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Impact of a web-based intervention supplemented with text messages to improve cancer prevention behaviors among adolescents: Results from a randomized controlled trial

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ABSTRACT

Objective. To assess the impact of a web-based intervention supplemented with text messages to reduce cancer risk linked with smoking, unhealthy diet, alcohol consumption, obesity, sedentary lifestyle and sun exposure.

Methods. A total of 2001 voluntary adolescents from Spain and Mexico were recruited between 2009 and 2012 and randomly assigned to: one control group and two experimental groups, which received exclusively the online intervention (experimental group 1) or the intervention supplemented with encouraging text messages (experimental group 2). The educational intervention was based on both: successful psychosocial models (i.e. A.S.E. and Transtheoretical model) and the school curriculum.

Results. After a 9-month follow-up, the prevalence of students who did not eat fruit was reduced significantly in all groups: experimental group 1 (−62.6%), experimental group 2 (−71.5%) and even the control group (−66.8%). Being overweight was only reduced in the experimental group 2 (−19.6%). The total cancer behavioral risk score, which ranged from 0 to 100 points (highest risk), was significantly reduced in the experimental group 1 (−3.5 points) and in the experimental group 2 (−5.3 points). The text-supplemented online intervention increased the probability of improving the post-test total cancer behavioral risk (OR = 1.62).

Conclusion. The web-based intervention supplemented with text messages had a positive global impact, but it lead to only minimal changes in risky behaviors. This intervention appears useful in controlling overweight adolescents.

Clinical trial registration number: ISRCTN27988779.

Introduction

Incidence of cancer in economically-developed countries has moderately decreased in the last few years. Even so, in the USA, 1 out of 2 men and more than 1 out of 3 women will develop a cancer in their lifetime (Siegel et al., 2012). According to GLOBOCAN estimations (Ferlay et al., 2010), age-adjusted incidence of cancer in Spain is lower than in the USA (241.4 vs 335.0 cases per 100,000). The same figure in Mexico is even reduced (128.4 cases). Notwithstanding that, cancer is also a major public health problem both in Spain and Mexico. Cancer is caused by the accumulation of genetic and epigenetic damage, which in turn is influenced by both internal and external factors (American Cancer Society, 2012). Peto (2011) has recently affirmed that if lifestyle risk factors are controlled, more than 40% of cancer diagnoses could be avoided — even in countries with an aging population. These include smoking, diet and overweight, among others.

Primary prevention is the only strategy capable of avoiding the disease. For this reason, prestigious institutions – such as the American Institute for Cancer Research (World Cancer Research Fund–American Institute for Cancer Research, 2007) and the European Code Against Cancer (Boyle et al., 2003) – have established clear recommendations aimed at controlling this disease.

Many studies have shown that preventing or modifying risk behaviors in adults is possible (López et al., 2007; Prochaska et al., 2005). However, the effectiveness of such strategies in adolescents has not yet been established. Even though, most risky behaviors are acquired in late childhood and consolidated during adolescence, making it an opportune time for prevention interventions (Holman et al., 2013). According to White et al. (2013), innovative approaches could be useful in designing multilevel evidence-based interventions. Modern communication media such as the Internet and cell phones represent important social media tools which should be utilized to improve young people's health. These have a high preventive capacity due to their widespread coverage and ease to adapt to adolescent codes. In a recent manuscript,

Abbreviations: TCBR, total cancer behavioral risk.

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Morse (2013) has even fought for including preventive patterns in the scholar environment. The author concludes that "coordinated collaboration between professionals in education and public health can better prepare our young people to be health literate and cancer-free". Interventions that combine both the Internet and the school context have achieved moderate success (Buendía Eisman et al., 2013; De Bourdeaudhuij et al., 2010; Hamel and Robbins, 2013). It is therefore essential to continue observing their impact.

In order to achieve behavior changes, it is necessary to know their underlying mechanisms (Carson et al., 2011; Glanz et al., 2008). Two psychosocial models aiming to explain behaviors have been successfully tested in previous programs — mainly when combined. These are the A.S.E. model (acronym of Attitude, Social influence and self-Efficacy) and the Prochaska and DiClemente's Transtheoretical model (López et al., 2007). They have been frequently used among adolescents to understand the role that the model's components (i.e. attitude, social influence and self-efficacy) play in the prediction of risk behaviors (Melbye et al., 2012; Vitória et al., 2011). However, their benefit for behavior change interventions remains unclear.

Advice to prevent cancer should be considered as a whole and in the context of a healthy lifestyle. Therefore, the aim of our study has been to assess the impact of a multiple educational intervention in reducing cancer risk associated with smoking, an unhealthy diet, alcohol consumption, obesity, and a sedentary lifestyle and sun exposure. Such interventions would be based on psychosocial models and be delivered through both the Internet and cell phone text messages.

Methods

Study and intervention design

This study assesses the impact of the PREVENCANADOL program, whose methods have been reported elsewhere (Lana et al., 2013 and Lana Pérez et al., 2013). Briefly, it was a randomized controlled trial (RCT), which was implemented on Spanish and Mexican adolescents attending school between 2009 and 2012. The program was supported by the educational authorities of Spain and Mexico and diffused among secondary education schools in both countries. Program information was sent by email to all teachers. Links and banners were placed on the main educational portals. Participation was voluntary, but most interested teachers encouraged their students to participate. Participants had to register with an alias in the program website and fill in a compulsory online questionnaire (pre-test). This form was based on one used in previous research, and adapted here for use in adolescents (López et al., 2007). Participants were randomly assigned to either the control group (CG) or experimental group (EG) using a computer program.

EG students had free access to all sections of the website, which was adapted to school curriculum and the features of each country (i.e. www.alertagrumete.com in Spain; www.alertagrumete.com.mx in Mexico). The website included several sections to learn how to prevent and treat main cancer risk behaviors using the theoretical framework of the A.S.E. model, that is: a) emphasizing advantages of following the recommendations and disadvantages of risk behaviors, b) creating a healthy online social environment and c) strengthening the skills to avoid risk behaviors. The section with the highest educational capacity contained problems or challenges that students had to solve. They were related both with subjects of their curriculum (e.g. Math, Literature or Science) and with the risk behavior prevention. The website also provided other services, such as expert dietetic advice after analyzing common homemade recipes and 24-hour food recalls, peer-starred educational videos, forums and chat lines to discuss cancer-related topics, documents and web links with selected information and online educational games. Moreover, adolescents who had provided a cell phone number received weekly text messages to encourage compliance with healthy behaviors. For instance, a text message focused on a healthy diet was the following: 'Don't be fooled! The best way to be pretty on the outside is by being pretty on the inside. Fruits and vegetables are your best makeup'. All behaviors were promoted equally. Consequently, the EG was formed by two EGs: EG1 (exclusively online) and EG2 (online intervention plus text messages). The described educational intervention lasted an entire academic year (9 months). After that, participants of both the CG and EG were required to complete another questionnaire (post-test assessment).

The study was approved by the Ethics Committee of Clinical Research (University Central Hospital of Asturias) and all participants gave their informed consent. The RCT complied with the principles of the Declaration of Helsinki and it was therefore included in an international register of clinical trials accepted by the World Health Organization (ISRCTN27988779).

Study variables

Main outcome: total cancer behavioral risk

In the questionnaire, students were directly asked about the presence of six cancer risk behaviors: smoking, unhealthy diet, alcohol consumption, obesity, sedentary lifestyle and sun exposure. Additionally, they were requested to classify their behaviors according to Prochaska and DiClemente's Stages of Change model (i.e. precontemplation, contemplation, preparation, action and maintenance). Students were considered to have a risky behavior if they provided an affirmative answer to direct questions or when they classified themselves in any of the first three stages. Weight was checked by self-reported BMI (Kg/m^2), whereas the dietetic behavior was assessed by a validated food frequency questionnaire (Martin-Moreno et al., 1993). This included two groups of food usually consumed in both Spain and Mexico. On the one hand, a group of theoretically risky foods, such as red meat (including pork and derivatives), sausage products (including bacon and pancetta), cream and pastries. On the other hand, a group of cancer protectors, such as fruit, fresh or stewed vegetables, legumes cooked without meat and whole grains. A synthetic indicator called total cancer behavioral risk (TCBR) was designed by adding up all of the risk points obtained for one or more risk behaviors. Points given by every risk behavior were calculated according to the Doll and Peto's estimations and to other more recent evidence (Doll and Peto, 1981; Peto, 2011). They read as follows: smoking regularly any amount of cigarettes = 35 points; eating less than five pieces of fruit and vegetables a day = 20 points; eating three or more fat pieces of food a day = 10 points; having a "frequency of cancer-protecting food/risky food" quotient <0.9 = 8 points; being obese or overweight = 15 or 10 points respectively; drinking excessively = 5 points; doing physical activity less than 360 min a week = 5 points; being in the sun without sunscreen = 2 points. Consequently, TCBR score ranged from 0 points (no risk) to 100 points (highest cancer behavioral risk).

Other variables

Other variables were also included due to their potential relationship with risk behaviors and TCBR score. In this respect, sociodemographic information was compiled: gender, age (12–16 years of age), country (Spain or Mexico), number of siblings (none, one, two, three, four or more), father's and mother's level of education (primary school, secondary school or university degree), family unit (parents, only father, only mother or with others) and weekly leisure expenditure (<3.0 €, between 3.0 and 5.9 € and ≥6.0 €) (1.0 € equals approximately 1.3 US $). Students were also required to provide their self-perceived health level (i.e. very good, good, regular, bad or very bad) and family history of cancer (i.e. number of first-degree and second-degree relatives suffering from any type of cancer).

Information about two academic variables was also required. The first one was the school grade, which is related to age (i.e. first, second or third), while the second one was self-reported academic level (i.e. very good, good, fair, bad or very bad). Finally, the questionnaire included the assessment of two behavior-determining factors that comply with the A.S.E. model. Firstly, the negative social influence from relatives (i.e. number of relatives with the risky behaviors highlighted in this study) and their peers (i.e. number of friends with risky behaviors). Secondly, the total self-efficacy score, which expresses the self-perceived capacity to comply with all preventive advice. It was measured using scale from 0 to 10 points, graded as "low <5", "medium = 5–9" and "high >9".

Statistical analysis

During the three academic years in which the program was active, 3855 students were involved. However, only 2001 (51.9%) completed and submitted the compulsory questionnaire and were consequently included in the RCT. The total sample was described in terms of proportions and using 95% confidence intervals (95%CI). Feature comparison of both study groups (CG and EG) was performed using the Pearson's χ^2 test, Z test (qualitative variables) and Mann–Whitney *U* test (quantitative variables). An exploratory data analysis which used a binary logistic regression allowed calculation of the adjusted odds ratio (OR) (95%CI), which best explains the probability of permanence in