



IVAN N. MARTINEZ-SALAZAR | ERIKA ACEVEDO-STEFANONI | SANTIAGO BOIRA | CHAIME MARCUELLO-SERVÓS | LAURA OTERO
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JOSÉ AZOH BARRY | FRANCISCO JAVIER GORJON GÓMEZ

¿Cómo afrontar la obesidad en una sociedad digital? Respuestas desde el campo del Análisis Aplicado de la Conducta How to treat obesity in a digital society? Answers from the Applied Behavior Analysis field

Ivan N. Martinez-Salazar* y Erika Acevedo-Stefanoni**

* Western Michigan University / Ejército y Fuerza Aérea Mexicanos. dr_ivan_martinez@yahoo.com.mx

** Instituto Unisahm (México)

Abstrac:

The obesity epidemic represents a global problem, which is increasing in prevalence. This problem is preventable as are its short and long term consequences. This article presents the advantages and why it should be encouraged the use and research of eHealth technology, specifically combining it with selected concepts of the Applied Behavior Analysis (ABA) field for the treatment of obesity, a problem that many have called the "twenty-first century disease".

Keywords: Obesity, treatment, eHealth, Applied Behavior Analysis.

Resumen:

La epidemia de obesidad representa un problema global, el cual está incrementando en prevalencia. Este es un problema prevenible así como lo son sus consecuencias a corto y largo plazo. Este artículo presenta las ventajas y el porque se debe motivar el uso e investigación de la tecnología *eHealth*, específicamente combinándola con conceptos seleccionados en el campo del Análisis Aplicado de la Conducta (ABA) para el tratamiento de la obesidad, un problema que muchos han llamado, la enfermedad del siglo XXI.

Palabras clave: Obesidad, tratamiento, eHealth, Análisis Aplicado de la Conducta.

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1. Introduction

In a digital society, in which people is using intensively new communication technologies, the purpose of this article is to present the advantages of eHealth technology for the treatment of obesity, which has turn into a severe problem in the world. There is an urgent necessity to find solutions, easily accessible for the general population. In this article, the use of long distance technology (eHealth) is analyzed and combined with selected theoretical concexpts from the perspective of Applied Behavior Analysis (ABA). This article is addressed to Behavior Analysts to encourage them to develop research using eHealth technology for the treatment of obesity. Nevertheless, an additional goal is to present concepts and applications of ABA combined with eHealth technology to other professionals from different areas such as primary care physicians, nurses, social workers, health educators, and even health administrators. In first place, we will present epidemiological numbers related with the obesity epidemic. Second, we will presents definitions of eHealth and Applied Behavior Analysis (ABA) and provide a rationale for the advantages of their combination in the obesity treatment. In third place, we will explain the obesity treatment approach from the conceptual perspective of the ABA field combining it with eHealth. As a fourth part of this article we have select-ed research studies on ABA, eHealth and Obesity Treatment that will support our conclusions section where we will synthesize the advantages derived from the application of the proposed approach presented along the article.

2. Obesity and Chronic Diseases

In this section, cold, dramatic, and disturbing numbers about the obesity epidemic and its relationship to the prevalence and evolution of several chronic diseases will be presented.

According to the World Health Organization (WHO 2003), obesity has reached levels of epidemic and global proportions. Related risks of diseases such as diabetes, cardiac diseases, hypertension, among other significant health problems, have increased substantially (Noble et al. 2007).

Recent estimations have suggested that over half of the population within the United States of America is overweight; an estimated 34% of adults and 17% of children are obese (Ogden et al. 2012). In Mexico, 7 out of 10 adults are overweight, half of which are obese (Gutiérrez et al. 2012: 186).

In recent decades, the prevalence of obesity has been dramatically related to lifestyle. A number of interventions and guidelines have been recommended to promote the consumption of healthy food, but results are inconsistent (Noble et al. 2007). Perhaps the inconsistency of positive results is because of efforts directed

toward reducing weight, (e.g., kilograms or pounds), not directed toward changes in specific behaviors.

The increase in costs of health care to treat chronic diseases and their relation with obesity has augmented the necessity for research directed toward prevention and treatment of this problem (Normand 2008). Nevertheless, the use of technology in our daily life is also increasing and the costs of access to this technology are decreasing and can be used for the improvement of health. For example, mobile phones with free tracking applications for physical activity, sleeping or eating behaviors can be used for obesity control.

A recommended practice is the performance of physical activity, which reduces many of the risks associated with overweightness and obesity for adults and children. It is recommended that children and adolescents perform at least 60 minutes of moderate to intense physical activity per day. For adults, at least 150 minutes of moderate to intense physical activity per week is recommended (Benjamin 2010; WHO 2010). For instance, using new and free mobile phone technology allows the users to track his or her physical activity performance, even sharing this data with peers or why not with health care professionals as will be explained later.

3. eHealth and ABA

The eHealth concept, also called mHealth (i.e. mobile health), was defined by Gaddi, Capello and Manca as, "the term used to describe interactions with health services that can be performed using computer-based communication technologies. It evolved from telemedicine and tele-health where telecommunication is the delivery method for health care" (Gaddi et al. 2014: 16). The World Health Organization also provided a definition of this concept as, "the use of information and communication technologies (ICT) for health. Examples include treating patients, conducting research, educating the health workforce, tracking diseases and monitoring public health" (WHO 2015).

The field of ABA was defined by Cooper, Heron and Heward as "the science in which tactics derived from the principles of behavior are applied systematically to improve socially significant behavior, and experimentation is used to identify the variables responsible for behavior change" (Cooper et al. 2007: 20).

In this article will be presented essential concepts of ABA, combining those with specific tools available nowadays (i.e., eHealth technology). There is no question that control of the obesity epidemic is an urgent need. Efforts to attend to this problem are totally and absolutely important for society. The field of Behavioral Medicine specifically, taking the principles of ABA as a basis can be the best course of action. Physicians can learn and apply these concepts in the first level of medical attention.

The advantages of doing this not only benefits people individually, but also represents a strategy that could lead to targeting administrative aspects of health care systems around the world. The spirit of the present article using eHealth technology but adding the ABA approach, can be found in the following citation.

No medication can cure chronic diseases. Instead, behavior change is required to manage the impacts of chronic diseases on an ongoing basis. Integration of behavioral medicine and primary care represents an alternative to delivering comprehensive, high-quality care to patients, and, in doing so, forges new relationships within the health care team and administrative leadership (Bholat et al. 2012: 606).

eHealth technology creates better communications between people and their health care providers, allowing all of them the record of daily behaviors of a person, (sometimes also called patient or client) in this case behaviors related with prevention and treatment of obesity. Adding to the equation the selected ABA concepts (e.g., behavioral contingencies, self-monitoring and feedback), will clarify and improve even more this interaction, preventing and treating the problem.

4. Obesity Treatment Explained from the Perspective of eHealth and ABA

For purposes of the present article, it is necessary to refer to two different approaches that even many Behavior Analysts consider antagonistic. An interesting challenge has always been to distinguish clearly the differences but also the convergent points between the traditional medical model and the approach of ABA. The agreement of convergent points between these two approaches will allow the discovery of possible solutions to obesity. It is precisely in the field of Behavioral Medicine where these convergences can be found.

Probably one of the most respected and passionate theoreticians in the field of Behavior Analysis nowadays is Malott. He explained the concept of the "Medical-Model Myth"

An erroneous view of human behavior- that behavior is always a mere symptom of an underlying psychological condition... the medical model suggests that the behavior is of little importance in its own right... most people use the medical model when they explain human behavior. But usually a simpler, behavioral interpretation is more accurate and will help us intervene with better results (Malott 2008: 25).

In the case of excess weight and obesity, and following the traditional medical model, an excessive intake of food (i.e. calories) can be explained from different perspectives. For instance, an obese middle-aged woman could be obese, primarily, because of an endocrinological disease (e.g. hypothyroidism, diabetes, etc.), or due

to a mental disorder (e.g., depression or anxiety). However, this model leads to what Malott defined as “circular reasoning” (Malott 2008: 27). In short, if the woman of the previous example is obese, it is because she has a disease. But why does she have a disease? Because she is obese. And why is she obese? Because she is depressed. So why is she depressed? Because she is obese. Following exclusively the medical model, specific behaviors are not clearly addressed; neither is it explained why this woman is obese. The reason or cause could be explained in a different way. For example, food is a reinforcer for the behavior of eating, providing positive reinforcement (e.g., taste), or providing an escape from the aversive stimulus of hunger. It is true that overeating can be a sign or symptom of some medical conditions. However, these behaviors and reinforcers should be clearly identified and receive the proper assessment and treatment, just as a physician prescribes a pharmacologic treatment to control endocrine or neurochemical imbalance. Therefore, the use of eHealth technology permits the exact record of daily behaviors and their consequences. The woman in the previous example, could record in her mobile phone what, where, and how fast she eats, even the quantity of calories eaten. She could also set alarms to remember her to take medications or even to establish her daily meals schedule. At this point, all these behaviors are frequently done, but the next step then, will be sharing all these data with her health provider. Using eHealth technology provides not only the person but also physicians with invaluable data to improve treatments for any medical condition related with the performance of specific behaviors, in this case for obesity prevention and treatment.

Cooper, Heron and Heward presented an example directly related with the topic of weight control and the reason why behaviors, or habits, are usually not studied correctly. According to Cooper et al., several programs and interventions were not successful because the goal was placed on weight reduction and not on the behaviors necessary to produce that goal,

Losing weight is not a specific response that can be defined and performed; it is the product or result of other behaviors- most notably reduced food consumption and/or increased exercise. Eating and exercise are behaviors and can be specifically defined and measured in precise units (Cooper et al. 2007: 61).

When people talk about behavioral principles, they are talking about concepts that have evolved for the past 60 years. Today, more than ever, these concepts must be present to solve important health problems like the prevention and treatment of excess weight and obesity. Next, selected ABA concepts and their relation with obesity control will be defined, adding examples using eHealth technology.

4.1. *Behavioral Contingencies*

Malott defined behavioral contingency as, “the occasion of a response, the response, and the outcome of the response... the occasion is a stimulus in the presence of which

a particular response (behavior) will produce a particular outcome” (Malott 2008: 16). Following this concept, it can be assumed that, for controlling the different habits that lead to excess weight and obesity, the first step that is required is the identification of specific behaviors, integrating those habits, and therefore, noting the specific responses and outcomes they produce. It is also important to identify the environmental factors that influence the performance of related behaviors. For example, a physician regularly must search for frequency of eating in an obese patient, probably advising to eat 5 times per day following a specific diet, and controlling the number of calories with special control of carbohydrate intake. Then, not only is there a specific behavior (i.e., eating) and a specific measure (i.e. frequency of meals per day), but it would also be important to identify where the person usually eats in order to identify other possible environmental risk factors (i.e., obesogenic environment). A health professional could send daily automatic mobile phone text messages encouraging a person to accomplish daily goals such as number of calories, physical activity, then, at the end of the day the person could return a text message with recorded data, describing the consequences for the specific behaviors performed during that day. It may appear to be a lot of extra work to do, however, this can be done for educational purposes and for specific periods and scheduled periods of times, until the person masters the desired and appropriate behaviors, there are several options of interventions that can be tailored for each person, identifying the components of the behavioral contingencies related with the prevention and treatment of obesity.

4.2. *Rule-Governed Behavior*

Human behavior can be controlled by rules, describing consequences that might occur, not immediately, but delayed (e.g., hours, days, months and even years later). Malott defined Rule-Governed Behavior as “behavior under the control of a rule” (Malott 2008: 364); he defined rule as “a description of a behavioral contingency” (Malott 2008: 364).

A diabetic and obese person could repeat a rule for him or herself, such as “I don’t have to eat this cake because it might affect my blood glucose level”. This is a rule that describes an outcome, which is neither concrete nor clear. The same person might say, “I must exercise to decrease weight”, and again, this is an unspecific rule. In order to apply the concept of Rule-Governed behavior for the control of being overweight and obesity, Malott’s definition is required: “Rules that are easy to follow (which) describe outcomes that are both sizable and probable, the delay isn’t crucial” (Malott 2008: 400). A diabetic and obese person might express to him or herself and/or to somebody else, “If I eat this cake, tomorrow my blood glucose level will be affected by 10%”, or, “If I run at least 3 times this week, my weight will decrease around a kilogram in two weeks”.

It can be tempting to think that the mere establishment of clear rules, and describing sizable and probable outcomes, would be the solution of many problems for human beings. In the end, we are surrounded by rules, some of which work better than others. The difference resides probably in two aspects, the supervision of rules compliance and the involvement of deadlines. Many problems, such as being overweight and obesity, can be prevented or treated with a clear design of rules with specific deadlines. For instance, "If I run 5 kilometers today before 8 pm., and if I run 3 times this week, I will decrease my weight around one kilogram in two weeks". In this case, the rule presents two deadlines, one per day and one per week. The same rule can be improved by adding other consequences for the performance of the specific behavior (e.g. running). These consequences must be powerful reinforcers in order to maintain and increase the desired behavior, and/or aversive enough to decrease inappropriate behaviors. Without deadlines and consequences both sizable and probable, people tend to dwell in a state of everlasting procrastination (Malott 2008: 405). The eHealth technology allows communication between people and their health providers for the design and establishment of these rules and their specific deadlines and then for the supervision of rules compliance. For example, a behavior analyst can monitor a client's performance every day sending a mobile phone message prompting the client to send a photo of his or her daily physical activity performance, this photo can be taken from a tracking device or a mobile phone application, repeating the same procedure everyday until the client reaches a behavioral goal (e.g., exercising 3 times per week). As can be seen following this strategy it is not needed a frequently direct physical interaction (i.e., person to person) to support obesity control programs.

4.3. *Avoidance of-Loss Contingency*

Using the same example provided earlier, a new rule could be created: "If I run 5 kilometers today before 8 pm., I will pay myself \$1 USD". If the reinforcer is valuable for the person and motivates the performance of the specific behavior efficiently, then it has been designed as a behavioral management contingency, and specifically what Malott defined as an Avoidance-of-Loss Contingency.

Response contingency, prevention of the loss of a reinforcer resulting in an increased frequency of that response... operating beneath this contingency is the principle of avoidance of loss—a response becomes more frequent in the future if it has prevented the loss of a reinforcer in the past (Malott 2008: 259).

In the previous example, the person will perform the specific desired behavior in order to avoid the loss of the reinforcer (i.e., \$1 USD). For the prevention and treatment of being overweight and obesity, a good strategy consists in involving the person in the performance and maintenance of specific behaviors, such as practicing exercise and eating healthy food. Therefore, avoidance-of-loss contingencies could be

designed with a preferred reinforcer for that person. In order to have success with this strategy, it will be fundamental to identify which are the preferred reinforcers for each person. In the earlier example, money was the reinforcer but there are other options, like having access to preferred activities or other rewards that the same person could grant to him or herself. Food will be probably the only reinforcer not recommended in an intervention with the goal of weight reduction. The eHealth technology (e.g., e-mail, text message) will support the long distance interaction and supervision with a professional who will function as a behavior manager, supporting the accomplishment of specific behavioral goals.

As a conclusion at this stage, it can be said that rules must be designed and clearly stated by the person themselves, or by a different person supporting the design of those rules (e.g., a Behavior Analyst, and ideally in the future, a physician of the first level of medical attention, or another professional). The specific performance of behaviors and both sizable and probable consequences must be described, with the addition of specific daily and/or weekly deadlines. With these rules and consequences, it should be possible to maintain and increase appropriate behaviors for the prevention and control of being overweight and/or of obesity. The concept of avoidance-of-loss of reinforcer contingencies could also be used, with the reinforcer being selected with regard for each person's preferences. Finally, eHealth technology favor the interaction between a person and their health care provider supporting the compliance with the established rules and monitoring the performance using technology such as tracking devices for physical activity, sending data through text messages, e-mail or even videoconferences.

The strategy of avoidance-of-loss of a reinforcer appears as a valid and needed option in the face of health problems as complex and disturbing like being overweight and obesity. Moreover, it must be a goal to teach the person to take care of him or herself, and to be monitoring and controlling his or her behaviors.

4.4. *Self-control, Self-monitoring and Feedback*

"A Self-management program begins with identifying a personal goal or objective and the specific behavior changes necessary to accomplish that goal or objective" (Cooper et al. 2007: 607). For example, a person seeking the goals of controlling his or her blood glucose level, decreasing weight, or simply improving physical appearance in order to improve the quality of his or her health, can start by identifying specific target behaviors to reach each one of those objectives (e.g., running outdoors or on a treadmill, establishing goals of time and distance per week).

Many people believe that the cause of poor self-management is that results are too delayed (e.g., weight reduction). Once again, the mistake is concentrating efforts on the final outcome, monitoring only those results (e.g., number of kilograms

reduced per week), and not concentrating on the behaviors (e.g., number of minutes of physical activity per week). As mentioned before, success depends on rules that are easy to follow. Once a person starts monitoring target behaviors, this by itself can lead to behavior change and contributes to a better design of specific interventions. "Self-monitoring makes a person observant of events occurring before and after the target behavior; information about antecedent-behavior-consequent correlations may be helpful in designing an effective intervention" (Cooper et al. 2007: 607).

When Behavior Analysts design an intervention with the goal of changing a specific behavior, frequently they have to deal with competing natural contingencies. For example, a person trying to exercise for one hour/day could experience a slight increment in health (i.e., the outcome not particularly sizable, or too small but often of cumulative significance), and on the contrary, could experience fatigue or even muscular pain, which would compete with the performance of running behavior.

Self-monitoring, self-management, and the clear establishment of objectives and goals with gradual and achievable increments, should be possible to involve a person in the performance of physical activity, even with the existence of competing natural contingencies. "When self-monitoring alone does not result in the desired behavior changes, the next step is designing a contrived contingency to compete with the ineffective natural contingencies" (Cooper et al. 2007: 607).

Feedback using eHealth technology is a related concept that must be described in this article. A person who is trying to control weight, performing different behaviors like exercising or following a diet, requires knowing if he or she is performing those behaviors in an appropriate manner or not. Feedback "is information a person receives about a particular aspect of his or her behavior following its completion" (Cooper et al. 2007: 262). Malott described another definition of feedback as, "non-verbal stimuli or verbal statements contingent on past behavior that can guide future behavior" (Malott 2008: 379).

A complex challenge is precisely to achieve self-monitoring and obtain appropriate feedback to finally achieve self-control. In several occasions, access to a health professional is limited by a number of reasons. The most important are probably the reduced number of professionals, the excess amount of work they have, or even the cost of services. However, nowadays there is technology specifically designed to achieve self-monitoring of diverse behaviors related with health (e.g., physical activity, eating and sleep habits). Sometimes the same technology allows the access to automatic feedback, or even contacting professionals without the need of traveling long distances. An especially significant use of eHealth technology is that people can be actively involved in their own health care: "Engaging with eHealth provides a vehicle to empower and motivate patients, giving opportunity to take wider ownership and control over their own health" (Gaddi et al. 2014: 17).

5. Research on ABA, eHealth and Obesity Treatment

For the present article, a search of studies combining concepts of ABA and eHealth was performed. The eHealth concept is a relatively new one, which wasn't explicitly referred to in the ABA studies found. However, in the development of some of those studies, the technologies used were related to the concept of eHealth (e.g. education, monitoring and follow-up of people at long distance).

In the development of the present article, a search strategy was performed combining the keywords "obesity", "treatment", and "behavior" on research tools such as PsycInfo, PubMed, and Cochrane. The search was reduced to only studies developed in the last 15 years (2000-2015). Later the keyword "eHealth" was added and reducing the search to only the last 10 years (2005-2015).

In PsycInfo, combining the terms "*obesity*", "*treatment*", "*eHealth*" and "*Behavior*", an on-line article (Cushing and Steele, 2015) was found in which the authors described the evidence-based treatment for obesity. The authors concluded that pediatric psychologists from the first level of attention could provide evidence-based assessments about psychological factors related to health and producing obesity. This type of professional can provide behavioral, motivational, and conflict-solving therapy to support families in the establishment of healthy habits. This article mentioned on-line education for following healthy recommendations for eating habits.

In PubMed, combining the terms "*obesity*", "*treatment*", "*eHealth*" and "*Behavior*", a total of 49 results in the last 10 years (2005-2015) were found. In the Cochrane library combining the terms "*obesity*", "*treatment*", "*eHealth*" and "*Behavior*", a total of 3 articles (González et al. 2013; Bennett et al. 2012; Jensen et al. 2012) in the last 10 years (2005-2015) were found.

A particular search strategy was performed in the Journal of Applied Behavior Analysis (JABA) with the combination of the terms "*obesity*" and "*treatment*". A total of 58 results were found, 23 of which were published in the last 15 years. Only three articles (VanWormer 2004; Fogel et al. 2010; Shayne et al. 2012) made reference in their title to any technology of the eHealth type. Van Camp and Hayes developed one of the articles found about recent behavioral research, the study consisted in the assessment of measures of physical activity and interventions directed to increase it (Van Camp and Hayes 2012). Washington, Banna and Gibson developed a study including technologies of the eHealth type. Their procedure consisted in sending information by text messages and e-mail, also using contingent rewards with the fulfillment of the required behavior (Washington et al. 2014). Details about both studies will be explained later.

5.1. Obesity Treatment and eHealth Research

A selection of the results found after the searching strategy will be described next. The studies have been selected because of their use of eHealth technology for the control of obesity, making special comments on the review articles and meta-analysis found. At the same time, the studies will be discussed from the perspective of the conceptual frame of the ABA previously presented.

One of the most significant advantages of the use of technology is that it allows the interaction between different health professionals and their clients in spite of long physical distances. For example, talking about education and behavioral changes of patients, Gaddi, Capello and Manca wrote, "Email and SMS messaging interventions have the ability to reach groups that are difficult to engage with" (Gaddi et al. 2014: 21). These authors cited examples of programs using this type of technological strategy.

One of those examples is a study developed by Franklin, Waller, Pagliari, and Greene, which is of particular interest for the control of obesity and its consequences. These authors developed a program named, "*Sweet Talk*," which consisted of a system of motivational text messages for young patients 8 to 18 years old and with type 1 diabetes. These patients received conventional therapy with insulin. The program integrated the establishment of goals when visiting a clinic, and reinforcement by using text messages with personalized information of the specific goals. These goals were adapted to each patient in accordance with their age, gender, and insulin regime. At the end, the program reported an improvement in self-efficacy and in adherence of medication (Franklin et al. 2006). In this particular study, different concepts of ABA (e.g., self-monitoring, self-control, goal setting) can be found. People with diabetes require well-established deadlines indicating schedules for medication and food intake. Type 2 Diabetes has been related to a higher risk of overweight and obesity. In this case, the study previously mentioned was focused on the treatment of Type 1 Diabetes. However, the procedure described can be applied to any medical condition related to being overweight and to obesity.

The avoidance of loss of a reinforcer contingency can be useful, and its use can be improved adding technology, such as in the case of text messages. In the study of Franklin et al. the researchers were able to affect a population particularly difficult to reach because of their young age, and yet this population is familiar and comfortable with the use of new technology. It is important to recall that the obesity epidemic is affecting not only adults, but also children and adolescents who, in the future, will be even more familiarized with the use and advantages of long distance communications.

As can be seen, the conceptual theoretical mark of ABA is present in these types of studies, but not described in the terms frequently used by Behavior Analysts. One of the goals of the present article is to introduce or reinforce ABA terms to other pro-

professionals. The purpose is to help professionals achieve a better understanding of the behavioral procedures performed, understand why those procedures are favorable for patients, and to show how it is possible to accomplish better results.

An additional approach in using eHealth technology is the use of social networks (e.g., Facebook, Twitter, etc.). Social networks allow interaction between similar people, better known as peers, integrating on-line groups (Gaddi et al. 2014: 24). It is important to mention that these types of groups must be ideally created and supervised by health organizations and conducted by well-trained professionals who provide appropriate feedback to participants. An example of this type of program was done in the study of Sahama, Liang and Iannella, and their program called, "*Patients-LikeMe*", in which people were linked with peers on simulated social networks. The study designed a special platform where each person had only one personal profile shared in different social networks, simulating the most popular real social networks. Data shared with professionals and peers included health habits. However, there is specific private information that can be shared only with health care professionals. The authors of this study presented an interesting conclusion; they reported that incomplete daily behavioral information received by health professionals could impact treatments, and could even result in fatal complications (Sahama et al. 2012).

Self-monitoring on its own can help self-management with regard to several habits. However, the establishment of objectives and clear goals, and having access to feedback, improves adherence to behavioral and medical treatments. The great advantage of social networks, when used by professionals and used correctly, allow interaction over long distances between people and their health care providers and their peers. This networking can recover or even strengthen the dynamics of patient-physician interactions.

Norman, Zabinski, Adams, Rosenberg, Yaroch and Atienza, developed a review article on using an eHealth intervention applied to the control of habits. These authors reviewed studies focused on behavioral changes when performing physical activity, eating, and their interaction (Norman et al. 2007) The review included 49 articles, of which 13 were focused on physical activity, 16 on eating behaviors, and 20 articles on both behaviors. All the articles were published from 2000 to 2005. The conclusion of Norman et al. had mixed findings related to the efficacy of the eHealth interventions. The authors suggested that this type of intervention offering long distance interaction should be refined and evaluated in a more rigorous way to determine its real potential as a tool for health behavioral change. The majority of the studies analyzed were principally directed toward the improvement of physical activity and eating behaviors, with the goal of preventing chronic diseases. Although a large number of those interventions used computers, the authors of the review suggested that the use of new technologies such mobile devices, (e.g., mobile phones, laptops, messaging devices), could improve the efficacy of results in future studies. These new technologies integrate the use of movement and performance sensors or GPS

technology, and represent a potential to improve data records, obtain more exact measurements, and even provide feedback.

A more recent study done by Kreps, Prochaska and Rosky, consisted of a meta-analysis evaluating 88 studies, which used feedback and assessments by computers, as well as printed and phone communications (Kreps et al. 2010). The studies were published between 1988 and 2009, and focused on four related health behaviors: stopping smoking, increasing physical activity, eating healthy, and obtaining a mammography study. The main conclusion of this meta-analysis was that tailored interventions using computers had the potential to improve related behaviors. For example, 43% of people receiving this type of intervention adhered to the WHO physical recommendations and increased a significant increment of fruit and vegetable consumption. Also, this meta-analysis demonstrated that it is possible to perform simultaneous interventions directed toward different behaviors without blocking the interventions' effectiveness. It is important to perform interventions on different behaviors at the same time, particularly for weight and obesity control, both of which require interventions related to physical activity, eating and sleeping at the same time.

The treatment of chronic diseases often requires the use medications and specific follow-up procedures. The application of the concepts of ABA, in combination with eHealth technology, is clearly an opportunity to improve patient health, but also to implement services provided by health professionals. Of course, there are many variables that must be considered. Among those are the type of health professional, the cost of services, and the availability of resources to provide those services. The present article is attempting to demonstrate that the optimization of human and technological resources can be achieved by using the appropriate conceptual theoretical mark (i.e., ABA), thereby offering many advantages which could even be transformed into administrative benefits for the different health care systems focused on prevention and treatment of being overweight and obesity.

5.2. *Obesity treatment and ABA Research*

In this final section, two articles have been selected because of their direct relation with the ABA field and with the challenges of overweight and obesity control. Both articles were published on the JABA.

Van Camp and Hayes published a review about recent behavioral research for the assessment and increment of physical activity (Van Camp and Hayes 2012). In this review, the use of devices such as pedometers, accelerometers, and cardiac monitors are described. However, the use of pedometers represents a methodological problem: "Pedometers are relatively unobtrusive and inexpensive, but reliability and validity of the measures produced vary greatly by model (Butte et al 2012)" (Van Camp and Hayes 2012: 871). Nevertheless, these instruments allow self-monitoring, functioning as a com-

ponent of self-managed intervention, and are useful when it is not possible to directly observe behaviors. Also, the same instruments can be used to permit people (e.g. relatives) other than researchers to supervise the reliability of results (VanWormer 2004). A final critique for the use of pedometers was that these instruments could underestimate the total physical activity because pedometers only measure translocation.

Additional instruments mentioned in the review from Van Camp and Hayes were the cardiac monitors. In a particular study, cardiac monitors who assessed the number of calories burned were evaluated for self-performance intervention, with weekly meetings with researchers verifying participants' reports (Donaldson and Normand 2009). The problem of this type of instrument is that the heart rate can be affected by different variables besides physical activity (Butte et al. 2012).

It is true that certain measurements of devices such as pedometers or cardiac monitors cannot be precise at a 100% level of accuracy (at least not yet), differing among models. However, analyzing their utility with the perspective of the basic principles of ABA, the mere fact of having an instrument provides the person with visual reinforcement of their performance, and could encourage that person to increase the future frequency of physical activity (positive reinforcement). In the case of inappropriate performance, in other words, transforming the information into a visual aversive stimulus, the same visual information could be used to obtain feedback, allowing the person to make changes in future performance of specific behaviors.

Finally, in a study developed by Washington, Banna and Gibson, 11 college students were studied who wore accelerometers for three weeks. (Washington et al. 2014) Using a withdrawal design, during the intervention the participants received rewards for accomplishing a pre-established criterion of number of walked steps. During the baseline phases, students were only rewarded for wearing the accelerometers. Subjects had to send text messages or e-mails containing the number of steps counted at the end of the day and before midnight. Four of the participants were overweight. At the end of the study, four of the participants increased the number of walked steps as a result of the intervention.

In this last study, the use of rewards to increase the desired performance was included, as were clear pre-established deadlines. Appropriate technology used in this case were accelerometers and the interaction from long distances using text messages and e-mails, which allowed self-monitoring and therefore participants' self-control.

6. Conclusions

Many of the studies presented in this article ended with the same suggestion, which is to encourage the use of new technologies to allow a more accurate and real time measurement of people's behaviors. Some of the studies already described the implementation of different technologies, like mobile devices in the form of applica-

tions for what are now commonly called smartphones, which can provide visual data in the form of graphics about the performance of specific behaviors. The promotion and use of eHealth technology deserves to continue being researched, especially for a problem as complex as obesity. Certainly, in the future, as a result of technological advances, better and more exact instruments will be developed.

A clear explanation and promotion of ABA theoretical concepts directed to other health professionals, and even to the general population, could allow a better understanding for the value of behavioral interventions, and could promote a better adherence and trust in those procedures.

A final thought that the first author of this article would like to share here, as a psychiatrist who has learned to be also a Behavior Analyst, is that, in this globalized world where the epidemic of obesity is affecting millions of people, physicians of the first level of attention should be able, in the future, to provide well designed behavioral interventions. It will be not enough to provide the best medical treatment or to provide superficial advise about eating or physical activity. Also, it will not be enough to provide a follow-up only after weeks, or even months post-visit. The opportunity of interaction in spite of long distances, and the possibility to track daily behaviors of our patients or other people who are overweight or obese by using eHealth technology, will facilitate our work as health professionals, and will even represent a strategy to improve the health care systems all over the world.

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