

Mathematical Reasoning of Treatment Principle Based on “*Yin Yang Wu Xing*” Theory in Traditional Chinese Medicine

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Received December 21, 2010; revised January 20, 2011; accepted January 28, 2011

Abstract

By using mathematical reasoning, this paper demonstrates the treatment principle: “Virtual disease is to fill his mother but real disease is to rush down his son” and “Strong inhibition of the same time, support the weak” based on “*Yin Yang Wu Xing*” Theory in Traditional Chinese Medicine (TCM). We defined two kinds of opposite relations and one kind of equivalence relation, introduced the concept of steady multilateral systems with two non-compatibility relations, and discussed its energy properties. Later based on the treatment of TCM and treated the healthy body as a steady multilateral system, it has been proved that the treatment principle is true. The kernel of this paper is the existence and reasoning of the non-compatibility relations in steady multilateral systems, and it accords with the oriental thinking model.

Keywords: Traditional Chinese Medicine, “*Yin Yang Wu Xing*” Theory, Steady Multilateral Systems, Opposite Relations, Side Effects, Medical and Drug Resistance Problem

1. Main Differences between Traditional Chinese Medicine and Western Medicine

Western medicine treats disease from Microscopic point of view, always destroys the original human being's balance, and has none beneficial to human's immunity. Western medicine can produce pollution to human's body, having strong side effects. Excessively using medicine can easily paralysis the human's immunity, which AIDS is a unique product of Western medicine. Using medicine too little can easily produce the medical and drug resistance problem.

Traditional Chinese Medicine (TCM) studies the world from the macroscopic point of view, and its target is in order to maintain the original balance of human being and in order to enhance the immunity. TCM believes that each medicine has one-third of drug. She never encourages patients to use medicine in long term. Traditional Chinese Medicine has over 5,000-year history. It almost has none side effects or medical and drug resistance problem [19].

After long period of practicing, Chinese ancient medical scientists use “*Yin Yang Wu Xing*” Theory exten-

sively in the traditional treatment to explain the origin of life, human body, pathological changes, clinical diagnosis and prevention. It has become an important part of the Traditional Chinese Medicine. “*Yin Yang Wu Xing*” Theory has a strong influence to the formation and development of Chinese medicine theory. But, many Chinese and foreign scholars still have some questions on the reasoning of Traditional Chinese Medicine.

Zhang's theory, multilateral matrix theory [1] and multilateral system theory [13,14,19], have given a new and strong mathematical reasoning method from macro (Global) analysis to micro (Local) analysis. He and his colleagues have made some mathematical models and methods of reasoning [2-17], which make the mathematical reasoning of TCM possible [13] based on “*Yin Yang Wu Xing*” Theory [18]. This paper will use steady multilateral systems to demonstrate the treatment principle of TCM: “Real disease is to rush down his son but virtual disease is to fill his mother” and “Strong inhibition of the same time, support the weak”.

The article proceeds as follows. Section 2 contains basic concepts and main theorems of steady multilateral systems while the treatment principle of Traditional Chinese Medicine is demonstrated in Section 3 and 4.

Conclusions are drawn in Section 5.

2. Basic Concept of Steady Multilateral Systems

In the real world, we are enlightened from some concepts and phenomena such as “biosphere”, “food chain”, “ecological balance” etc. With research and practice, by using the theory of multilateral matrices[1] and analyzing the conditions of symmetry [1-2] and orthogonality [3-5, 12,17] what a stable system must satisfy, in particular, with analyzing the basic conditions what a stable working procedure of good product quality must satisfy [11, 17], we are inspired and find some rules and methods, then present the logic model of analyzing stability of complex systems [7-10]—steady multilateral systems [13,14,19]. There are a number of essential reasoning methods based on the stable logic analysis model, such as “transition reasoning”, “atavism reasoning”, “genetic reasoning” etc.

2.1. Equivalence Relations

Let V be a nonempty set and x, y, z be their elements. We call it an equivalence relation, denoted \sim , if the following 3 conditions are all true:

- 1) Reflexive: $x \sim x$ for all x ;
- 2) Symmetric: if $x \sim y$, then $y \sim x$;
- 3) Conveyable (Transitivity): if $x \sim y, y \sim z$, then $x \sim z$.

If there are some x, y, z such that at least one of the conditions above is true, the relation is called a compatibility relation. Any one of compatibility relations can be expanded into an equivalence relation [19].

Western Science only considers the reasoning under one Axiom system such that only researches on compatibility relation reasoning. However, there are many Axiom systems in Nature. Traditional Chinese Science (TCS, or Oriental Science) mainly researches the reasoning among many Axiom systems in Nature. Of course, she also considers the reasoning under one Axiom system but she only expands the reasoning as the equivalence relation reasoning [19].

2.2. Two Kinds of Opposite Relations

Equivalence relations, even compatibility relations, cannot portray the structure of the complex systems clearly. For example, assume that A and B are good friends and they have close relations. So are B and C . However, you cannot get the conclusion that A and C are good friends. We denote $A \rightarrow B$ as that A and B have close relations. Then the example above can be denoted as: $A \rightarrow B, B \rightarrow C$ do not imply $A \rightarrow C$, *i.e.*, the relation \rightarrow is a non-

conveyable (or non-transitivity) relation, of course, a non-equivalence relation.

In the following, we consider two non-compatibility relations.

Let V be a nonempty set and x, y, z be none equal. There are two kinds of opposite relations, called neighboring relations \rightarrow and alternate relations \Rightarrow , having the property:

- 1) If $x \rightarrow y, y \rightarrow z$, then $x \Rightarrow z$;
 \Leftrightarrow if $x \rightarrow y, x \Rightarrow z$, then $y \rightarrow z$;
 \Leftrightarrow if $x \Rightarrow z, y \rightarrow z$, then $x \rightarrow y$.
- 2) If $x \Rightarrow y, y \Rightarrow z$, then $z \rightarrow x$;
 \Leftrightarrow if $z \rightarrow x, x \Rightarrow y$, then $y \Rightarrow z$;
 \Leftrightarrow if $y \Rightarrow z, z \rightarrow x$, then $x \Rightarrow y$.

Two kinds of opposite relations cannot be exist separately.

Such reasoning can be expressed as follows:

$$\begin{array}{ccc} x & & x \\ \Downarrow \searrow & & \Downarrow \swarrow \\ z \leftarrow y & & y \Rightarrow z \end{array}$$

The first triangle reasoning is known as a jumping-transition reasoning, while the second triangle reasoning is known as an atavism reasoning. Both neighboring relations and alternate relations are not compatibility relations, of course, none equivalence relations, called non-compatibility relations.

2.3. Genetic Reasoning

Let V be a nonempty set and x, y, z be not equal one another. If equivalence relations exist, neighboring relations, and alternate relations in V at the same time, then a genetic reasoning is defined as follows:

- 1) if $x \sim y, y \rightarrow z$, then $x \rightarrow z$;
- 2) if $x \sim y, y \Rightarrow z$, then $x \Rightarrow z$;
- 3) if $x \rightarrow y, y \sim z$, then $x \rightarrow z$;
- 4) if $x \Rightarrow y, y \sim z$, then $x \Rightarrow z$.

2.4. Multilateral Systems

For a nonempty set V , if there exists at least an non-compatibility relation, then it is called a multilateral system about complexity [13,14,19], or equivalently, a logic analysis model of complex systems [7-10].

Assume that there exist equivalence relations, neighboring relations, and alternate relations in system V , which satisfy genetic reasoning. If for every $x, y \in V$, at least there is one of the three relations between x and y , and there are not $x \rightarrow y$ and $x \Rightarrow y$ at the same time, then V is called a logic analysis model of complex systems, which is equivalent to the logic architecture of reasoning model of “*Yin Yang*” Theory in Ancient China. Obviously, V is

a multilateral system with two non-compatibility relations. In this paper, we only consider this multilateral system.

Theorem 2.1 For a multilateral system V with two non-compatibility relations, $\forall x, y \in V$, only one of the following five relations is existent and correct:

$$x \sim y, x \rightarrow y, x \leftarrow y, x \Rightarrow y, x \Leftarrow y.$$

Theorem 2.2 For a multilateral system V with two non-compatibility relations, $\forall x, y, z \in V$, the following reasoning holds:

- 1) if $x \rightarrow z, y \rightarrow z$, then $x \sim y$;
- 2) if $x \Rightarrow z, y \Rightarrow z$, then $x \sim y$;
- 3) if $x \rightarrow y, x \rightarrow z$, then $y \sim z$;
- 4) if $x \Rightarrow y, x \Rightarrow z$, then $y \sim z$.

2.5. Steady Multilateral Systems

The multilateral system V is known as a steady multilateral system (or, a stable multilateral system) with two non-compatibility relations if there exists at least the chain $x_1, \dots, x_n \in V$, which satisfy any one of the two conditions below:

$$\begin{aligned} x_1 \rightarrow x_2 \rightarrow \dots \rightarrow x_n \rightarrow x_1; \\ x_1 \Rightarrow x_2 \Rightarrow \dots \Rightarrow x_n \Rightarrow x_1. \end{aligned}$$

Theorem 2.3 For a steady multilateral system V with two non-compatibility relations, there exists five-length chain, and the length of the chain is integer times of 5.

Theorem 2.4 For a steady multilateral system V with two non-compatibility relations, there exists a partition of V as follows:

$$\begin{aligned} V &= V_1 + V_2 + V_3 + V_4 + V_5; \\ V_i &= \{y \in V \mid y \sim x_i\}, \forall i = 1, \dots, 5. \end{aligned}$$

which x_1, x_2, x_3, x_4, x_5 is a chain. The notation that $V = V_1 + V_2 + V_3 + V_4 + V_5$ means that $V = V_1 \cup V_2 \cup V_3 \cup V_4 \cup V_5, V_i \cap V_j = \emptyset, \forall i \neq j$.

Theorem 2.5 The decomposition above for the steady multilateral system with two non-compatibility relations, there exist relations below **Figure 1**.

Theorem 2.6 For each element x in a steady multilateral system V with two non-compatibility relations, there exist five equivalence classes below:

$$\begin{aligned} X &= \{y \in V \mid y \sim x\}, \quad X_S = \{y \in V \mid x \rightarrow y\}, \\ X_K &= \{y \in V \mid x \Rightarrow y\}, \quad K_X = \{y \in V \mid y \Rightarrow x\}, \\ S_X &= \{y \in V \mid y \rightarrow x\}, \end{aligned}$$

which the five equivalence classes have relations below **Figure 2**.

3. Relationship Analysis of Steady Multilateral Systems

3.1. Energy of a Multilateral System

Energy concept is an important concept in Physics. Now, we introduce this concept to the multilateral systems and use these concepts to deal with the multilateral system diseases.

In mathematics, a multilateral system is said to have energy (or dynamic) if there is a none negative function $\varphi(*)$ which makes every subsystem meaningful of the multilateral system.

For two subsystems V_i and V_j of multilateral system V , denote $V_i \rightarrow V_j$ (or $V_i \Rightarrow V_j$, or $V_i \sim V_j$) means $x_i \rightarrow x_j, x_i \in V_i, x_j \in V_j$ (or $x_i \Rightarrow x_j, x_i \in V_i, x_j \in V_j$ or $x_i \sim x_j, x_i \in V_i, x_j \in V_j$).

For subsystems V_i, V_j and $V_i \cup V_j$ where $V_i \cap V_j = \emptyset, i \neq j$, let $\varphi(V_i) = |V_i|, \varphi(V_j) = |V_j|$ and $\varphi(V_i \cup V_j) = |V_i \cup V_j|$, where $\varphi(V_i \cup V_j)$ is the total energy of both V_i and V_j .

For an equivalence relation $V_i \sim V_j$, if $|V_i \cup V_j| = |V_i| + |V_j|$ (the normal state of the energy of $V_i \sim V_j$), then the equivalence relation $V_i \sim V_j$ is called that V_i likes V_j which means that V_i is similar to V_j . In this case, the V_i is also called the brother of V_j while the V_j is also called the brother of V_i . In the causal model, the V_i is called the similar family member of V_j while the V_j is also called the similar family member of V_i . There are not any causal relation considered between V_i and V_j .

For a neighboring relation $V_i \rightarrow V_j$, if $|V_i \cup V_j| > |V_i| + |V_j|$ (the normal state of the energy of $V_i \rightarrow V_j$), then the neighboring relation $V_i \rightarrow V_j$ is called that V_i bears (or loves) V_j [or that V_j is born (or loved) by V_i] which means that V_i is beneficial on V_j each other. In this case, the V_i is called the mother of V_j while the V_j is called the son of V_i . In the causal model, the V_i is called the beneficial cause of V_j while the V_j is called the beneficial effect of V_i .

For an alternate relation $V_i \Rightarrow V_j$, if $|V_i \cup V_j| < |V_i| + |V_j|$ (the normal state of the energy of $V_i \Rightarrow V_j$), then the alternate relation $V_i \Rightarrow V_j$ is called as that V_i kills V_j (or that V_j is killed by V_i) which means that V_i is harmful on V_j each other. In this case, the V_i is called the bane of V_j while the V_j is called the prisoner of V_i . In the causal model, the V_i is called the harmful cause of V_j while the V_j is called the harmful effect of V_i .

In the future, unless stated otherwise, any equivalence relation is the liking relation, any neighboring relation is the bearing relation (or the loving relation), and any alternate relation is the killing relation.

Suppose V is a steady multilateral system having energy, then during normal operation, its energy function for any subsystem of the multilateral system has an average (or expected value in Statistics), the state is called

normal when the energy function is nearly to the average. Normal state is the better state.

A subsystem of a multilateral system is called not running properly (or disease, abnormal), if the energy deviation from the average of the subsystems is too large, the high [real disease] or the low [virtual disease].

In a subsystem of a multilateral system being not running properly, if the energy of this sub-system is increased or decreased by using external forces and returned to its average (or its expected value), this method is called intervention (or making a medical treatment) to the multilateral system.

The purpose of intervention is to make the multilateral system return to normal state. The method of intervention is to increase or to decrease the energy of a subsystem.

What kind of treatment should follow the principle to treat it? Western medicine emphasizes direct treatment, but the indirect treatment of oriental medicine (or Traditional Chinese Medicine) is required. In mathematics, which is more reasonable?

Based on this idea, many issues are worth further discussion. For example, if an intervention treatment has been done to a multilateral system, what situation will happen?

3.2. Intervention Rule of a Multilateral System

For a steady multilateral system V with two non-compatibility relations, suppose that there is an external force (or an intervening force) on the subsystem X of V which makes the energy $\varphi(X)$ of X changed by the increment $\Delta\varphi(X)$, then the energies $\varphi(X_S)$, $\varphi(X_K)$, $\varphi(K_X)$, $\varphi(S_X)$ of other subsystems X_S , X_K , K_X , S_X (defined in Theorem 2.6) of V will be changed by the increments $\Delta\varphi(X_S)$, $\Delta\varphi(X_K)$, $\Delta\varphi(K_X)$ and $\Delta\varphi(S_X)$, respectively.

It is said that a multilateral system has the capability of intervention reaction if the multilateral system has capability to response the intervention force.

If a subsystem X of multilateral system V is intervened, then the energies $\Delta\varphi(X_S)$ and $\Delta\varphi(S_X)$ of the subsystems X_S and S_X which have neighboring relations to X will change in the same direction of the force outside on X . We call them beneficiaries. But the energies $\Delta\varphi(X_K)$ and $\Delta\varphi(K_X)$ of the subsystems X_K and K_X which have alternate relations to X will change in the opposite direction of the force outside on X . We call them victims.

Furthermore, in general, there is an essential principle of intervention: any one of energies $\Delta\varphi(X_S)$ and $\Delta\varphi(S_X)$ of beneficial subsystems X_S and S_X of X changes in the same direction of the force outside on X , and any one of energies $\Delta\varphi(X_K)$ and $\Delta\varphi(K_X)$ of harmful subsystems X_K and K_X of X changes in the opposite direction of the force

outside on X . The changed size of the energy $\Delta\varphi(X_S)$ (or $\Delta\varphi(S_X)$) is equal to that of $\Delta\varphi(X_K)$ (or $\Delta\varphi(K_X)$), but the direction opposite.

Intervention Rule: In the case of virtual disease, the treatment method of intervention is to increase the energy. If the treatment has been done on X , the energy increment (or, increase degree) $|\Delta\varphi(X_S)|$ of the son X_S of X is greater than the energy increment (or, increase degree) $|\Delta\varphi(S_X)|$ of the mother S_X of X , *i.e.*, the best benefit is the son X_S of X . But the energy decrease degree $|\Delta\varphi(X_K)|$ of the prisoner X_K of X is greater than the energy decrease degree $|\Delta\varphi(K_X)|$ of the bane K_X of X , *i.e.*, the worst victim is the prisoner X_K of X .

In the case of real disease, the treatment method of intervention is to decrease the energy. If the treatment has been done on X , the energy decrease degree $|\Delta\varphi(S_X)|$ of the mother S_X of X is greater than the energy decrease degree $|\Delta\varphi(X_S)|$ of the son X_S of X , *i.e.*, the best benefit is the mother S_X of X . But the energy increment (or, increase degree) $|\Delta\varphi(K_X)|$ of the bane K_X of X is greater than the energy increment (or, increase degree) $|\Delta\varphi(X_K)|$ of the prisoner X_K of X , *i.e.*, the worst victim is the bane K_X of X .

In mathematics, the changing laws are as follows.

1) If $\Delta\varphi(X) = \Delta > 0$, then $\Delta\varphi(X_S) = \rho_1\Delta$, $\Delta\varphi(X_K) = -\rho_1\Delta$, $\Delta\varphi(K_X) = -\rho_2\Delta$, $\Delta\varphi(S_X) = \rho_2\Delta$;

2) If $\Delta\varphi(X) = -\Delta < 0$, then $\Delta\varphi(X_S) = -\rho_2\Delta$, $\Delta\varphi(X_K) = \rho_2\Delta$, $\Delta\varphi(K_X) = \rho_1\Delta$, $\Delta\varphi(S_X) = -\rho_1\Delta$;

where $1 \geq \rho_1 \geq \rho_2 \geq 0$. Both ρ_1 and ρ_2 are called intervention reaction coefficients, which are used to represent the capability of intervention reaction. The larger ρ_1 , the better the capability of intervention reaction. The state $\rho_1 = 1$ is the best state but the state $\rho_1 = 0$ is the worst state.

Medical and drug resistance problem is that such a question, beginning more appropriate medical treatment, but is no longer valid after a period. It is because the capability of intervention reaction is bad, *i.e.*, the intervention reaction coefficients ρ_1 and ρ_2 are too small. In the state $\rho_1 = 1$, any medical and drug resistance problem is non-existence but in the state $\rho_1 = 0$, medical and drug resistance problem is always existence. At this point, the paper advocates the principle of treatment to avoid medical and drug resistance problems.

This intervention rule is similar to force and reaction in Physics.

3.3. Self-Protection Rule of a Multilateral System

If there is an intervening force on the subsystem X of a steady multilateral system V which makes the energy $\varphi(X)$ changed by increment $\Delta\varphi(X)$ such that the energies $\varphi(X_S)$, $\varphi(X_K)$, $\varphi(K_X)$, $\varphi(S_X)$ of other subsystems X_S , X_K , K_X , S_X (defined in Theorem 2.6) of V will be changed by the

increments $\Delta\varphi(X_S)$, $\Delta\varphi(X_K)$, $\Delta\varphi(K_X)$, $\Delta\varphi(S_X)$, respectively, then can the multilateral system V have capability to protect the worst victim to restore?

It is said that the steady multilateral system has the capability of self-protection if the multilateral system has capability to protect the worst victim to restore. The capability of self-protection of the steady multilateral system is said to be better if the multilateral system has capability to protect the all victims to restore.

In general, there is an essential principle of self-protection: any harmful subsystem of X should be protected by using the same intervention force but any beneficial subsystem of X should not.

Self-protection Rule: in the case of virtual disease, the treatment method of intervention is to increase the energy. If the treatment has been done on X , the worst victim is the prisoner X_K of X . Thus, the treatment of self-protection is to restore the prisoner X_K of X and the restoring method of self-protection is to increase the energy $\varphi(X_K)$ of the prisoner X_K of X by using the intervention force on X according to the intervention rule.

In the case of real disease, the treatment method of intervention is to decrease the energy. If the treatment has been done on X , the worst victim is the bane K_X of X . Thus, the treatment of self-protection is to restore the bane K_X of X and the restoring method of self-protection is to decrease the energy $\varphi(K_X)$ of the bane K_X of X by using the same intervention force on X according to the intervention rule.

In mathematics, the following self-protection laws hold.

1) If $\Delta\varphi(X) = \Delta > 0$, then the energy of subsystem X_K will decrease the increment $(-\rho_1\Delta)$, which is the worst victim. So the capability of self-protection increases the energy of subsystem X_K by increment $(\rho_1\Delta)$ in order to restore the worst victim X_K by using the same intervention force on X according to the intervention rule.

2) If $\Delta\varphi(X) = -\Delta < 0$, then the energy $\Delta\varphi(K_X)$ of subsystem K_X will increase the increment $(\Delta\varphi(K_X) = \rho_1\Delta)$, which is the worst victim. So the capability of self-protection decreases the energy of subsystem K_X , by the same size to $\Delta\varphi(K_X)$ but the direction opposite, *i.e.*, by increment $\Delta\varphi(K_X)_1 = -\rho_1\Delta$, in order to restore the worst victim K_X by using the same intervention force on X according to the intervention rule.

The self-protection rule can be explained as: the general principle of self-protection subsystem is the most affected is protected firstly; the protection method is in the same way to the intervention force.

Theorem 3.1 *Suppose that a steady multilateral system V which has energy and capability of self-protection is with intervention reaction coefficients ρ_1 and ρ_2 . If the capability of self-protection can make the subsystem X_K*

to be restored, then the following statements are true.

1) *In the case of virtual disease, the treatment method is to increase the energy. If an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = \Delta > 0$, then all five subsystems will be changed finally by the increments as follows:*

$$\Delta\varphi(X)_2 = \Delta\varphi(X) + \Delta\varphi(X)_1 = (1 - \rho_2\rho_1)\Delta > 0,$$

$$\Delta\varphi(X_S)_2 = \Delta\varphi(X_S) + \Delta\varphi(X_S)_1 = (\rho_1 + \rho_2\rho_1)\Delta > 0,$$

$$\Delta\varphi(X_K)_2 = \Delta\varphi(X_K) + \Delta\varphi(X_K)_1 = (-\rho_1 + \rho_1)\Delta = 0,$$

$$\Delta\varphi(K_X)_2 = \Delta\varphi(K_X) + \Delta\varphi(K_X)_1 = -(\rho_2 - \rho_1^2)\Delta,$$

$$\Delta\varphi(S_X)_2 = \Delta\varphi(S_X) + \Delta\varphi(S_X)_1 = (\rho_2 - \rho_1^2)\Delta,$$

$$\forall\Delta\varphi(X) = \Delta > 0.$$

2) *In the case of real disease, the treatment method is to decrease the energy. If an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = -\Delta < 0$, then all five subsystems will be changed finally by the increments as follows:*

$$\Delta\varphi(X)'_2 = \Delta\varphi(X)' + \Delta\varphi(X)'_1 = -(1 - \rho_2\rho_1)\Delta < 0,$$

$$\Delta\varphi(X_S)'_2 = \Delta\varphi(X_S)' + \Delta\varphi(X_S)'_1 = -(\rho_2 - \rho_1^2)\Delta,$$

$$\Delta\varphi(X_K)'_2 = \Delta\varphi(X_K)' + \Delta\varphi(X_K)'_1 = (\rho_2 - \rho_1^2)\Delta,$$

$$\Delta\varphi(K_X)'_2 = \Delta\varphi(K_X)' + \Delta\varphi(K_X)'_1 = (\rho_1 - \rho_1)\Delta = 0,$$

$$\Delta\varphi(S_X)'_2 = \Delta\varphi(S_X)' + \Delta\varphi(S_X)'_1 = -(\rho_1 + \rho_2\rho_1)\Delta < 0,$$

$$\forall\Delta\varphi(X)' = -\Delta < 0,$$

where the $\Delta\varphi(*)_1$'s and $\Delta\varphi(*)'_1$'s are the increments under the capability of self-protection.

Corollary 3.1 *Suppose that a steady multilateral system V which has energy and capability of self-protection is with intervention reaction coefficients ρ_1 and ρ_2 . Then the capability of self-protection can make both subsystems X_K and K_X to be restored at the same time, *i.e.*, the capability of self-protection is better, if and only if $\rho_2 = \rho_1^2$.*

Side effects of medical problems were the question: in the medical process, destroyed the normal balance of a normal system which is not falling-ill system or intervening system. By Theorem 3.1 and Corollary 3.1, it can be seen that a necessary and sufficient condition is $\rho_2 = \rho_1^2$ if the capability of self-protection of the steady multilateral system is better, *i.e.*, the multilateral system has capability to protect all victims to restore. At this point, the paper advocates the principle to avoid any side effects of treatment.

3.4. Mathematical Reasoning of Treatment Principle by Using the Neighboring Relations of Steady Multilateral Systems

Treatment principle by using the neighboring relations of steady multilateral systems is “Virtual disease is to fill his mother but real disease is to rush down his son”. In order to show the rationality of the treatment principle, it is needed to prove the following theorems.

Theorem 3.2 *Suppose that a steady multilateral system V which has energy and capability of self-protection is with intervention reaction coefficients ρ_1 and ρ_2 satisfying $\rho_2 = \rho_1^2$. Then the following statements are true.*

In the case of virtual disease, if an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ increases the increment $\Delta\varphi(X) = \Delta > 0$, then the subsystems S_X , X_K and K_X can be restored at the same time, but the subsystems X and X_S will increase their energies finally by the increments

$$\begin{aligned}\Delta\varphi(X)_2 &= (1 - \rho_1\rho_2)\Delta\varphi(X) = (1 - \rho_1^3)\Delta\varphi(X) \\ &= (1 - \rho_1^3)\Delta\end{aligned}$$

and

$$\begin{aligned}\Delta\varphi(X_S)_2 &= (\rho_1 + \rho_1\rho_2)\Delta\varphi(X) = (\rho_1 + \rho_1^3)\Delta\varphi(X) \\ &= (\rho_1 + \rho_1^3)\Delta,\end{aligned}$$

respectively.

On the other hand, in the case of real disease, if an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ decreases, i.e., by the increment $\Delta\varphi(X)' = -\Delta < 0$, the subsystems X_S , X_K and K_X can also be restored at the same time, and the subsystems X and S_X will decrease their energies finally, i.e., by the increments

$$\begin{aligned}\Delta\varphi(X)'_2 &= (1 - \rho_1\rho_2)\Delta\varphi(X)' = (1 - \rho_1^3)\Delta\varphi(X)' \\ &= -(1 - \rho_1^3)\Delta\end{aligned}$$

and

$$\begin{aligned}\Delta\varphi(S_X)'_2 &= (\rho_1 + \rho_1\rho_2)\Delta\varphi(X)' = (\rho_1 + \rho_1^3)\Delta\varphi(X)' \\ &= -(\rho_1 + \rho_1^3)\Delta,\end{aligned}$$

respectively.

Theorem 3.3 *For a steady multilateral system V which has energy and capability of self-protection, assume intervention reaction coefficients are ρ_1 and ρ_2 which satisfy $\rho_2 = \rho_1^2$ and $\rho_1 \geq 0.5897545123$. Then the following statements are true.*

1) *If an intervention force on the subsystem X of steady multilateral system V is implemented such that its*

energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = \Delta > 0$, then the final increment $(\rho_1 + \rho_1^3)\Delta$ of the energy $\varphi(X_S)$ of the subsystem X_S changed is greater than the final increment $(1 - \rho_1^3)\Delta$ of the energy $\varphi(X)$ of the subsystem X changed based on the capability of self-protection.

2) *If an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = -\Delta < 0$, then the final increment $-(\rho_1 + \rho_1^3)\Delta$ of the energy $\varphi(S_X)$ of the subsystem S_X changed is less than the final increment $-(1 - \rho_1^3)\Delta$ of the energy $\varphi(X)$ of the subsystem X changed based on the capability of self-protection.*

Corollary 3.2 *For a steady multilateral system V which has energy and capability of self-protection, intervention reaction coefficients are ρ_1 and ρ_2 which satisfy $\rho_2 = \rho_1^2$ and $\rho_1 < 0.5897545123$. Then the following statements are true.*

1) *In the case of virtual disease, if an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = \Delta > 0$, then the final increment $(\rho_1 + \rho_1^3)\Delta$ of the energy $\varphi(X_S)$ of the subsystem X_S changed is less than the final increment $(1 - \rho_1^3)\Delta$ of the energy $\varphi(X)$ of the subsystem X changed based on the capability of self-protection.*

2) *In the case of real disease, if an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = -\Delta < 0$, then the final increment $-(\rho_1 + \rho_1^3)\Delta$ of the energy $\varphi(S_X)$ of the subsystem S_X changed is greater than the final increment $-(1 - \rho_1^3)\Delta$ of the energy $\varphi(X)$ of the subsystem X changed based on the capability of self-protection.*

3.5. Mathematical Reasoning of Treatment Principle by Using the Alternate Relations of Steady Multilateral Systems

Treatment principle by using the alternate relations of steady multilateral systems is “Strong inhibition of the same time, support the weak”. In order to show the rationality of the treatment principle, it needed to prove the following theorem.

Theorem 3.4 *Suppose that a steady multilateral system V which has energy and capability of self-protection is with intervention reaction coefficients ρ_1 and ρ_2 satisfying $\rho_2 = \rho_1^2$. Assume there are two subsystems X and X_K of V with an alternate relation such that X encounters virtual disease, and at the same time, X_K befalls real disease. Then the following statements are true.*

If an intervention force on the subsystem X of steady multilateral system V is implemented such that its energy $\varphi(X)$ has been changed by increment $\Delta\varphi(X) = \Delta > 0$, and

at the same time, another intervention force on the subsystem X_K of steady multilateral system V is also implemented such that its energy $\varphi(X_K)$ has been changed by increment $\Delta\varphi(X_K) = -\Delta < 0$, then all other subsystems: S_X , K_X and X_S can be restored at the same time, and the subsystems X and X_K will decrease and increase their energies by the same size but the direction opposite, i.e., by the final increments

$$\begin{aligned} \Delta\varphi(X)_3 &= (1 - \rho_1\rho_2)\Delta\varphi(X) = (1 - \rho_1^3)\Delta\varphi(X) \\ &= (1 - \rho_1^3)\Delta \end{aligned}$$

and

$$\begin{aligned} \Delta\varphi(X_K)_3 &= (1 - \rho_1\rho_2)\Delta\varphi(X_K) = (1 - \rho_1^3)\Delta\varphi(X_K) \\ &= -(1 - \rho_1^3)\Delta, \end{aligned}$$

respectively.

These theorems can be found in [7-10] and [13,14]. Figures 1 and 2 in Theorems 2.5 and 2.6 are the Figures of “Wu Xing” Theory in Ancient China. The steady multilateral system V with two non-compatibility relations is equivalent to the logic architecture of reasoning model of “Yin Yang Wu Xing” Theory in Ancient China.

4. Rationality of Treatment Principle of Traditional Chinese Medicine and “Yin Yang Wu Xing” Theory

4.1. Traditional Chinese Medicine and “Yin Yang Wu Xing” Theory

Ancient Chinese “Yin Yang Wu Xing” Theory has been surviving for several thousands of years without dying out, proving it reasonable to some extent. If we regard \sim as the same category, the neighboring relation as beneficial, harmony, obedient, loving, etc., and the alternate relation \Rightarrow as harmful, conflict, ruinous, killing, etc., then the above defined stable logic analysis model is similar to the logic architecture of reasoning of “Yin Yang Wu Xing”. Both “Yin” and “Yang” mean that there are two opposite relations in the world: harmony or loving \rightarrow and conflict or killing \Rightarrow , as well as a general equivalent category \sim . There is only one of three relations \sim , \rightarrow and \Rightarrow between every two objects. Everything ($X \neq \emptyset$) makes something ($X_S \neq \emptyset$), and is made by something ($S_X \neq \emptyset$); Everything restrains something ($X_K \neq \emptyset$), and is restrained by something ($K_X \neq \emptyset$); i.e., one thing overcomes another thing and one thing is overcome by another thing. The ever changing world V , following the relations: \sim , \rightarrow and \Rightarrow , must be divided into five categories by the equivalent relation \sim , being called “Wu Xing”: wood (X), fire (X_S), earth (X_K), gold (X_K) and wa-

ter (S_X).

The relationship among the “Wu Xing” is to be “neighbor is friend”:

wood(X) \rightarrow fire(X_S) \rightarrow earth(X_K) \rightarrow gold(K_X) \rightarrow water(S_X) \rightarrow wood(X),

and to be “alternate is foe”:

wood(X) \Rightarrow earth(X_K) \Rightarrow water(S_X) \Rightarrow fire(X_S) \Rightarrow gold(K_X) \Rightarrow wood(X).

On the other words, $V = X + X_S + X_K + K_X + S_X$ satisfying

$$X \rightarrow X_S \rightarrow X_K \rightarrow K_X \rightarrow S_X \rightarrow X$$

and

$$X \Rightarrow X_K \Rightarrow S_X \Rightarrow X_S \Rightarrow K_X \Rightarrow X$$

where elements in the same category are equivalent to one another. We can see, from this, the ancient Chinese theory “Yin Yang Wu Xing” is a reasonable logic analysis model to identify the stability and relationship of complex systems, i.e., it is a steady multilateral system.

Traditional Chinese Medicine (TCM) firstly uses the verifying relationship method of “Yin Yang Wu Xing” Theory to explain the relationship between organ of human body and environment. Secondly, based on “Yin Yang Wu Xing” Theory, the relations of physiological processes of human body can be shown by the neighboring relation and alternate relation of five subsets. Thus a normal human’s body can be shown as a steady multilateral system. Loving relation in TCM can be explained as the neighboring relation, called “Sheng”. Killing relation in TCM can be explained as the alternate relation, called

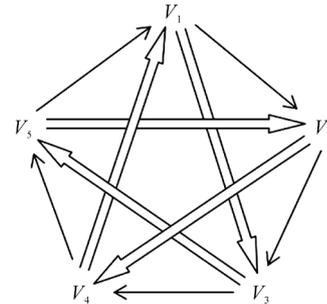


Figure 1. Uniquely steady architecture: “Wu Xing”.

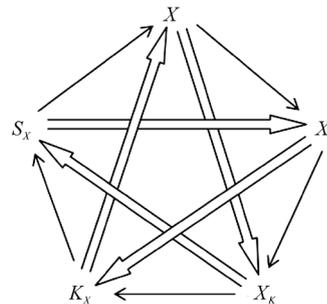


Figure 2 The method of finding “Wu Xing”.

“Ke”. Constraints and conversion between five subsets are equivalent to the two kinds of triangle reasoning. So a normal human’s body can be classified into five equivalence classes. It has been shown in Theorems 2.1-2.6 that the classification of five subsets is quite possible based on the mathematical logic. To make sure the characteristics of the five subsets is reasonable or not, it needs more research work. It has been also shown in Theorems 3.2-3.4 that the logical basis of TCM is a steady multilateral system.

The gas [“Chi”, or “Qi”, energy of life] of TCM means the energy in a steady multilateral system.

There are two kinds of diseases in TCM: real disease and virtual disease. They generally mean the subsystem is abnormal (or disease), its energy [“Chi”, or “Qi”, energy of life] is too high or too low.

The treatment method of TCM is to “Xie Qi” which means to rush down the energy if a real disease is treated, or to “Bu Qi” which means to fill the energy if a virtual disease is treated. Like intervening the subsystem, decrease when the energy is too high, increase when the energy is too low.

Both the capability of intervention reaction and the capability of self-protection of the multilateral system are equivalent to the Immunization of TCM. This capability is really exist. Its target is to protect other organs while treating one organ.

4.2. Treatment Principle if Only One Organ of the Human Body System Falls Ill

If we always intervene the abnormal organ of the human body system directly, the intervention method always destroy the balance of the human body systems because it is having strong side effects to the mother or the son of the organ which is non-disease system by using Theorem 3.2. The intervening directly method also decreases the capability of intervention reaction ρ_1 , because the method which doesn’t use the capability of intervention reaction makes the ρ_1 near to 0. The state $\rho_1 = 0$ is the worst state of the human body system, namely AIDS. On the way, the resistance problem will occur since any medicine or treatment has little effect for small ρ_1 .

However, by Corollary 3.2, it will even be better if we intervene subsystem X itself directly while $\rho_1 < 0.5897545123$, *i.e.* $\rho_1 + \rho_1^2 < 0.9375648971$. It can be explained that if a multilateral system which has a poor capability of intervention reaction, then it is better to intervene the subsystem X itself directly than indirectly. However, similar to above, the intervening directly method always destroys the balance of multilateral systems such that there is at least one side effect occurred. Moreover, the intervening directly method is also harm-

ful to the capability of intervention reaction and might causes the medical and drug resistance problem. Therefore, the intervention method directly can be used in case $\rho_1 < 0.5897545123$ but should be used as little as possible.

If we always intervene in the abnormal organ of the human body system indirectly, the intervention method can be to maintain the balance of the human body system because it has not any side effects to all other organs which are not both the disease organ and the intervened organ by using Theorem 3.2. The intervening indirectly method also increase the capability of intervention reaction because the method of using the intervention reaction makes the ρ_1 near to 1. The state $\rho_1 = 1$ is the best state of the human body system. On the way, it almost has none medical and drug resistance problem since any medicine is possible good for some large ρ_1 .

Overall, the human body system satisfies the intervention rule and the self-protection rule. It is said healthy while intervention reaction coefficient ρ_1 satisfies $\rho_1 > 0.5897545123$. In logic and practice, it’s reasonable $\rho_1 + \rho_2$ near to 1. In case: $\rho_1 + \rho_2 = 1$, all the energy for intervening human body organ can transmit to other human body organs which have neighboring relations or alternate relations with the intervening human body organ. The healthy condition $\rho_1 > 0.5897545123$ can be satisfied when $\rho_2 = \rho_1^2$ for a healthy human body since $\rho_1 + \rho_2 = 1$ implies $\rho_1 = (\sqrt{5}-1)/2 \approx 0.618 > 0.5897545123$. If this assumptions is set up, then the treatment principle: “Real disease is to rush down his son and virtual disease is to fill his mother” based on “*Yin Yang Wu Xing*” Theory of TCM, is quite reasonable.

On the other hand, in TCM, real disease and virtual disease have their reasons. The bear organ X_5 causes real disease of X , while the born organ S_X causes virtual disease of X . Although the reason cannot be proved easily in mathematics or experiments, the treatment method under the assumption is quite equal to the treatment method in the intervention indirectly. It has also proved that the treatment principle is true from the other side.

4.3. Treatment Principle if Two Organs with the Loving Relation of the Human Body System Encounter Sick

Suppose that the two organs X and X_5 of the human body system are abnormal (or disease). In the human body of relations between non-compatible with the constraints, only two situations may occur:

1) X encounters virtual disease, and at the same time, X_5 befalls virtual disease, *i.e.*, the energy of X is too low and the energy of X_5 is also too low. It is because X bears X_5 . The disease causal is X .

2) X encounters real disease, and at the same time, X_S befalls real disease, *i.e.*, the energy of X is too high and the energy of X_S is also too high. It is because X bears X_S . The disease causal is X_S .

If intervention reaction coefficients satisfy $\rho_2 = \rho_1^2$, it can be shown by Theorem 3.2 that if one wants to treat the abnormal organs X and X_S , then the following statements are true.

1) For virtual disease of both X and X_S , the one should intervene organ X directly by increasing its energy. It means, “Virtual disease is to fill his mother” because the disease causal is X .

2) For real disease of both X and X_S , the one should intervene organ X_S directly by decreasing its energy. It means, “Real disease is to rush down his son” because the disease causal is X_S .

The intervention method can be to maintain the balance of the human body because only the energies of two disease organs are changed by using Theorem 3.2, such that there is no side effect for all other organs. And the intervention method can also be to enhance the capability of intervention reaction because the method of using intervention reaction makes the ρ_1 greater and near to 1. The state $\rho_1 = 1$ is the best state of the human body system. On the way, it almost has none medical and drug resistance problem since any medicine is possible good for some large ρ_1 .

4.4. Treatment Principle if Two Organs with the Killing Relation of the Human Body System Encounter Sick

Suppose that the organs X and X_K of a human body system are abnormal (or disease). In the human body system of relations between non-compatible with the constraints, only a situation may occur: X encounters virtual disease, and at the same time, X_K befalls real disease, *i.e.*, the energy of X is too low and the energy of X_K is too high. It is because it is normal when X kills X_K but it is abnormal when X doesn't kill X_K .

If intervention reaction coefficients satisfy $\rho_2 = \rho_1^2$, it can be shown by Theorem 3.4 that if one wants to treat the abnormal organs X and X_K , the one should intervene organ X directly by increasing its energy, and at the same time, intervene organ X_K directly by decreasing its energy. It means that “Strong inhibition of the same time, support the weak”.

The intervention method can be to maintain the balance of human body system because only two energies of both disease organs are changed by using Theorem 3.4, such that there is no side effect for all other organs. And the intervention method can also be to enhance the capability of intervention reaction because the method of us-

ing intervention reaction makes the ρ_1 greater and near to 1 such that X can kill X_K . The state $\rho_1 = 1$ is the best state of the steady multilateral system. On the way, it almost has none medical and drug resistance problem since any medicine is possible good for some large ρ_1 .

5. Conclusions

This work shows how to treat the diseases of a human body system and three methods are presented. If only one organ falls ill, mainly the treatment method should be to intervene it indirectly for case: the capability coefficient $\rho_1 \geq 0.5897545123$ of intervention reaction, according to the treatment principle of “Real disease is to rush down his son but virtual disease is to fill his mother”. The intervention method directly can be used in case $\rho_1 < 0.5897545123$, but should be used as little as possible.

If two organs with the loving relation encounter sick, the treatment method should be intervene them directly also according to the treatment principle of “Real disease is to rush down his son but virtual disease is to fill his mother”.

If two organs with the killing relation encounter sick, the treatment method should intervene in them directly according to the treatment principle of “Strong inhibition of the same time, support the weak”.

Other properties such as balanced, orderly nature, and so on, will be discussed in the next articles.

6. Acknowledgements

This article has been repeatedly invited as reports, such as People's University of China in medical meetings, Shanxi University, Xuchang College, and so on. The work was supported by Specialized Research Fund for the Doctoral Program of Higher Education of Ministry of Education of China (Grant No.44k55050).

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