

## 特约专稿

# Values of medical-grade smart wearable device on improvement of individual health

## Taking philips health watch as an example

Oscar Wager Fong

(China Medicinal Biotech Association, Beijing, 100022)

**ABSTRACT:** Health is an inevitable demand to promote people's all-round development and to make foundation for economic and social development. Health and longevity of citizens is not only important symbols of national development and prosperity but also the common wish of the Chinese people. Actually, smart wearable technology is an emerging one and the application of some smart wearable devices such as health watch is the most promising one in the health industry. As new psychotherapy, cognitive behavioral therapy (CBT) can change the poor awareness by means of changing one's way of thinking, thus eliminating the unhealthy emotions and behaviors. In terms of health management, CBT enjoys such advantages as guidance, motivation, integrity and short therapy time. This paper introduces the improvement of smart wearable device guided by professional health management solutions on individual health by taking Philips health watch as an example, and the users can therefrom get full understanding of the relationship between smart wearable devices and health, thus improving their individual health.

**KEY WORDS:** medical grade; smart wearable device; individual health; Philips; health watch; behavior; lifestyle

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## 1 Introduction

As far as we know, health is an inevitable demand to promote people's all-round development and to make foundation for economic and social development. Health and longevity of citizens is not only an important symbol of national development and prosperity but also the common wish of the Chinese people. In 2015, the average life expectancy in China reached 76.34 years old which lays an important foundation for building a moderately prosperous society<sup>[1]</sup>. However, industrialization, urbanization, an aging population, disease spectrum change as well as environmental and lifestyle changes have created new challenges to people's health. In accordance with the "Healthy China 2030" blueprint released by the Central Committee of the Communist Party of China and the State Council, the state-level strategies are needed to solve "major and long-term

health-related issues", so that people can have a healthy lifestyle and effectively control any factors affecting their healthy life, thus achieving a harmonious development between health and economic society.

Smart wearable technology is an emerging technology in recent years, which is applied to the smart design and development of the daily wearing, such as wrist watch, glasses, bracelet, footgear and costume, and various physical signs of the users can be measured to extensively collect users' health data while they are wearing such smart devices<sup>[2]</sup>. At present, some smart wearable devices have started stepping in the health industry, of which, the light and advanced health watch enjoys obvious advantages and gradually becomes an affordable wearable device. As a new psychotherapy, cognitive behavioral therapy (CBT) can change the poor awareness through a set of methods by means of changing one's way of thinking, thus eliminating the unhealthy e-

motions and behaviors<sup>[3]</sup>. In terms of health management, CBT enjoys such advantages as guidance, motivation, integrity and short therapy time. This paper introduces the improvement of smart wearable device guided by professional health management solutions on individual health by taking Philips health watch as an example.

## 2 Effect of CBT on health behavior

Some scholars<sup>[4]</sup> think that, “psychotherapy is a method using psychology to affect or change the feeling, cognition, emotions and behaviors of the patients and coordinate the balance between the individual and the environment based on the good doctor-patient relationship and guided by certain theoretical system, thus achieving the therapeutic goal”. However, Zhang Boyuan et al.<sup>[5]</sup> think that, “the followings can be considered as psychotherapy, i. e. , by applying the principles and skills of psychology, relying on the effect of voice, character, expression, posture, behavior and surroundings to enlighten, educate, advise and hint the patients, improve the patients’ feelings and understanding, improve the patients’ emotions, thus regulating the mental state, behavior style and resulting physical symptoms of the patients.” Cognitive psychology is one kind of psychological science studying the mental processes. It covers wide research areas, aiming at studying memory, attention, perception, knowledge representation, inference, creativity and problem solving.

As one of current most influential psychological guidance and psychotherapies, CBT applies cognitive restructuring method to correct people’s irrational beliefs of people and teach them skills of behavior improvement and problem-solving tactics<sup>[6]</sup>. According to the cognitive theory, cognitive process is determined jointly by emotion and behavior, and people can change their ideas through changing the cognitive process, thus to correct their emotions and behaviors. Behavior therapy believes that behavior can be obtained from learning. Therefore, some practical operation methods can be adopted to eliminate, restrain, change and substitute the original

bad behaviors. CBT is a combination of the above two methods, where cognitive process determines the generation of behavior, the behavior change, in turn, can affect the cognitive change. The effect of CBT on health behavior is mainly manifested in two aspects: One is to improve people’s awareness rate of health knowledge and behavior, and the other is to improve people’s bad living behavior and reduce the prevalence rate<sup>[7]</sup>.

## 3 Medical-Grade smart wearable devices

### 3.1 Service condition of medical-grade smart wearable devices

In recent years, healthcare technology has been facing the unprecedented integration of healthcare and information technology. Varieties and numbers of healthcare terminal devices that are characterized by intelligence, portability, openness and networking have been developed quickly<sup>[8]</sup>. According to the research<sup>[9]</sup> of Transparency Market Research, the most promising application area of smart wearable device lies in healthcare which can bring about innovation to the device. Medical-grade smart wearable devices can be widely used in clinical monitoring, home health care, sleep analysis, emergency rescue, aviation and aerospace, special crowd monitoring, psychological evaluation, physical training and military operation. At present, the researches<sup>[9-10]</sup> have show that the medical-grade smart wearable devices can monitor the vital signs of the patients, collect the human body’s physiological data via the sensor, such as blood pressure, heart rate, body temperature, blood oxygen content, respiratory rate and blood glucose level which are transmitted to CPU as well as to the medical center, so that the doctors can analyze the data timely, professionally and comprehensively and formulate reasonable therapeutic plan so as to prevent and treat diseases. Besides, it also can predict different diseases, with more detailed division and more accurate data recording, for example, the wrist type blood glucose meter<sup>[11]</sup> can inject the insulin automatically according to the blood glucose level of the patients; the wearable defibrillator<sup>[12]</sup> equipped with an alarm

can notify the medical staffs in case of abnormal detection; the smart glasses<sup>[13]</sup> can record the user's daily life in detail, which effectively helps the patients with senile dementia. The application and popularization of emerging information technology and product represented by smart wearable devices not only make positive contributions to improving the living quality of people but also provide many overturning innovative applications in human physiological real-time monitoring and disease treatment, thus promoting the all-round upgrading of functions and services in healthcare field.

### 3.2 Innovative concept of Philips health watch

As the world's largest family health care company, the health watch developed by Philips has not only been equipped with a set of self-developed ecological system and smart health management system, but also is the unique medical-grade watch approved by Food and Drug Administration (FDA) and Europe, the Middle East and Africa (EMEA). Based on the accurate measurement of heart rate, respiratory rate, maximum oxygen uptake (VO<sub>2</sub>max) and heart rate variability (HRV), etc. via clinical verification, the management system of Philips health watch can monitor the data in real time and continuously, and can also keep tracking our health and present remote real-time consulting and online health consultation, which can realize individual and professional health management, and eventually achieve the goal of healthy life as well as diagnosis and health management of early chronic diseases. The health improvement concept of Philips health watch includes continuous monitoring, accurate measurement and behavior motivation (i. e., smart alert). The health application of Philips can offer ongoing support to immediately feedback and deeply understand the measured data of the user through the straightaway scoring. Aiming at the sleep, activity, nutrition and pressure, and by adopting the professional advanced algorithm, this watch can provide real-time health monitoring and the personalized health improvement plan for the user through creative personal dual drive health coach integration system- smart health coach and internal senior expert

consultation. The senior health management experts can, through the background, fully understand the health status of the users and give professional, accurate and personalized health care guidance, combined with mining, analysis and application of big data. During the service, the professional health manager will encourage the users to form a good life style and improve their behaviors based on watch data, telephone communication and short message, etc.

## 4 Discussion

“Health for All” is the fundamental goal for building a healthy China. One's health is closely related to health literacy which means one's ability to obtain and to understand the basic health information and service as well as to apply these information and services to make the right decisions for maintaining and promoting one's health. Based on the theoretical model of “Knowledge-Behavior-Skill”, the health literacy covers basic health knowledge and concept literacy, healthy life style and behavior literacy, and basic skill literacy. The related study<sup>[14]</sup> has found that individual health is greatly affected by health literacy. The residents will enjoy lifetime benefits if they learn health knowledge and skills, maintain a healthy lifestyle, and have self-disciplined health behavior. As the general term of a set of therapeutic method, CBT emphasizes that cognitive activity plays an important role in the occurrence and prognosis of mental or behavior problems<sup>[15]</sup>. During therapeutic process, this therapy also adopts various cognitive correction and behavioral therapy technologies. The followings are the common cognitive techniques in the aspect of health management: ① Understand the automatic thinking; help the users to recognize the existence of automatic thinking and its effect, and correct the negative psychological imagination in a timely manner. ② List the cognitive distortions; help the users to identify cognitive distortion, improve his/her cognitive level and correct the wrong thinking. ③ Change the extreme health management belief or principle; replace the wrong or extreme principle with realistic or rational health management belief or principle. ④ Hypothesis testing;

one method to understand and correct user's cognitive distortion and wrong idea is to test whether certain erroneous hypothesis should be supported or not, so that the attitude of the user to health management can be detected. ⑤ Positive self-talk: on reviewing and finding one's own merits every day, and put forward positive and effective solution for the negative health management thought.

The followings are the common behavioral techniques: ① Hierarchical task arrangement: adopt the decentralized strategy to make the users first complete several small health management tasks in his/her power step by step, and then complete major tasks. ② Daily activity plan: negotiate and cooperate with the users, and arrange the activities which the user can complete first, then arrange the plan and task reasonably based on the completion status and credibility of the user. ③ Mastery and pleasure assessment technique: record the daily activities, and score the mastery or difficulty degree and pleasure degree. ④ Coaching technique: provide health management guidance for the users, help the users to analyze and find the problem, encourage the users in case of difficulty, and strengthen the user in case of progress. ⑤ Others: guide and find the problems in health management, make self-question, analyze the advantages and disadvantages, change the user's expectation, perform self-confidence training, and provide desensitization, demonstration and role playing.

In terms of health behavior, positive behavioral psychology can encourage the users to change his/her poor daily healthy behavior with positive mental attitude and establish good daily life system through learning the user's specific situation. In the course of the actual operation, Positive behavioral psychologists first will analyze and determine the health problem of the user and its nature and severity based on the overall effective data provided by the user, describe the time, frequency, intensity, environment, correlated condition and task of poor health behaviors of the user in detail, determine the sequence of health behaviors based on the data obtained and formulate the optimal improvement plan, and guide the user's behaviors, such as What to do? What to eat?

Which physical training style shall be selected What kind of work and life shall be selected When and how long During wearing Philips health watch, senior health management experts can fully learn the status of the user in the background, e. g. , the main factor causing the sub-health status of the patient, including the inducement, unhealthy living and exercise habits, and whether the patients misunderstand their health status and sub-health; and analyze the behavior rule and mental state of the user based on the data obtained, put forward constructive suggestions, encourage the user to change the poor routine, and form good life style ( healthy diet and moderate exercise, etc. ) to make the users improve their behaviors and the habits. Meanwhile, Philips health watch can upload the user's data monitored to the cloud database through the wearable devices in combination with mobile device APP and smart health management system, implement real-time analysis on the user's data through specific professional health consultant, carry out online feedback and put forward relevant suggestions for the user on basis of the health management guidelines, or return the data to local health management institutions and perform one-on-one consultation and guidance, thus to realize personalized and professional health management, help the user to form good routine and regular life and improve the physical condition, so as to keep away from illness.

The medical-grade smart wearable devices can improve the vitality and skills of the patients as well as lower the expensive cost of critically ill medical services, reduce the risk of complications, and improve the survival chance of the patients, which is important for improving the patient's health status and preventing disease. Studies<sup>[16]</sup> have shown that the medical-grade smart wearable devices can monitor, measure and timely feedback one's health data and transmit it to the data center, which is helpful for improving the individual health condition and facilitating the medical staffs to take reasonable and effective measures in a timely manner. In combination with telemedicine and under the guidance of online experts, the user can monitor the physiological

status anytime and anywhere without affecting the daily work and life, and achieve early detection, diagnosis and therapy of the disease. At the same time, the medical-grade smart wearable device can, through remote monitoring, raise the user's health management consciousness by adopting CBT, implement encouraging education to the users, promote China Healthy Lifestyle for All, and strengthen the guidance and intervention to the healthy life style of the family and high-risk individuals.

In conclusion, the improvement value of medical-grade smart wearable devices guided by professional health management solutions on individual health is mainly reflected in the following aspects: ① Health management: help people to formulate regular daily schedule based on the motion data, calories burned, blood oxygen content and heart rate variation, etc., remind them to exercise frequently and improve the sleep quality; ② Disease prevention: help the patient to timely detect the disease at an early stage, realize early detection, early diagnosis and early treatment, which is conducive to effecting a radical cure of the disease and maintaining the health; ③ Information networking: establish network database, learn its health status and predict the health condition of next generation, and the factors affecting health, diet and living habits etc. of people; ④ Chronic disease management: have early prediction to the illness change of the sufferers with chronic disease, remind the patient to treat the disease timely, put forward constructive suggestions, improve the patient's diet, living and exercise habits, and help the patients track and manage their illness conditions; ⑤ Physical exercise: can be used for weight loss, which is suitable for overweight people, to set weight loss goal for them, to improve the body function of sub-health population, which is suitable for the people lack of exercises, and to set with reasonable and effective exercise intensity.

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