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A Review on Lifestyle before and after COVID-19 Pandemic: Four Levels of Prevention

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Mini Review Article

Abstract

Lifestyle (LS)-related risk factors are the most important factors for increasing non-communicable chronic diseases (NCDs). Coronavirus disease 2019 (COVID-19) is known to have a significant impact on LS, exposing patients with NCDs to adverse outcomes. This study aimed to investigate the LS changes after the COVID-19 pandemic and the strategies that can be used to manage the LS changes in the four levels of disease prevention. The prevalence of LS-related problems such as obesity and overweight has an upward trend and physical activity has declined dramatically in COVID-19 pandemic time. COVID-19 pandemic can worsen the patients' mental disorders or, as a major stressor, trigger mental disorders in the people. Moreover, stress and anxiety of pandemic situation may induce the consumption of smoking and alcohol in societies under disease. In addition, poor sleep and excessive use of social networks have been associated with poor health outcomes. LS modification is a substantial strategy for the prevention and management of NCDs that due to the pandemic situation, has become more serious now. The comprehensive LS modification program can promote various dimensions of knowledge, attitude, and LS-related behaviors at four levels of prevention. Primordial prevention by preventing LS-related risk factors, primary prevention by reducing or

eliminating LS-related risk factors, secondary prevention by using LS modification in the treatment approach, and tertiary prevention by integrating LS interventions into rehabilitation make up the basics of a comprehensive LS reform program.

Keywords: Life style; Prevention; COVID-19; SARS-CoV-2 infection

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Introduction

Non-communicable chronic diseases (NCDs) are one of the leading causes of death and disability worldwide. The disease incidence and prevalence is increasing worldwide (Habib & Saha, 2010) and nearly 80 percent of deaths which occur in low and middle-income countries are estimated to be related to NCDs. The NCDs growth is multifactorial and is based on some of the major trends such as globalization, rapid urbanization, and an increasingly sedentary lifestyle (LS) (Wagner & Brath, 2012).

Urbanization and urban development lead to changes in the urban environment as well as changes in the LS of residents, which can lead to human health problems independently and synergistically. Urbanization encourages changes in people's LSs, which are recognized by researchers as a key determinant of human health (Salgado Canseco, 2019). NCDs such as diabetes, blood pressure, high body mass index (BMI), and hyperlipidemia have been reported as problems associated with modern LS changes (Goryakin, Rocco, & Suhrcke, 2017).

The main risk factors for NCDs have been well known for decades and they are similar in almost all countries. Influential LS variables are known to be the most substantial factors in increasing NCDs (Unwin & Alberti, 2006). The LS variables include diet and BMI, physical activity, consumption of harmful substances (smoking and alcohol), entertainment, and sleep (Farhud, 2015). Unhealthy LSs such as a poor diet with saturated and trans fats, salt, and sugar, inactivity, smoking, and alcohol consumption cause more than two-thirds of new cases of NCDs and increase the risk of disease complications (Currie et al., 2004). Studies reported that at least 80% of heart disease, stroke, and type 2 diabetes, as well as 40% of cancers, can be prevented by following a healthy LS such as a proper diet, regular physical activity, and avoiding alcohol and smoking (Kluge et al., 2020).

Coronavirus disease 2019 (COVID-19) is a global crisis that develops persistent and profound effects on public health and the health systems. Despite the magnitude of its consequences, COVID-19 pandemic can be considered a collective trauma that can lead to a wide range of disorders at individual (all kinds of fear and stress, isolation, physical and financial insecurity) and societal (economic recession, educational limitations, job loss, rising inequities and stigma, infodemia, coronaphobia) levels (Serafini, Parmigiani, Amerio, Aguglia, Sher, & Amore, 2020). COVID-19 affects the entire health system through its direct impact as an infectious disease as well as its potency to accelerate the morbidity and mortality of NCDs (Mesenburg et al., 2021).

Health services access limitation due to quarantine laws and traffic bans, the fear of disease or death, the priority of managing patients with COVID-19 in medical centers (Chu, Alam, Larson, & Lin, 2020), as well as dramatic LS changes and increased risky LS-related behaviors such as the sedentary LS and unbalanced nutrition (Enriquez-Martinez et al., 2021), have accelerated the risk of adverse outcomes of NCDs in patients and the incidence of NCDs in susceptible people. This study aimed to investigate the LS changes after the COVID-19 pandemic and the strategies that can be used to manage the impact of LS changes in the four levels of disease prevention.

Diet and BMI

COVID-19 event has concluded to high levels of stress, anxiety, and depression through travel restrictions, quarantine, and housing. The psychosocial impact of the COVID-19 crisis may lead to eating disorders (Ramalho et al., 2021). A maladaptive approach to deal with stress and negative emotions may include unhealthy eating

patterns such as overeating or use of unhealthy calorie-rich diet and poor nutrient foods (Frayn & Knäuper, 2018). Emotional eating is prevalent in young adults and predicts weight gain, generally (Mason, 2020). Perceived stress, depressive symptoms, financial stress, and loneliness – factors that may be exacerbated during the COVID-19 epidemic – are related to emotional eating (Mason & Lewis, 2014), and overeating, eating to coping, and unhealthy eating increased during the COVID-19 pandemic (Ammar et al., 2020).

Studies have shown a significant prevalence of unhealthy eating behaviors to cope with social distance and isolation during the pandemic and an increased BMI between the ages of 12 and 86 years (76% of women) was documented in 48% of the population; adults who are overweight and obese are also at greater risk for increased BMI (Mason, Barrington-Trimis, & Leventhal, 2021). This causes more people to become more obese, and evidence suggests that severe obesity is strongly associated with adverse outcomes of the health, and if immediate modified strategies are not followed, the pandemic may lead to more obese or overweight young adults coming to severe obesity and its serious complications.

Obesity and overweight, in addition to causing chronic problems, also have significant effects on the consequences of COVID-19 during the pandemic. One of the indexes of obesity is low-grade chronic inflammation, which can disrupt immune system responses to infection (Hauner, 2005), and may predict hospitalization in patients with COVID-19 (Ruan, Yang, Wang, Jiang, & Song, 2020). Obesity, especially severe obesity (BMI > 40 kg/m^2), is associated with an increased risk of intensive care unit (ICU) admission, and death in patients with COVID-19 (Simonnet et al., 2020). It may also deplete the effectiveness of existing treatments of COVID-19. Studies have shown that T cell responses are also impaired in obese people who receive the COVID-19 vaccine (Painter, Ovsyannikova, & Poland, 2015), suggesting that the future COVID-19 vaccine may be less effective in the obese population.

Physical Activity

Quarantine, social distancing and isolation of the affected people, and closure of schools and jobs limited the opportunity of physical activity (Mattioli, Sciomer, Cocchi, Maffei, & Gallina, 2020). In particular, both daily activities (such as walking or cycling) and recreational activities (such as going to the park, walking outside, and going to the gym) are limited; therefore, in the peak times of COVID-19 and curfew, being sedentary at home in a long time becomes available and quite reasonable. In fact, COVID-19 pandemic is exacerbating the epidemic of physical inactivity and it will probably continue even after returning to normal living after the pandemic end.

Physical activity not only contributes to physical health but there is also a strong relation between activity and mental health. Studies have shown that after the onset of the pandemic, approximately 60% of adults have no physical activity and more than 90% of children have lost access to playing and exercise facilities (Theis, Campbell, De Leeuw, Owen, & Schenke, 2021). The level of physical activity has decreased both in terms of time spent on physical activity and the intensity of activities (Woods et al., 2020). Inadequate physical activity enhances the prevalence of NCDs [such as cardiovascular disease (CVD), diabetes] and it is directly related to obesity and metabolic syndrome (Hamilton, Hamilton, & Zderic, 2007). Due to immune system attenuation, physical inactivity can increase the susceptibility of infection (Grande, Keogh, Silva, & Scott, 2020), severe COVID-19 (Lee et al., 2021), and morbidity and mortality of COVID-19 (Jakobsson, Malm, Furberg, Ekelund, & Svensson, 2020). In addition, physical activity can improve mental health during the

pandemic period by reducing depression and its consequences (Maugeri et al., 2020).

Mental Health

Patients with chronic diseases have many physical, social, and psychological problems, which affect their quality of life (QOL) (Tóthová et al., 2014). Physicians do not always have time to address all of these issues in one visit. About a quarter of patients with chronic medical problems have clinically significant psychological disorders (Eiser, 1990). In some cases, the psychological problems are accompanied by further physical complications. For example, when medical factors are controlled, the risk of myocardial infarction (MI) due to depressive symptoms increases 4 to 5 times (Hippisley-Cox, Fielding, & Pringle, 1998). Even in the absence of overt mental or psychiatric disorders, patients have to adjust thoughts, feelings, and behaviors (De Ridder, Geenen, Kuijer, & Van Middendorp, 2008).

The pandemic has triggered various mental health problems. It can worsen the state of patients who had mental disorders or, as a major stressor, can start mental disorders in general population (Kontoangelos, Economou, & Papageorgiou, 2020). Negative emotions (such as anxiety, depression, and anger) have intensified during the pandemic, while positive emotions (such as happiness and life satisfaction) have declined (Li, Wang, Xue, Zhao, & Zhu, 2020). Fear of disease or dying from COVID-19 may lead to anxiety, depression, exhaustion, job boredom, and negative feelings, and it may disturb the balance of work, life, and mental health (Prikhidko, Long, & Wheaton, 2020).

Studies have shown that women, front-line medical staff, quarantined people, and patients with a psychiatric history are at greater risk for mental disorders (Vizheh, Qorbani, Arzaghi, Muhidin, Javanmard, & Esmaeili, 2020). Fear and anxiety with stimulation of the hypothalamus followed by increased secretion of cortisol from the adrenal cortex and sympathetic stimulation in the short term is beneficial to deal with stressors, but if the fear and stress continues and increased cortisol levels and sympathetic stimulation persists in the long run, it leads to a weakened immune system and reduced ability of this system to dominate disease (Wong et al., 2012). During epidemics, the mental consequences in communities are sometimes neglected, so that few interventions are taken to meet the psychological demand of the patients, their families, and community as well as health care workers (Chiappini, Guirguis, John, Corkery, & Schifano, 2020). The psychological effects of a pandemic can affect all aspects of a person's health and it may persist for a long time and involve communities and health care system even after the pandemic.

Substance Abuse (Cigarettes, Alcohol, and Drugs)

Prolonged periods of quarantine can lead to boredom, and subsequent mental health problems that may lead to the start or increased use of alcohol, cigarette, etc. (Burton & Sheron, 2018; Vanderbruggen et al., 2020). Cigarettes and alcohol are well known risk factors of NCDs (Griswold, Fullman, Hawley, Arian, Zimsen, & Tymeson, 2018; Reitsma et al., 2017). Pandemic stress and anxiety can increase the consumption of cigarettes, alcohol, or other harmful drugs in societies under stress (Satre, Hirschtritt, Silverberg, & Sterling, 2020). Alcohol has long-term and short-term effects on communities' health; therefore, there is no limit to "safe" consumption, and studies have shown that it can attenuate immune response ability (Romeo, Wärnberg, Nova, Díaz, Gómez-Martinez, & Marcos, 2007) and possibly increase vulnerability to COVID-19 infection. Alcohol consumption also exacerbates psychological imbalances and psychological or social problems in the context of the COVID-19 epidemic. The relationship between depression-anxiety disorders and alcohol consumption has

been studied and confirmed by several scientific evidence (Yeasmin et al., 2020).

A meta-analysis showed that smoking increased the risk of severe COVID-19 (Patanavanich & Glantz, 2020). Suppression of the immune system by smoking inhibits the effective activation of T cells, which also inhibits B cells from proliferating and producing antibodies, thereby disabling humoral immunity (Cheemarla, Uche, McBride, Naidu, & Guerrero-Plata, 2019). C-reactive protein (CRP) is positively associated with smoking (Tonstad & Cowan, 2009), and increased inflammation in COVID-19 patients with a history of smoking can lead to worse disease outcomes in this subpopulation.

Chronic use of tobacco, alcohol, and other drugs is associated with CVDs (arrhythmia, heart failure, and MI), pulmonary disease [chronic obstructive pulmonary disease (COPD), pulmonary hypertension (PHTN)], and metabolic diseases [diabetes, hypertension (HTN)] (Bahorik, Satre, Kline-Simon, Weisner, & Campbell, 2017), all of which are risk factors for COVID-19 infection and poor outcomes (Christie, Brooks, Hicks, Sauber-Schatz, Yoder, & Honein, 2021; Zhou et al., 2020), and as the pandemic continues, disregard to the abuse of the harmful substances can cause complex acute and chronic health problems in communities.

Screen Time

Preventive and quarantine measures taken in many countries since 2020 have made life more dependent on screens and cyberspace due to in-home education, telecommuting, and online communication (Qin et al., 2020). In studies, 80% of parents reported that their children's cyberspace usage time was increased (Shin & Ahn, 2015). Excessive use of cyberspace can dramatically reduce proper physical activity (Ghram et al., 2021), disrupt sleep-wake cycles and sleep patterns (Gupta et al., 2020), reduce social interactions that underlie social development especially in children and adolescents (de Figueiredo et al., 2021), and may help stabilize unhealthy behaviors (Ben Hassen, El Bilali, Allahyari, & Morrar, 2022).

The major health risks of long-term and continuous use of cyberspace are increased risk of CVDs, changes in sleep patterns, sedentary LS, and depression. Other related problems include dry eye, back pain, carpal tunnel syndrome (CTS), migraine headaches, eating disorders, and inattention or lack of personal hygiene (Lange & Nakamura, 2020).

There are certain injuries in children, for example, watching pages out of children's age or negative comments or rumors and messages containing unconventional and offensive content through social media can damage children psychologically and emotionally (Zeitlin, 2020). Studies have shown a positive relationship between cyberspace usage time and poor mental health in children, and increasing this time significantly increases the suicide rate in children and adolescents (Smith et al., 2020).

Light emitted with the short wavelength of monitor screens disrupts the circadian sleep-wake cycle and reduces deep sleep and the secretion of the melatonin hormone (Chang, Aeschbach, Duffy, & Czeisler, 2015). Continued exposure to this light over time can damage retinal cells and cause vision problems such as age-related macular degeneration (Marquioni-Ramella & Suburo, 2015). It can also cause cataracts and cancers (Good, 2014). Short-wavelength light emitted may also have adverse effects on the skin. Studies have shown that redness, pigmentation, and dry skin can possibly be caused by prolonged exposure to this light. A study on the survival of skin cells has been published, which showed the relation between exposure to this light and the production of free radicals in the skin, which is associated with increased skin aging (Furukawa et al., 2021).

Sleep

In recent years, evidence from experimental and epidemiological studies has shown that poor sleep quality is associated with adverse health outcomes such as diabetes, CVD, HTN, and obesity (Chin et al., 2010; Harada et al., 2012; Sridhar & Madhu, 1994). Inadequate sleep can lead to exhaustion, inactivity, and malnutrition or overeating; and all of these factors can exacerbate obesity and depression, leading to metabolic syndrome, type 2 diabetes, sexual dysfunction, potential mood problems, and heart diseases (Egger, Binns, & Rossner, 2009).

A predominant problem during pandemic and quarantine period is the change in sleep patterns (Gooley et al., 2011). In addition to excessive use of screens, such as watching TV, using computers and mobile devices, and playing games, the quality of sleep may also decline due to COVID-19 anxiety and stressors. Anxiety and stress, especially in children and adolescents, can be revealed by manifestations of sleep and appetite disorders (Olive et al., 2020).

LS at Levels of Disease Prevention

As vaccines and medications are developed to control COVID-19, the pandemic period will eventually come to an end, but adverse LS behaviors are relatively stable habits. They will probably continue even after returning to normal living conditions after the COVID-19 control (de Palma & Vosough, 2021). Therefore, the number of NCDs, such as diabetes and coronary heart disease (CHD), and mental health disorders is expected to increase significantly even after this period (Aleebrahim-Dehkordi, Deravi, Reyhanian, Saberianpour, Mokhtari, & Hasanpour-Dehkordi, 2020). The preventive approach should be primarily focused on health-promoting behaviors, LS modifications, and the implementation of health programs in this regard more than before.

A comprehensive LS modification program can include the various aspects of scientific knowledge, personal and social attitudes, and behaviors of LS. It also requires proper management to plan, implement, and evaluate a comprehensive LS reform program. A comprehensive LS reform program at all levels of prevention offers a variety of effective approaches in individual, group, and social levels of population. The main goal of the program is to reduce high-risk behaviors related to LS at four levels of prevention in different population groups, and its ultimate goal is to increase the QOL and reduce mortality and morbidity of all community. Providing scientific resources supporting interventions, developing guidelines and designing comprehensive LS modification interventions for each level of prevention, designing course materials to be integrated into the curriculum of medical students, providing educational resources for health providers and human resources by training courses to integrate LS modification at all levels of prevention, and finally, defining a proper infrastructure for implementing the comprehensive LS reform program are essential.

Primordial Prevention

The goal of primordial prevention in a comprehensive LS modification program is to prevent the development of high risk LS-related behaviors (Claas & Arnett, 2016). Development of right knowledge and attitude about high-risk behaviors and healthy behaviors is essential for avoiding the start of high risk LS-related behaviors (Rimal & Real, 2003). Education is a fundamental part of developing knowledge and attitude in this level of prevention (Simonds, 1974). Health education is a basic part of activities of primary health care services and according to the trend of chronic diseases, healthy LS education should be considered as the main focus of education in health service providers (King, 2001). Educating healthy and high-risk behaviors should include different ages and populations at all levels of society. Mass media, advertisements,

movies, series, and cultural products play an essential role in changing people's attitudes (Petty, Brinol, & Priester, 2009). Promoting a healthy LS, especially concerning nutrition and physical activity, and avoiding normalizing high-risk behaviors such as smoking, alcohol consumption, and eating unhealthy snacks in cultural products are very important in developing attitude toward LS, especially in children, adolescents, and youth (González-Gross, Gómez-Lorente, Valtueña, Ortiz, & Meléndez, 2008). An environment that encourages the healthy LS is the most substantial factor in changing people's performance and behavior (Kruize et al., 2019). Using the process of advocacy at high levels of policy-making and making positive changes toward the healthy LS approach in macro-policy-making to modify cultural, social, and economic policies can fundamentally improve many complex and multi-sectoral challenges.

Primary Prevention

The goal of primary prevention is to reduce or eliminate disease risk factors (Albee & Gullotta, 1996). In LS modification program, primary prevention eliminates high-risk LS behaviors that developed in people before the onset of disease (Larsen et al., 2018). Primary LS prevention activities include providing smoking cessation services, quitting alcohol, treating obesity, promoting healthy eating habits, and developing educational and practical context for promoting physical activity and mental health in healthy individuals (Jepson, Harris, Platt, & Tannahill, 2010). Primary prevention can diminish the risk of NCDs by decreasing LS-related risk factors; in addition, it can increase the QOL and life expectancy in healthy people (Reddy, 2003).

Due to the existence of a comprehensive network of primary health care in some countries and also the wide reference of population to this system, it is possible to integrate primary LS prevention programs in this network and it can increase the network's ability to control NCDs as a critical health challenge. Some LS modification services are sporadically performed on this network, but integrating it into a comprehensive LS modification program for all people can lead to better outcomes.

Secondary Prevention

In secondary prevention, the main goal is the timely and effective diagnosis and treatment of diseases (Halpin, Morales-Suárez-Varela, & Martin-Moreno, 2010). Several clinical trials and interventional studies have been performed that clearly demonstrate the benefits of regular physical activity and proper diet to improve the condition of patients with CVD, diabetes, non-alcoholic fatty liver disease, and HTN, due to improvement in plasma lipids, blood pressure, inflammation, insulin sensitivity, coronary blood flow, endothelial function, and oxidative stress (Blair et al., 1996).

LS modification in the treatment of NCDs should not be introduced as an alternative approach but it is better to be the main component of treatment guidelines (Hyman, Ornish, & Roizen, 2009). LS interventions are now being accepted as a specialized field (Rea & Wilson, 2020). Toward a broader view, the use of LS medicine in the clinic requires the acquisition of skills and competencies in improving various factors of individual LS including diet, body weight control, physical activity, behavior change, stress, coping, and consumption of tobacco, alcohol, and drugs (Ripoll, 2012). It seems that educating specialists involved in the NCDs management and training special physicians in the field of LS should be improved in medical education curriculums. LS medicine as a therapeutic approach should be considered more than it used to be by medical professionals.

Tertiary Prevention

The purpose of the third level of prevention is to reduce or limit injuries and

disabilities, to minimize the complications of the disease, and to support the patient's adaptation of the inherent conditions (Riley, Warner, & Pullen, 2018). Tertiary prevention in NCDs is to reduce the severity and complications of diseases to maintain daily function, QOL, and life expectancies, such as rehabilitation programs of CHDs (Mosayebi, Javanmard, Mirmohamadsadeghi, Rajabi, Mostafavi, & Mansourian, 2011) or strokes (Mineva, 2019).

LS modification is not only a way to proper treatment of chronic diseases, but if the complications of these diseases occur, it can improve the QOL and control the complications (Psaltopoulou, Ilias, & Alevizaki, 2010). In some studies, LS intervention is an influential component of the management of CHD (Prasad, 2021), stroke (Saboula & Sallam, 2015), and diabetes (Lambrinou, Hansen, & Beulens, 2019). LS intervention services should be part of rehabilitation services in specialized and sub-specialized rehabilitation centers and like secondary prevention, LS modification should be the main treatment approach and not an alternative choice; therefore, LS professionals should be a member of the rehabilitation team or one of the team members must be trained to provide these services through special courses. Figure 1 shows the levels of prevention of the comprehensive LS modification program.

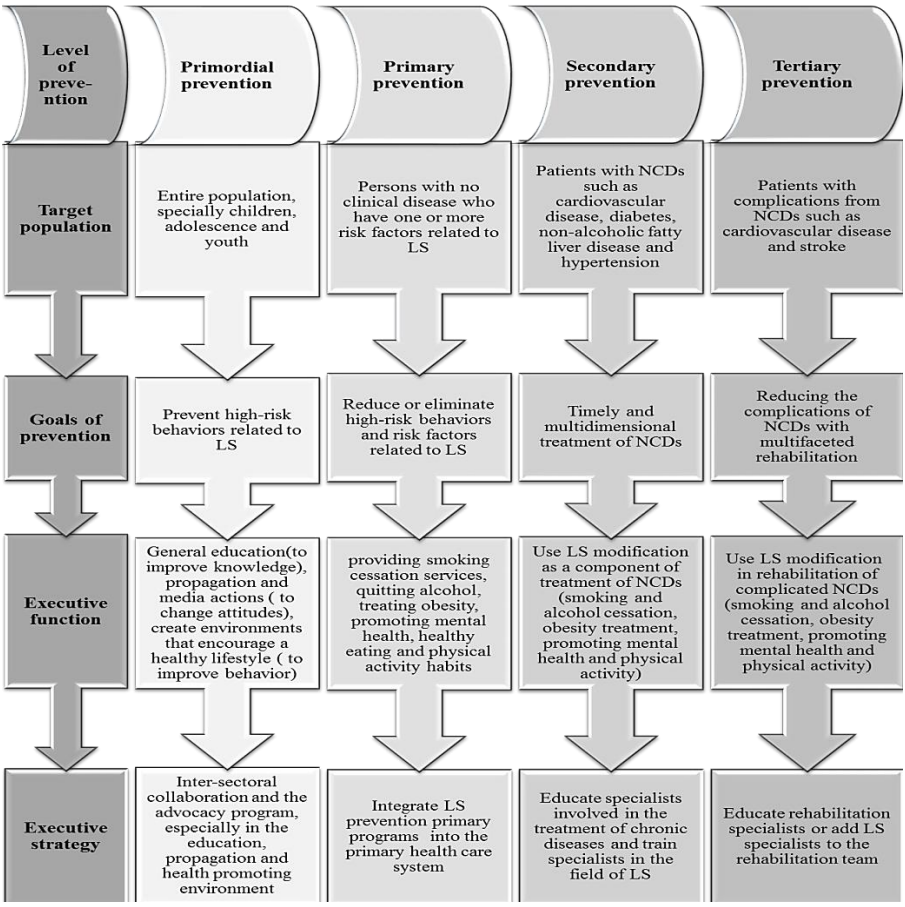

Figure 1. Prevention levels of the comprehensive lifestyle (LS) modification program

Conclusion

LS modification is a substantial strategy in the prevention and treatment of NCDs. This approach is now more important because the unhealthy LS during the COVID-19 pandemic threatens the communities' health more than it used to be. A comprehensive LS modification program can effectively improve all dimensions of LS in scientific knowledge, individual and social attitudes, and LS-related practices and behaviors at four levels of prevention using a variety of individual, group, and social interventions. Primordial prevention by preventing LS-related risk factors, primary prevention by reducing or eliminating LS-related risk factors, secondary prevention by using LS modification in disease treatment approach, and tertiary prevention by integrating LS interventions into rehabilitation make up the basics of a comprehensive LS reform program.

Conflict of Interests

Authors have no conflict of interests.

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