

Cost and cost-effectiveness of obesity treatment: A mini review

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Introduction

In the past two decades, the prevalence of obesity has increased significantly and became one of the important issues of public health and medical care in the world [1-3]. About 27.5% of adults and 47.1% of children are overweight or obese in 2013 worldwide [2]. Obesity and its related co-morbidities, such as type 2 diabetes mellitus (T2DM), hypertension, dyslipidemia, coronary heart disease, degenerative arthritis, respiratory and sleep disorders, and certain cancers, are common chronic diseases in both developed and developing countries [4]. For example, the risk for obese subjects to develop T2DM and hypertension is 27.6 times and 3.9 times greater than normal weight subjects, respectively [4]. Furthermore, as the medical expenses of these diseases increase, the costs of obesity and its related co-morbidities make up 2-20% of total medical expenditure and become a major economic burden worldwide.

Cost of obesity

The costs of obesity include direct and indirect costs [5-8]. Hammond divided the obesity-related cost into four major categories: direct cost, productivity cost, transportation cost, and cost of human capital accumulation [6]. The direct cost of obesity is the cost of the utilization of medical resources, such as manpower, medications, diagnostic examinations, treatments and equipments [5]. The direct cost can also be divided into the medical costs of obesity itself and the cost associated with obesity-related co-morbidities. The direct costs of obesity varies depend on the population and region of study-- it ranges from 2% to 20% of the total health care expenditure, depending on the country of study [9-14]. However, as the average life expectancy increases and the prevalence of obesity continue to rise, the costs of obesity persist to be a major issue for both developed and developing countries. The indirect cost of obesity is more complex to evaluate. It accounts for economic or production losses, such as sickness, absenteeism, reduced productivity, disability and premature death caused by obesity and the indirect cost accounts for about 50-60% of the total cost of obesity [8,15].

Some studies have shown that the direct costs of obesity may be under-estimated due to people or the health care system not regarding obesity as a disease. More importantly, the non-medical prescription or alternative treatment expenses may be higher than the medical costs [4]. The direct costs of obesity and its related co-morbidities depend on the risk of attribution of these co-morbidities that are attributed by obesity [4]. For example, the correlation between obesity and chronic diseases, such as T2DM, hypertension, and coronary heart

disease, are stronger than the non-obese subjects. In 2017, Leung, *et al.* found that the risk of T2DM is six times higher in morbidly obese subjects (BMI ≥ 40 kg/m²) than people who are not obese [10]. The average health expenditure is \$13,581 per year for those with diabetes and \$3,954 per year for those without diabetes in the US [10]. Tasi, *et al.* reviewed the medical costs of obesity from 1968 to 2009 in the US and found that obesity accounts for about 5-10% of total medical expenditure. For people who are overweight, obese or morbidly obese, the average medical costs increase by 9.9%, 42.7% and 68.0% when compared with the normal weight subjects, respectively [15]. In Holland, the overweight and obese had more than 20% and 40% of medical consultation than the normal weight subjects on 1994 [11]. According to data from Taiwan in 2008, people with obesity in the outpatient unit use medical services two to three times more frequently than people who are normal weight. In Taiwan, the expenditures of outpatient services increased from NT\$1,857 (at an exchange rate of NT\$32 to US\$1) for normal weight to NT\$3,960 for overweight and to NT\$5,118 for obese subjects [3]. Therefore the medical costs of obesity from these diseases may actually be higher

Kim, *et al.* conducted a systemic review and meta-analysis to evaluate the impact of variation on the estimated medical care cost of obesity from 2008 to 2010 in the US using the national survey data. The results demonstrated that the average medical spending attributable to obese subjects is about US\$1,901 (ranging from US\$1,239 to US\$2,582) per year per person, which leads to a cost of US\$149.4 billion on the national level. Furthermore, the age of subject and the adjustment for obesity-related co-morbid conditions are two most significant factors associated with the variation of obesity cost [16]. In 2014, Dee, *et al.* conducted a systemic review to evaluate the direct and indirect cost of obesity. The results have shown that the indirect cost accounts for about 54% to 59% of the estimated total costs of obesity. Reduced productivity and early premature death are the most important factors that associated with the gradient direct costs and indirect costs of obese subjects with increasing BMI [17].

Cost-effectiveness of obesity treatment

In 2004, Avenell, *et al.* reviewed randomized controlled trials (RCTs) and epidemiological cohort studies and found that

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medications, such as orlistat and sibutramine, appear to be beneficial for the treatment of obesity among adults. Low-fat diet is associated with the prevention of obesity and its related co-morbidities. Further, a low-fat diet combined with exercise intervention program in obesity-related diseases, such as T2DM and hypertension, are of comparable cost to anti-obesity drug treatment. Diet plus exercise or behavioral therapy could make weight loss more effective, but there is no study that evaluates the cost-effectiveness of these treatments. Family or group treatments are better than individual treatment, but further research is also needed to evaluate the cost effectiveness of the program [18]. Further longitudinal study and collecting data of the quality of life could explore the gaps in this area.

For obesity consultation, the total cost of face-to-face consultation was higher than that conducted through website or telephone. In the telephone group, 1 kg of weight loss costs €1,009 while in the internet group 1 kg of weight loss costs €16 [19]. In 2011, Krukowski, *et al.* compared the cost-effectiveness of internet-based vs. in-person behavioral weight loss program. The cost is US\$706 per person for in-person program and is US\$372 per person for internet program. Furthermore, website consultation is more cost-effective than telephone consultation [20]. But more empirical researches are needed to confirm these results.

The cost-effectiveness between the medical and surgical treatment for obese subjects varies. Metabolic surgery is a more cost-effective option for those who are severely obese and have other obesity-related co-morbidities [21]. The T2DM and hypertension control is also better for the patients who received metabolic surgery. For medical treatment, the effect of weight loss was around 3 to 5 kg weight reduction over a treatment period of six months to two years. However, more evidences are needed to evaluate the differences among treatments. Furthermore, long-term and in-depth quality of life assessment clinical trials are also needed to evaluate the cost-effectiveness of obesity treatment.

Among children, the cost of hospitalization for obesity increased from US\$ 125 million in 2001 to US\$ 237 million in 2005 [22]. For obesity intervention program, the cost to lower 0.1 BMI z-score is about US\$ 579 for programs that include parents and is about US\$ 758 for programs that include entire family. For children, it costs about US\$ 417 to lower 1% body fat [22]. In 2017, Darling, *et al.* used a systemic review and meta-analysis to evaluate the technique of mobile health (e-Health) on self-monitoring of lifestyles to manage body weight in children [23]. There is no significant effect of e-Health on self-monitoring physical activity. However, there are significant changes on dietary behavior and sugar-beverage consumption [23].

Conclusion

In conclusion, overweight and obesity have become one of the major issues in health care not only because it is associated with many co-morbidities but also of its high prevalence. The costs of obesity increase not only due to more co-morbidities, but also with absenteeism, disability, early death and other factors that are caused by obesity. Cost-effectiveness or cost-utility studies demonstrate that obesity counseling or treatment is beneficial and is also acceptable for preventing and treating obesity.

Since obesity is an important health issue and the costs of obesity and its related comorbidities are increasing in the world, more aggressive and effective prevention and treatment strategies that address obesity are necessary. It is imperative to allocate appropriate resources to develop obesity prevention and treatment programs. In order to

address the issue of obesity and improve the status of public health, it is imperative to develop payment-based prevention and treatment programs on the existing health care system, to evaluate the cost of obesity control programs, and to assess the cost-effectiveness of current prevention and treatment programs.

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