



Telephone based weight loss intervention: relevance for developing countries

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Title: Telephone based weight loss intervention: relevance for developing countries

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Abstract:

Obesity is a major public health challenge not only for developed but developing countries as well. The World Health Organization recommends the immediate use of effective, efficient and widely accessible weight loss interventions. Telephone based weight loss intervention could provide a cheaper and wider reach of obese participants. Previous systematic reviews on telephone based weight loss interventions either excluded studies that had obese participants with co-morbidities or were silent on their inclusion. Obese/overweight

individuals with co-morbidities constitute an important population in any weight loss intervention study due to the strong association of obesity with major chronic health conditions. This paper, reviews the efficacy of telephone based weight loss intervention solely in obese/overweight individuals with obesity related diseases and discusses its relevance for developing countries.

Keywords: Telephone, weight loss, developing countries, lifestyle modification, efficacy, diabetes, hypertension, hypercholesterolemia, metabolic syndrome

Introduction:

Overweight and obesity are characterised by the excessive accumulation of body fat such that health risks are incurred (WHO 2000). Overweight and obesity are commonly diagnosed using the Body Mass Index (BMI) which is defined as weight in Kilogram divided by the square of height in Metres. An Adult with a BMI of 25 to 29.9 Kg/m² is classified as overweight and a BMI of 30 Kg/m² and above is classified as obese (Ogden et al., 2006). The health risks associated with overweight/obesity include hypertension, non-insulin-dependent diabetes mellitus, coronary heart disease, stroke, various types of cancers, gall bladder disease, dyslipidaemia, osteoarthritis, gout and others (WHO 2000).

Globally the proportion of overweight/obese adults, adolescents and children have increased significantly over the last three decades (1980-2013) affecting both developed and developing countries (Ng et al., 2014). Globalization has contributed to the modification of the diets of developing countries to that of the western world. Obesity is now a public health challenge not only in the developed world but in developing countries as well (Popkin, et al.,

2012). There are marked differences in the trends of overweight and obesity for developed and developing countries. Ng and colleagues (Ng et al., 2014) through a systematic review of literature revealed that although there is a general rise in obesity prevalence worldwide, developed countries have since the year 2006 experienced a relative reduction in the rate of increase in overweight and obesity prevalence while developing countries (where two thirds of the world's obese live) continue to see a rise in prevalence. Additionally, developed countries have a higher overweight and obesity prevalence in men compared to developing countries. Obesity prevalence is however higher for women in both developed and developing countries (Ng et al., 2014).

The rising trend in overweight/obesity is linked to an increasing prevalence of obesity related diseases (Guh et al., 2009). The global prevalence of diabetes increased by about four fold from 1980 to 2014 and the rate of increase was more rapid in developing countries compared to developed countries (WHO 2016). Cardio Vascular Diseases (CVDs) accounts for 31% of all global deaths and of these deaths seventy five percent occur in developing countries (WHO 2018). Forouzanfar and colleagues (Forouzanfar et al., 2017) through a spatio-temporal Gaussian regression process, globally estimated the number of adults with elevated systolic pressure (≥ 140 mm Hg) to be 874 million in the year 2015. This represented a 19% increase in hypertension prevalence compared to that of the year 1990. The high prevalence of obesity and its co-morbidities places a significant burden on the global health care system and impacts negatively on the global economy (WHO 2016).

Weight loss is beneficial in reducing the risks of developing obesity related co-morbidities (Hamman et al., 2006; Williamson et al., 2000). Weight loss interventions involving lifestyle modification has been recommended as the first line of treatment for obesity ("Clinical

Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults--The Evidence Report. National Institutes of Health," 1998). This approach combines dietary therapy, physical activity and behaviour change therapy in addressing overweight/obesity and is offered either to groups or to individuals (Wadden & Butryn 2003). Behaviour change therapy consists of key principles including goal setting, problem solving, self-monitoring, stimuli-control combined with weekly visits to professional therapists for the initial weight loss phase usually lasting between 3-6 months and bi-weekly visits for the maintenance phase (Butryn et al., 2011; Wadden & Foster 2000). Attendance to weight loss program sessions have proven to improve weight loss outcomes significantly (Acharya et al., 2009; Gardener et al., 2007; Honas et al., 2003; Lloyd & Khan 2011; Teixeira et al., 2004).

Regular visits to meet with professional therapists however pose some real challenges to participants of these programs as they are faced with having to juggle these visits with other demands of daily living. Studies report popular reasons given by participants of weight loss programs for not attending weight loss sessions to include inability to travel to weight loss centre, demands of their job, job loss, and family obligations, financial constraints, and the desire for anonymity (Ciao et al., 2012; Meffert & Gerdes 2010; Webber et al., 2010). The issues of busy job schedule, loss of job, family obligations, constitute a significant part of life and are likely to recur in any human life. It is therefore important to look for alternative methods to the face to face weight loss programs, that ease participants of the burden of having to travel to weight loss centres for weight loss sessions by providing remote support approaches that have similar or comparable weight loss outcomes.

Aside the inconvenience of having to travel to weight loss centres for the in-person type programs, there is also the issue of the numbers of people that can be reached at any point in time being below the capacity that would facilitate a large scale public health delivery of weight loss services. With the rising global prevalence of obesity and its co-morbidities, as

well as the associated growing financial costs of management, the World Health Organisation (WHO) strongly recommends the immediate use of effective and widely accessible weight loss interventions (Morak et al., 2008).

There is evidence of telephones being used in the delivery of lifestyle interventions including weight loss (de Jongh et al., 2012; Donnelly et al., 2013; Fjeldsoe et al., 2009; Haapala et al., 2009; Sherwood et al., 2010). Telephone based weight loss intervention could provide a cheaper and a wider reach of participants (Donnelly et al., 2013; Weinstock et al., 2013; Willis et al., 2016). Previous systematic reviews on telephone based weight loss interventions either excluded studies that had obese participants with chronic health conditions or were silent on their inclusion (Khokhar et al., 2014; Lywinski 2014, Woo 2013). Obese/overweight individuals with co-morbidities constitute an important population in any weight loss intervention study due to the strong association of obesity with major chronic health conditions. To the best of our knowledge there has not been any review on the relevance of telephone based weight loss for developing countries (which is home to two-thirds of the world's obese population).

This paper, therefore, reviews the efficacy of telephone based weight loss intervention solely in obese/overweight individuals with obesity related diseases (Metabolic Syndrome, Diabetes, Hypertension, and Hypercholesterolemia) and discusses its relevance for developing countries.

Efficacy of telephone based weight loss interventions in obese individuals with obesity related diseases:

The Support, Health Information, Nutrition and Exercise (SHINE) study compared the effectiveness of two Primary Care Provider (PCP) staff telephone-delivered versions of the Diabetes Prevention Program (DPP) lifestyle intervention. Obese persons with metabolic

syndrome were randomised to receive the DPP lifestyle intervention by telephone either individually or in conference calls (consisting of groups of 8 individuals per call). Significant weight loss occurred and was comparable in both groups. The mean percent weight loss for the group call intervention versus individual call intervention were comparable and are presented for the different time periods as follows: 6 months ($4.0\% \pm 14.8\%$ versus $3.9\% \pm 15.2\%$, $P < 0.001$) and 12 months ($4.5\% \pm 20.3\%$ versus $4.2\% \pm 16.9\%$, $P < 0.001$) (Weinstock et al., 2013).

Group calls may have better long-term weight loss outcomes compared to individual calls due to the benefits of social facilitation (Befort et al., 2010). In the SHINE study for instance, the group based intervention had a better weight loss outcome compared to the individual based intervention at 24 months ($5.6\% \pm 26.8\%$, $P < 0.001$ versus $1.8\% \pm 18.6\%$, $P < 0.05$ respectively). The Study was not powered to study effects of the intervention on diabetes and did not report on the effects of the intervention on metabolic syndrome indicators (Weinstock et al., 2013).

Eakin and others investigated the effectiveness of a phone based lifestyle intervention in 302 Australian primary care patients with type 2 diabetes at 6 months and found small but significantly better weight loss (relative rate [RR] -1.2% of initial body weight) in the phone intervention group compared to the usual care group (Eakin et al., 2013). Similarly at 18 months (end of weight loss phase) the authors (Eakin et al., 2014) reported modest but significantly better improvements in weight loss [RR] -1.42% of baseline weight) for the phone intervention group relative to the usual care group. Weight loss outcome did not change or deteriorate during maintenance.

In patients with one or more cardiovascular risk factors, telephone alone intervention or telephone with face to face intervention both yielded significantly better weight loss outcomes compared to controls that pursued a self-directed weight loss (Appel et al., 2011).

Improvements in the health profile of obese patients with chronic diseases such as Diabetes and Hypertension after a phone based weight loss intervention have been reported. A quasi-experimental web-based (via phone SMS or internet) intervention study in obese and diabetic individuals reported significant ($P < 0.05$) improvements in glycosylated haemoglobin (HbA(1)c) levels in the intervention group at 3 months (a decrease of 1.22 percentage points), 6 months (a decrease of 1.09 percentage points), 9 months (a decrease of 1.47 percentage points) and 12 months (a decrease of 1.49 percentage points) compared with baseline. The percentage change in the control group was however not significant (Kim & Kim 2008). Improvements in HbA(1)c concentrations for diabetics have also been reported by Haddad *and* colleagues (Haddad et al., 2014). In this study the mean HbA(1)c of participants was decreased from $79 \text{ mmol/mol} \pm 14 \text{ mmol/mol}$ to $70 \text{ mmol/mol} \pm 13 \text{ mmol/mol}$ six months after the phone short message services (SMS) intervention ($P=0.001$). In a study (Weil 2016) that assessed the effect of six months telephone based weight loss intervention in 165 obese participants with idiopathic intracranial hypertension (IHH), the mean percent weight loss achieved was $5.9\% \pm 6.7\%$ consistent with literature on IHH which suggests that 6% weight loss promotes improvement in the condition. Eakin and others (Eakin et al., 2013; Eakin et al., 2014) however did not find any significant improvements in (HbA(1)c) concentration both in the six months and the 18 months study.

The frequency of calls made in telephone based intervention also plays a role in weight loss success as shown in a study that investigated the association of telephone intervention dose with dietary intake and physical activity in participants who were both diabetic and hypertensive. This study showed that relative to those with lower call completion,

participants with higher call completion during the maintenance phase of the intervention had lower fat and higher fibre intakes, behaviours known to promote weight loss (Goode et al., 2011). In another study, maintenance of lost weight was achieved with telephone based intervention when the frequency of telephone contacts was twice monthly and was as effective as weight loss maintenance results via on-site group counselling (Perri et al., 1984).

Relevance for developing countries

The trend in obesity and its co-morbidities in developing countries

Obesity/overweight is now a rapidly growing public health threat for developing countries, replacing the traditional health issues of underweight and infectious disease (WHO 2000). This is partly due to the modification of the diets of these developing countries to that of the western world as a result of globalization and improved incomes (Popkin et al., 2012). Globally, an estimated fifteen million people aged 30-69 years die from non-communicable diseases (most of which are obesity related) each year. Over 80% of these deaths occur in developing countries (WHO 2017).

In a study that analysed the demographic and economic transition of developing countries, the number of mega cities (a city having 8 million or more residents) was reported to have increased from five in 1970 to twenty-seven in 2015. Increased urbanization had resulted in significant changes in diet, physical activity and body composition. Urban diets had more of superior grains (rice or wheat rather than corn or millet), more milled and polished grains, fats, animal products, sugar, and processed foods. The switch to a western diet, improved incomes, coupled with a shift to a more sedentary lifestyle was linked to the rapid rise in

obesity in this population (Popkin 1997). Thus, the rising trend of obesity is evident in Asia, Africa, South America and the Middle-East, and this is discussed below.

Asian countries with low to medium Human Development Index (HDI) are experiencing a significant rise in obesity prevalence. Reported prevalence of adult overweight/obesity are 21.1%, 16.1%, 21.5%, 17.4%, 21.2% for Pakistan, Bangladesh, Philippines, Vietnam, and Indonesia, respectively (Barquera et al., 2016). India, rated as a medium HDI and the second most populous country across the globe has shown a significant rise in obesity over the years (Bhardwaj et al., 2011; Deepa et al., 2009; Mohan & Deepa 2006). A recent report puts the national prevalence of overweight/obesity for India at 19.7% (Barquera et al., 2016). The prevalence of hypercholesterolemia is estimated to be 31%, 25.7%, 43.3%, 36.1% and 35.8%, 27.9% for Pakistan, Bangladesh, Philippines, Vietnam, Indonesia and India, respectively. The annual percentage change in mortality from diabetes, cardiovascular disease, ischemic heart disease and ischemic stroke was negatively correlated with the HDI of these Asian countries as well as that of the other mega countries evaluated (Barquera et al., 2016). This shows that countries that are least developed experience a higher burden of obesity related diseases and mortality.

The African region is also experiencing an explosion in obesity rates. Agyemang and colleagues (Agyemang et al., 2015) reviewed the WHO's infobase on obesity prevalence in Africa. The review showed that the top five African countries with leading prevalence in obesity were Seychelles (63.8%), followed by Mauritius (44.8%), Cameroon (43.9%), Botswana (41.6%), and South Africa (41%) for males and that for females were Seychelles (73.8%), Lesotho (70.8%), South Africa (68.5%), Mauritania (58.6%), and Mauritius (56.8%).

The high prevalence of obesity in Africa is associated with a high prevalence of obesity related diseases. A study in Nigeria pointed to the co-existence of obesity with cardiovascular risk factors and diabetes (Okpechi et al., 2013). The prevalence of Hypercholesterolemia and elevated blood pressure in Nigeria was reported to be 16.8% and 27.8% respectively (Barquera et al. 2016). In Mauritius the high prevalence of obesity was found to co-exist with a high prevalence of diabetes (20.5%), pre diabetes (19.4%) and hypercholesterolemia (44.1%) (Baker IDI Heart and Diabetes Institute & Gayan et al., 2015). In Tanzania, a unit increase in BMI was associated with a 10% increase in the odds of developing hypertension (Njelekela et al., 2009). The Ghana Demographic Health survey carried out in 2014 reported 40% of women and 16% men between the ages 15-49 years to be either overweight or obese (Ghana Statistical Service (GSS) Ghana Health Service (GHS) ICF International, 2015). The rise in obesity is associated with a rising trend in the incidence of Hypertension, Diabetes and Hypercholesterolemia in Ghana. CVD is estimated to be the leading cause of institutional deaths in Ghana (Bosu 2013).

South American countries like Brazil and Mexico have adult obesity/overweight prevalence as high as 51.1% and 62.1% respectively. Obesity/overweight co-exists with a high prevalence of hypercholesterolemia and elevated blood pressure of 44.2% and 23.3% respectively for Brazil and 50.7% and 21.0% respectively for Mexico (Barquera et al., 2016).

Developing countries in the middle-eastern region such as Iran also share in the obesity pandemic and its co-morbidities. Iran's adult overweight and obesity prevalence ranged between 27.0%-38.5% and 12.6%-25.9% respectively as reported in a systematic review by Jafari-Adli and colleagues (Jafari-Adli et al., 2014). A recent study conducted in one of the provinces of Iran revealed the prevalence for pre-hypertension to be as high as 47.3% and that for overall hypertension to be 22.6% (Tabrizi et al., 2016).

The rising prevalence of obesity and its co-morbidities in developing countries is a worrying phenomenon. These countries are plagued with undernutrition, infectious diseases and obesity as well (Barquera et al., 2016). This places a serious burden on the already poor health systems of these countries. A significant number of these countries (Ethiopia, Nigeria, Pakistan, Bangladesh, India, Philippine, Indonesia, Brazil, Mexico) either fall in the category of mega countries (have over 100 million residents) or have a population (90 million) which is very close that of mega countries (Barquera et al., 2016). A small percentage increase in the prevalence of obesity related diseases in these mega countries translates into large numbers of affected individuals thus placing an even higher burden on their health systems.

Mobile phone subscription in developing countries

Mobile phones are portable, convenient and are increasingly being used by people of varying age groups, socio-economic backgrounds and geographic locations (Donnelly et al., 2013; Gerber et al., 2009; Haapala et al., 2009; Sherwood et al., 2010). This makes it the right tool for activating telephone based weight loss intervention in developing countries.

Ninety five percent of the global population live in an area that is covered by a mobile-cellular network and global mobile-telephone subscriptions increased from 10 per 100 inhabitants in the year 2000 to 96.8 per 100 inhabitants in the year 2015 (Sanou 2015).

Developing countries have not been left out in this phenomenon of rising mobile phone subscriptions. In India for instance over 1 billion inhabitants subscribed to mobile phone services in 2016 accounting for more than 70% of the population (Rai 2016; Worldometers 2017). Bangladesh, has about 129,584,000 subscribers and this constitutes about 78.6% of the population (Bangladesh Telecommunication Regulatory Commission; Worldometers 2017).

Africa has experienced growth in mobile phone subscription over the years with more than half a billion (47%) people subscribing to mobile phone services in 2015. This is expected to further rise by about 30% by the year 2020 (Group Special Mobile Association-Africa 2016). Nigeria for instance has over 149 million (82%) mobile phone subscribers making it the leader in mobile phone subscription in Africa (Lancaster, 2017). Tanzania recorded 40.17 million subscribers in 2016, representing about 75% of the national population (Ng'wanakilala 2017).

The rising number of mobile phone subscribers is seen in Latin America and the Caribbean as well. The subscriber rate from 2015 to 2020 is expected to grow at an annual rate of 4.8%, a figure that is higher than the global rate of 4.0% (Group Special Mobile Association-Latin America and Caribbean 2016). Brazil for instance recorded a total of 126.6 million (61%) subscribers in the year 2014 and this number is projected to increase to 139.2 million by the year 2018 (The statistics portal 2017).

Middle Eastern countries that belong to the non-Gulf Co-operation Council (GCC) have an average of 56% of their population subscribing to mobile phones (Group Special Mobile Association-Middle East and North Africa 2016). Developing countries in the Middle East fall in the non-GCC category. Iran for instance has experienced a rise in mobile phone subscription over the years ranging from zero in 1960 to as high as 77.4 million (98%) subscribers in the year 2015 (Union 2017).

Feasibility of mobile phone based weight loss interventions in developing countries

Some studies have already explored the use of mobile phone based weight loss interventions in obese individuals in developing countries and rural settings. A study investigating the feasibility and utility of mobile phones (SMS text) in the management of type 2 diabetes in a developing country (Iraq) reported significant improvement in HbA(1)c levels. Additionally

the intervention was acceptable to this population and cost effective (Haddad et al., 2014). Rural folks in Kansas, in the United States of America, have benefited from a mobile phone weight loss intervention in the area of efficacy and cost effectiveness in group based intervention compared to individual intervention. The cost for group versus one on one counselling was \$714 and \$1029 respectively (Befort et al., 2010). The rural nature of this population studied in Kansas makes it appropriate to justify the feasibility of mobile phone based weight loss intervention in developing countries where significant parts are still rural despite the rising rate of urbanisation. Donnelly and colleagues (Donnelly et al., 2013) found that phone based intervention was significantly cheaper than face to face intervention. The mean cost per session was $\$22.47 \pm 13.69$ in the phone based intervention and $\$44.07 \pm 18.33$ in the face to face intervention. The harsh economic condition of developing countries as reflected by the significant proportion of people living on less than a \$1 per day gives merit to telephone based weight loss intervention as a more suitable method in addressing the obesity pandemic in this region (Sinding 2009).

Although this seems to be an excellent opportunity for both public and private primary care providers and weight loss centres to harness, there could be potential challenges that need to be urgently and effectively addressed to make telephone based weight loss intervention a success in developing countries. Costs (with respect to healthcare charges as well as transportation expenses) has been cited as important barrier to health care access for the poor in both developed and developing countries even when health services are available (Musoke et al., 2014; Ravenell et al., 2008). Both the rural and urban poor (mainly rural urban migrants) in developing countries may have a greater challenge accessing a telephone based weight loss intervention as these individuals may not be able to afford the costs involved in using these services although fairly cheaper than the face to face weight loss intervention. A study in Kenya (Izugbara et al., 2009) reported that one of the reasons why urban poor

women did not utilise hospital services during delivery of their babies was due to the perceived high costs of hospital services. Further, the scarcity of health workers seems to be a significant challenge for the health systems in developing countries. Sub-Saharan Africa for instance bears more than 24% of the global burden of disease yet has only 3% of the world's health workers (Dussault & Franceschini 2006). The latter coupled with the scarcity of health services in rural compared to urban communities in the developing world (Magadzire et al., 2014; World Bank 2014) may work against the effective implementation of a telephone based weight loss intervention in this part of the world. Poor service delivery including poor attitudes of health workers, low employee morale, inadequate training of health workers have also been cited as major barriers to health care access (Chigona 2013; Commission on Macroeconomics and Health 2001; Izugbara et al., 2009). These could be potential barriers to the utilisation of a telephone based weight loss service offered in health centres.

Other limitations such as poor mobile connectivity due to weak signals and the lack of skill in the use of mobile phones by the less educated may also detract from the efficient use of mobile telephones in weight loss intervention in this region (Chigona 2013).

Managing potential health service delivery and utilisation barriers to ensure a successful implementation of telephone based weight loss program.

There is the need for a country based situation analysis of the problem of low patronage of health services by their respective populations. This will better reveal country based knowledge, attitudes, perceptions, and practices that undermine the patronage of modern health services. Social norms and attitudes for instance, have been identified as important factors impacting health seeking behaviour in developing countries (O'Donnell 2007). Broad stakeholder consultations will be needed for better planning, implementation, monitoring and evaluation of the program. The relevant actors such as nutritionists, dietitians, nurses,

doctors, and other health care staff need to be trained on the execution of the program taking learnings from best practices in developed countries and adopting to fit local conditions.

General scaling up of government expenditure on health care is needed to improve health service delivery (Commission on Macroeconomics and Health 2001). The latter calls for effective health policy reform and a strong political will in favour of this action. The numbers of trained health staff available for this intervention need to match up with the demand for the service while bridging the disparity in numbers of health workers in rural centres versus urban centres. The morale of the health workers need to be inspired and service rewarded in ways that can improve and sustain their motivation to provide this new intervention. Health institutions must be made to work efficiently and provide these services routinely and on a timely basis. The Ministry of Education's involvement will be crucial if this intervention is to be sustained. For instance, the curriculum of medical, nursing, nutrition and dietetic students at the tertiary level must be revised to include aspects that cover training on using mobile telephony in delivering health services including weight loss programs.

Mobile telephone connectivity needs to be improved dramatically in this region. This may involve some collaboration between government and telecommunication companies to invest in better equipment and emerging technology. Governments in the various developing countries need to provide mass media education on the benefits of the program to improve patronage. National Health Insurance coverage as well as government subsidies will help lower costs significantly to make it affordable to the poor.

Conclusion:

Telephone based weight loss intervention in obese individuals with obesity related chronic conditions is efficacious and to a large extent results in significant improvements in the health

profile of these individuals. Future studies must in addition to efficacy studies explore the effectiveness of this intervention both for weight loss and weight maintenance.

The high subscriptions of mobile phones in developing countries and its potential for large scale and cheaper service delivery to the populace make telephone based weight loss intervention very relevant for these countries. This kind of intervention in developing countries seems favourable in addressing the urgent call by the WHO to use effective weight loss interventions with wider reach in addressing the global obesity challenge and its co-morbidities.

There is however an urgent need to manage the potential barriers to health care access arising from disparities in socio-economic status, residential location (rural versus urban areas), staffing of health care centres (rural versus urban areas). Additionally, issues bordering on poor health service delivery (such as low staff morale, poor attitudes of health care providers), poor mobile telephone connectivity and the lack of skills among the illiterates in the usage of mobile phones need to be addressed.

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