicians from China and 17 from Taiwan agreed to participate in this study and provided informed consent. Only three participants from China were female. Approximately 87% of the experts had over 10 years of clinical experience. All of them were either full- or part-time multispecialty physicians. Over 90% identified themselves as proficient in internal medicine, 33.3% in obstetrics, 23.3% in otorlaryngology, and 20% in pediatrics. Over 60% of the experts had at least 10 years of teaching experience in TCM. Twenty-nine of the 30 experts had taught at least one TCM course. Seventy percent taught internal medicine, including 53% who taught diagnosis and fundamental theory, and 37% taught clinical practice.

Data collection and analysis

Round 1: Identify the major diagnostic procedures

The first Delphi questionnaire, Qi-p1, asked the experts to disclose their decision making process for diagnosing QD. Four open-ended questions were developed based on a previous Delphi study [16]. Twenty-seven of the 30 experts described their own approaches in the Qi-p1, telephone calls or face-to-face interviews. Content analysis was performed to explore the qualitative data, and 11 statements related to the diagnostic procedures were generated. The procedures were as follows: gather S/S via the four-examinations; evaluate the possibility of QD via S/S (PSS); identify the possibility of QD by the severity of S/S (WSS); identify the possible location/viscera of QD via S/S (LSS); differentiate QD from similar disorders via S/S (DSS); differentiate QD from similar disorders via risk factors (DRF); evaluate the severity of QD via S/S (WQD); evaluate the possibility of QD via risk factors (PRF); identify the possible viscera of QD by analyzing risk factors (LRF); confirm the diagnosis; and determine the treatment.

The experts also stressed the importance of holistic evaluation, as well as speculated on the appropriateness of QD diagnosis by comparing the manifestation of a patient with a set of enacted guidelines alone. Based on their responses, diagnostic procedures, and criteria for differentiating the S/S, an additional open-ended question, Qi-p2, was also developed.

Round 2: Build the model

Qi-p2 asked the experts to select and rank the procedures based on their diagnostic experiences. Twenty-nine experts completed Qi-p2. All of the individual diagnostic models have the same starting point as gathering S/S via the four examinations.
As in Round 1, the experts offered additional opinions. Nine experts addressed a situation in which patients tell the physician their sensations during a clinical encounter. Various complaints led to different diagnoses among the physicians. The decision-making process involves a number of procedures before a diagnosis is reached. The physicians generally had more than one favorite process. However, some experts mentioned that they diagnosed through a smaller range of frequently used processes, except under special circumstances. Several experts suggested that identifying common diagnostic procedures is essential for new entrants to learn how to diagnose a TCM disorder.

Nine of the 29 experts offered their criteria for integrating and/or cross-referencing S/S. A few experts offered other opinions on the following areas: identifying the attribute, location, cause, pathophysiological mechanism, and tendency with varied precedence; occasionally neglecting the cause; and locating the affected viscera.

**Round 3: Verify and reach consensus on the model**

Based on the results of Round 2, QI-p3 was divided into the following three sections: diagnostic processes, principles correlating S/S with QD, and S/S required differentiation. Reasons to build the diagnostic process were addressed through open-ended questions. When asked to select a maximum of three models with explanation, only 12 experts chose more than one model. Two of the raw processes were assumed to be equivalent to each other and had to be combined. Those experts had two procedures in reverse order according to the patients’ S/S and whether their occurrences were expeditious. Nineteen experts explained their selections and suggested modifications.

Diagnostic processes selected by over 25% of the experts were extracted and revised based on their suggestions for modifications. Statements in Sections 2 and 3 selected by 50% or more of the experts were kept. A final confirmation and comments for the remaining statements were performed.

**Results**

The diagnostic processes adopted by TCM physicians, from June 2007 to January 2010, were identified using a three-round survey and a final confirmation. Twenty-seven out of the 30 participants completed all four questionnaires. Sets of criteria were generated to build the diagnostic process and an algorithm of the diagnostic process after the final survey.

**Diagnostic process**

Eleven procedures attained in Qi-p1 were used as the alternatives to diagnose QD. According to the selection rate and suggested modifications, three sets of decision processes were developed and were agreed upon by 27 out of 30 experts in the final round. With the same starting point of gathering S/S via the four-examinations, this study integrated the three models into a tree-like algorithm. The decision nodes represented the procedure selected. The decision branches represented the sequence of decisions, in which the thickness of line denotes the quantity of selections.

Fig. 1 illustrates the raw combination of the selected processes (i.e., unbroken lines) and suggested modifications (i.e., broken lines). Each modification was presented as an alternative. Although the procedures were prioritized differently, the splits revealed common themes for certain steps in the model. The decision nodes were clustered to extract the themes and then arranged in a hierarchical order to represent the thinking processes involved in the logic of diagnosis.

In the final proposed model (Fig. 2), the procedure for gathering S/S via the four examinations at the root node was considered fundamental to this tree-like algorithm. The algorithm was divided into two branches during the second step and then split further with a maximum depth of nine. The right set of branches, systemic QD (SQD), goes through WSS and further splits into two paths. The right path has PRF followed by LSS. The left path goes to LSS first and then goes to DSS, DRF, and LRF. The left branch, visceral QD (VQD), goes either to PSS first or directly to DSS followed by WQD, with a side path to WSS and LRF. The themes divide the model into the following five stages: correlating, categorizing, attributing, weighting, and planning. Some criteria for decision making were also provided.

**Stage 1. Correlating**

In the clinical encounter, all paths used gathering of the S/S via the four examinations as the starting point. TCM practitioners evaluate the possible correlation between the manifestation of a patient and QD, as well as eliminate unrelated S/S via a set of criteria. Table 1 reveals that three out of the five selected principles emphasized a correlation between S/S as well as activity and rest. The remaining items emphasized that pale tongue coincided with other S/S as well as side effects from medication.

**Stage 2. Categorizing**

PSS and LSS were presented in tandem in right or left branches, regardless of their precedence, indicating that S/S was the core component in this stage. The branches revealed that TCM physicians expressed concern over whether QD is localized in certain viscera or is systemic.

**Stage 3. Attributing**

In the third stage, both DSS and PRF were presented twice. Namely, the experts cross analyzed the risk factors and S/S to confirm the assumption about the subtype of QD from Stage 2. Fifteen experts stressed that risk factors play an important role in exploring the real causes of QD, but are not compulsory. In long-established QD, elucidating the underlying mechanism is difficult. Additionally, 78.57% of the experts agreed that 17 of the S/S should be differentiated carefully. Table 2 indicates that most of the S/S of QD resembles those of deficiencies in yang, blood, and yin. The key to differentiation is thus to explore the origin of disorders. Thus, Stage 3 focuses mainly on the attributes of QD.

**Stage 4. Weighting**

This stage focuses on location and severity. Branches of SQD focus on the location affected. Branches of the VQD are divided into WQD and WSS. The path that follows WQD proceeds to the next stage directly. The path that follows WSS goes through LRF prior to entering the next stage. Regarding the theories on transmutation and transformation, the change in the affected location could also be used to infer the severity.

**Stage 5. Planning**

Despite ending at the nodes with the same name, there were indeed different diagnoses and interventions corresponding to the results in Stage 4. The qualitative data indicated that two structures of treatment, dosage and combination, were the major objectives.

**Rationale for building the diagnostic process**

According to the qualitative responses, the experts’ reasons for selecting and ranking the diagnostic procedures were categorized as subtype of QD, dynamics of diagnosis, and complexity of diagnosis.
Subtype of QD

Only two subtypes were presented in the experts’ explanation for selection, which were SQD and VQD. Some experts suggested that clinical manifestations of VQD are the combination of SQD and specific viscera deficiency. Many experts stressed the importance of localizing the affected viscera from the beginning of this study. Some experts emphasized that locating specific viscera is not mandatory if SQD is the main concern.

Dynamics of diagnosis

To explain their selection and modification, 13 experts mentioned four features of diagnosis, which include the following: identify the attributes of the disorder, locate the viscera affected, explore the cause, and predict the tendency. The experts emphasized their cognition on the contents and priorities. Eight of the 14 experts identified the attributes of disorder first and then located the viscera affected. Only two experts performed these tasks in reverse order. The other four experts expressed no priorities in the common expression. Two experts defined all of these as identifying the mechanism of disease. However, 15 experts assumed that identifying the real causes is an attempt to explore the underlying mechanism in their responses to the risk factors.

Complexity of diagnosis

Many experts mentioned the complexity of their diagnostic processes and the importance of extracting common models for new entrants to follow. In this respect, some experts suggested that certain selected processes in Qi-p3 were still too complex. When considering that same S/S indicating different disorders (Tongzhengyibing 同症異病), comorbidity (Zhengzhang 積證), and mixture of disorders (Jiaozu 包產), the experts occasionally modified their approaches to diagnose QD precisely based on the clinical situation. Nine experts suggested that certain procedures must coexist, including LSS and PRF, gathering S/S via the four-examinations and PSS, LRF and LSS, PSS and LSS, DSS and DRF, as well as PSS, WSS and PRF. Each combination was suggested by one expert only, except for PSS and LSS, which were suggested by four experts. Two experts suggested repeating specific procedures to ensure their inference.

Discussion

Integrating the ethnographic decision modeling and the Delphi method, this study used multispecialty experts to acquire a broader perspective. This design aimed to overcome the limitations of the inaccessibility of negative or parallel samples from the same group.
The results indicate that integration is a highly effective approach for extracting the common diagnostic model and identify the criteria for building the diagnostic processes from a group of cross-regional experts.

Due to the qualitative and descriptive basis of the data, we narrowed down the raw combination (Fig. 1) into five-stage processes (Fig. 2). According to Fig. 2, TCM physicians, a rather heterogeneous panel, approached the diagnosis of QD appropriately by applying different sets of specific procedures and criteria. The content of the procedures demonstrated two sets of constructs. The first set was empirical information about S/S and risk factors. S/S were important due to their presence in all stages. Meanwhile, risk factors, which were absent until a subtype had been indicated by S/S, could ensure the inference of QD from S/S. The second set of constructs was cognitive activities, in which correlation, differentiation, localization, and weighting were used to cross reference S/S and risk factors. These procedures reflect the complexity of diagnosis making in TCM.

According to Table 1, activity and rest are the most informative criteria for detecting QD, which is in agreement with the nature of QD, i.e., the lack of strength to empower different parts of the body. However, this finding contradicts the criteria in which the promulgated guidelines emphasized the “number” of manifestations [20,21]. This discrepancy reveals that qualitative indicators were neglected. This finding could also reflect the limitations of the promulgated guidelines and contribute to developing guidelines in the future.

Among various subtypes, only VQD and SQD were selected as the most important alternatives to determine the initial direction to follow. The reasons were recognized as deficiency in genuine qi or ancestral qi affecting the function of the whole body. However, the decline in the function of any specific viscera might not affect the whole body [28]. Selecting either SQD or VQD depended on the significant functional declines in a certain part of the body. This finding corresponds to the result in our previous article, in which the features of certain VQD are considered the combined expression of SQD and a specific viscera deficiency [16].

Most of the themes of the five stages match the four features of the dynamics of diagnosis. However, the prediction of tendency was missing and replaced by weighting. Change in the affected location implies an extended affected area, which is not only a form of increased severity, but also an evolution of disorder. Therefore, change in the location is crucial for weighting severity. Additionally, some experts suggested that more S/S implies a higher severity of
The disorders generating symptoms or signs that are similar to those of Table 2 despite the numerous studies on the quantification of individual S/S and severity of specific disorders.

Fifteen of the 29 experts stated that the real causes do not need to be comprehended. QD would not occur unless patients were exposed to the risk factors for an extended period [29]. The manifestations and pathology always change if QD persists [29]. TCM physicians would find it difficult to trace the real cause. Therefore, timely differential diagnosis is important to ensure TCM diagnostic accuracy.

Some experts acknowledged that they answered the questionnaire based on a simplified model; the extracted diagnostic model signifies only specific parts of their practical experience. The experts expressed their concerns over the oversimplification of the proposed processes. To identify the common TCM diagnostic processes for QD, various pathways were deleted even though they might have important clinical implications.

According to TCM theory, Chang [4] interpreted the human body as consisting of many levels of mutually interacting physiological systems, and health is a state of harmony emergent from the interactions of these systems. Human diseases are considered as disturbed functions rather than changed structures [4]. In the real TCM clinical context, diagnosis is considered dynamic, integrative, and complex [2,4]. These scientific methods of medical research take a reductionist approach to view the human body as a collection of basic and tractable components. The information about separate parts is considered insufficient for explaining the whole and for diagnosing, treating, and preventing disease [5]. Therefore, the modifications in Fig. 1 might embody the reality of TCM diagnosis. Because the descriptions of the dynamics of TCM diagnosis are lacking, our findings can be a reference for further research.

In contrast to physicians of Western medicine, TCM physicians follow a different approach to diagnose without instruments. The expertise comes from the extensive practical experience that develops a highly structured and rich knowledge base. Regardless of how TCM has been transformed and transmitted, proficient TCM physicians still form the corpora of the knowledge based on the accumulation of their practical experience [7,30]. To determine the ability of the model to predict decisions made by TCM physicians, the model could be tested on other separate, similar or negative samples. Although TCM physicians have gathered the imperative information, quantitative analysis is still lacking. However, in the future, the diagnostic criteria could be quantified via some tentative measures like that adopted by Chang [4].

### Conclusion

This article describes the construction of the diagnostic common processes and criteria for diagnosing QD in TCM. Focusing on the cognitive activities of proficient TCM physicians, this study provides further insight into the TCM diagnostic process for QD. The results demonstrate that the experts diagnosed through a number of specific procedures and criteria. In addition to patient's manifestations as the core data, the diagnostic appropriateness was verified using information about risk factors, effects of rest and activities, subtype of QD, differentiation, dynamics of diagnosis, and complexity of diagnosis. The results reveal the dynamic relationships between common processes as well as sets of decision criteria. These could be used as a reference to understand women complaining of S/S that are similar to QD. In addition, we recommend further research in the following areas: (1) development of quantitative descriptions of the diagnostic criteria for QD; (2) development of qualitative criteria for other disorders in TCM, similar to that in QD; and (3) development of criteria for weighting the severity.

### Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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