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An educational strategy for improving knowledge about breast and cervical cancer prevention among Mexican middle school students

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ABSTRACT

Introduction. Prevention programs have not achieved the expected results in preventing mortality from breast and cervical cancer in Mexico. Therefore, we propose a complementary strategy.

Methodology. An educational strategy for high school students in Mexico (2011–2013) was designed (longitudinal design, two measurements and a single intervention). The postintervention assessment included: 1) knowledge acquired by students about cancer prevention and 2) The performance of the student as a health promoter in their household. The strategy was based on analysis of cases and developed in three sessions. An assessment tool was designed and validated (Test–Retest). The levels of knowledge according to the qualifications expected by chance were determined. Wilcoxon test compared results before and after intervention.

Results. An assessment instrument with 0.80 reliability was obtained. 831 high school students were analyzed. Wilcoxon rank-sum test showed a significant learning after the intervention ($Z = -2.64$, $p = 0.008$) with improvement of levels of knowledge in a 154.5%. 49% of students had a good performance as health promoters.

Conclusions. The learning in preventive measures is important to sensitize individuals to prevention campaigns against cancer. This strategy proved to improve the level of knowledge of students in an easy and affordable way.

Introduction

Cancer is the result of the interaction of genetic and environmental factors and is a serious health problem in Mexico (Rushton et al., 2012). In spite of different campaigns on prevention, cervical cancer (CC) is the most frequent, and breast cancer (BC) is the first cause of mortality in women over 25 years old (Torres-Lobatón et al., 2013). In 2012, there were 78,352 deaths due to cancer, and 5663 women died from BC and 3840 from CC (INEGI, 2011a). Mortality from BC increased, from 1199 deaths in 1980 to 4893 deaths in 2009 in women 25 years of age or older, and 86,469 women died from this disease in the last 30 years (De la Vara-Salazar et al., 2011). In ten years (1990–2000), a total of 48,761 deaths were reported from CC; in 1990 there were 4280 deaths, and they increased to 4620 in 2000. Twelve females die daily and women living in rural areas have higher risk of mortality (OR = 3.07) than women in urban areas (Palacio-Mejía et al., 2003).

Regardless of the weight of genetic factors and environment, the more useful resource to control this problem at the population level is prevention (Bray et al., 2012). Within the preventive procedures are the programs of health education and early cancer detection (ECD). ECD program in BC includes breast self-examination, medical examination and mammography screening (Watson-Johnson et al., 2011). CC–ECD program includes Pap smear. While there are campaigns that

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use mass media to invite women to use methods of ECD, most of these women do not attend them for various reasons: fear of cancer, fatalistic views on cancer, lack of knowledge about cancer, linguistic barriers and culturally based embarrassment (Austin et al., 2002). In Mexico, according to the Health Report 2001–2005, the probability of developing BC is 10% (SSA report (Las cuentas en Salud), 2001–2005). Despite this, only 21.6% of women between 40 and 69 years have had a mammogram (SSA report (Las cuentas en Salud), 2001–2005), and only between 5 and 10% of cases are detected in the initial stages of the disease compared with 50% in the US (López-Carrillo et al., 2001). This situation is not exclusive of Latin-America, because countries like India have similar problems (Khokhar, 2012) Hence it is very important to educate people, both men and women, from early stages. It is essential that they know the basic principles of prevention and is also desirable that they participate as health promoters in the family. Therefore, it was a priority concern to design and implement an educational intervention with the following objectives: 1) develop knowledge and skills in students to analyze, address and solve practical problems of health promotion in relation to cancer, and 2) educate students to act as health promoters at home.

Methods

The design was longitudinal with two measurements, one before and one after intervention.

Participants

The study included middle school adolescent students (7–9th grades) from the metropolitan area of Monterrey, in northern Mexico (2011–2013). They participated voluntarily and without remuneration. The institutions were selected at random from the official list of middle schools. Briefly, a 3×3 quadrant division ($n = 9$) was performed on the Monterrey map with the following design: ABC/DEF/GHI. Then, all schools in each quadrant were enumerated serially. A random selection of schools was performed using Minitab program. Students from these schools participated in the educational strategy. After this selection, the remaining schools were sorted to select two other schools. In the first school, three groups (7–9th grades) and 10 students of each group were selected. These students reviewed and suggested modifications to the assessment instrument to make it more understandable. After a second review and the approval of the students, the instrument was applied to 45 students of the second selected school to validate the instrument. The Ministry of Public Education and all the principals of participating schools approved the project. The principals were contacted first, by telephone and the visits were scheduled. Before the intervention, mothers or legal guardians of the students signed informed consent forms to allow their children to participate.

Educational strategy

We used an educational strategy that promotes student participation to construct their own knowledge and to solve practical problems in relation to health promotion and cancer prevention. The strategy can be applied by teachers, nurses, or health workers and consists of three sessions. In the first one, the study is contextualized, emphasizing its importance and pre-intervention measurement is performed using the assessment tool designed and validated by the authors. In addition, students received an illustrated brochure to be read at home that included the basics of risk factors, prevention and general measures to be taken in case of abnormalities. Also, a reading guide was supplied (Annex). After reading the text, the student should answer all guide items arguing the reason for each answer.

Both, the reading guide and the instrument had a similar format. The response options were “true” or “yes” if the student agreed with the statement, “no” or “false” if he disagreed and “don't know” if he could not decide. Besides the brochure, a survey addressed to the student's mother was given. It consisted of 42 questions investigating the general demographics of women, gynecological and obstetric history and knowledge about breast and cervical cancer. The mothers' responses to the questionnaire were used for other research. For purposes of this work, it was considered that the student performed his (her) work as health promoter if he (she) returned the mother's questionnaire fully answered by his (her) mother or legal guardian. Students were instructed to answer their study guide by themselves, and bring it the next meeting, as well as bringing the mother's questionnaire for the third session. The second session was a plenary meeting where the students analyzed and discussed the reading guide under researcher direction. In the third and final session, the post-intervention measurement took place and the mothers' questionnaires were collected.

Instrument design

A knowledge assessment tool about the prevention of breast and cervix cancer was designed based on short clinical cases that explored the knowledge about risk factors, etiology and preventive measures of these two pathologies (Annex). Three physicians with expertise in cancer prevention and education made the initial design. There were two rounds until the agreement among the three experts was obtained. The instrument was then submitted to the evaluation of a group of three teachers from the Ministry of Education, in charge of health promotion activities. The adjustments proposed by the panel of expert teachers were made. Subsequently, the instrument was applied to a pilot group of 30 students to refine the material from the standpoint of understanding terminology. After obtaining an instrument accessible and easily understood by the student, it was subjected to validation. The final instrument consisted of 44 questions distributed in 4 cases (2 BC and 2 CC) and 3 types of responses, true (+1), false (−1) and don't know (0). The questions explored knowledge about risk factors (1–5, 14–17, 28–31, 37–40), decisions making about prevention of the disease (6–13, 18–20, 32–34, 41–44), identification of physical abnormalities suggestive of cancer (21–24) and making decisions about the need for a medical evaluation (25–27, 35–36).

Instrument validation

The instrument was applied to a different group of 45 students selected randomly from a general list of 500 students using the package MINITAB version 20. Eleven men (12.91 ± 0.83 years) and 34 women (13.31 ± 0.91 years) participated. The Test–Retest (Williams et al., 1992; Perez Padilla and Viniegra, 1989) was applied to the 1980 (questions × pupils = 44 × 45) responses obtained “before” and the 1980 obtained “after” (a week later and no intervention).

According to the authors, “in order to calculate the distribution of correct answer and the difference between correct and incorrect answers (core), we use a method based on a Gaussian distribution. The distribution of scores expected by chance is approximated by a Gaussian distribution with a mean of zero and a standard deviation equal to $\sqrt{n(pA + pE)}$. The distribution of the total number of correct answers has a mean of npA and SD $= \sqrt{npApE}$, where n is the total number of questions, and pA and pE are probabilities of having a right or wrong answer, respectively. The formulae are applicable to questions false/true/do not know and to the more common type of one correct in five options. Once the chance distribution is known, it can be compared with the distribution of scores or correct answers obtained, which can then be used to separate people in two groups: those answering the test as expected or worse than expected by chance, and those than answer the text better than expected by chance. The first group should not be passed. The passing of individuals in the second group can be decided by additional criteria” (Perez Padilla and Viniegra, 1989).

Knowledge evaluation

The student's ability to recognize risk factors, clinical evidence to suspect a disease, use of resources (mammography and Pap smear) and preventive behaviors was evaluated. The development of this ability was measured using the validated instrument that was applied before and after the educational strategy.

Assessment as health promoters

The students where invited to be a "health promoter". They received information about barriers that women have, to request preventive medical services. They were invited to give the surveys to their mothers (or female guardians). It was considered a positive effect as a promoter when the student returned the survey completely answered by the mother or guardian. This design was used as a first approximation to analyze the disposal of students to communicate health information in their household. Survey for mothers included: 1) general information (age, marital status, occupation, education, and religion), 2) gynecological and obstetric information, and 3) knowledge about BC/CC, cancer prevention, mammography and Pap smear. Also, it included an invitation to attend a health institution for early detection of cancer. Finally, women were questioned about their preferences to attend a lecture on cancer prevention at a health center or at their children's school.

Statistical analysis

Analyses were conducted with the statistical package IBM SPSS version 21, in four phases. First, to determine the instrument's internal consistency, the Test–Retest reliability method was applied to 45 students. Second, after the intervention to 831 students, the 36,564 responses (correct, incorrect and "don't know") were analyzed using the formula Test–Pretest (Williams et al., 1992; Perez Padilla and Viniegra, 1989) to determine levels of knowledge according to the qualifications expected by chance. Third, comparisons of the assessments made before and after intervention were made using the Wilcoxon rank-sum test. Fourth, a Cramer-V test was applied to compare responses (before and after) versus correct answer (false or true). A p-value less than 0.05 was considered significant.

Results

For the instrument, a reliability of 0.80 was obtained. We analyzed 831 high school students, 449 women female students (13.21 ± 0.91 years) and 382 men male students (13.23 ± 1.08 years). Table 1 shows the distribution and comparison of 3 types of responses with a total of 36,564 (44 questions × 831 students). The analysis of responses to questions (Cramer-V test) showed that the improvement was observed in all items after educational intervention. The percentage of the level of knowledge and skills increased significantly from 53.44% up to 74.68% after the intervention ($Z = -95.96$, $p = 0.0001$). Table 2 shows the distribution and comparison of the evaluations obtained from the 831 students before and after the intervention. The Wilcoxon test showed that there was a significant learning in these high school students ($Z = -2.64$, $p = 0.008$). Considering a cutoff of approval of 6 (education system in Mexico), for "Before": 46.57% was less than 6, 38.51% was equal to six, and 14.92% was more than 6;while for "After": 17.45% was less than 6, 18.41% was equal to 6, and 64.14% was more than 6. This indicates that the educational intervention improved levels of applied knowledge in a 154.5%. 408 of 831 students returned the surveys completely answered (49%). Of the total questionnaires, 100% of women agreed it was important to follow indications for early detection of breast and cervical cancer and to attend go to a health center or hospital to get Pap smear and mammography, when indicated. When asked whether they preferred to attend a lecture on cancer prevention at the hospital or school, 90% preferred to go to school.

Table 1
Distribution of types of responses obtained before and after the intervention.

Response	Before N (%)	After N (%)
Correct	19,540 (53.44)	27,305 (74.68)
Incorrect	8728 (23.87)	6526 (17.85)
Don't know	8296 (22.69)	2733 (7.47)
Total	36,564*	36,564
Standard deviation	2.37	2.42

* Reagents × total number of students = 44 × 831 = 36,564 responses.

Table 2
Distribution and comparison of the results obtained from the 831 students before and after the educational intervention.

Results (categories)	Correct answers	Score	Before N (%)	After N (%)
Explained by random	≤13	Academic failure	387 (46.57)	145 (17.45)
Very low	14–20	6	320 (38.51)	153 (18.41)
Low	21–26	7	108 (13.00)	156 (18.77)
Mean	27–32	8	14 (1.68)	138 (16.61)
High	33–38	9	2 (0.24)	111 (13.36)
Very high	39–44	10	0 (0.00)	128 (15.40)
Total			831	831

Z (Wilcoxon) $= -2.64$, $p = 0.008$.
Response explained by random $= 1.96 \times \sqrt{44} \times (0.1785 + 0.7468) = 13$.
Number of categories or grades $= (44 - 13)/5 = 6$.
In Mexico, the minimum passing score in high school is 6; below this score, the result is considered academic failure.

Discussion

In Mexico, BC is the leading cause (22%) of hospital mortality by cancer in women, followed by hematopoietic neoplasms (14.1%) and tumors of reproductive system (uterus and ovaries) (13.5%) (INEGI, 2011b).

It is undeniable that breast and cervical cancers (BC/CC) constitute a health challenge that must be managed holistically (Katz et al., 2007). The best technologies for early diagnosis are useless if the population is not sensitized to request them. The strengthening of prevention campaigns requires not only the work of the health authorities, but also the active participation of the education authorities and of course, the responsibility of the female sector (Adams et al., 2007). The lack of information on early detection of cancer and ignorance of risk factors, have caused the high female mortality. It is necessary to sensitize women, and this is extremely important in Latin America and other countries where these neoplasms are the first causes of mortality. It is also essential to educate men about the importance of early detection (Thiel de Bocanegra et al., 2009). We believe that awareness should start in early stages in both genders.

On these bases, we selected middle school students. Students at this level in Mexico and in most Latin American countries are mostly 12 years of age or older. Knowing the risk factors of these diseases at an early age helps to adopt preventive measures more efficiently (Vogtmann et al., 2011). Finally, adolescents may influence the women of their family to attend screening programs for cancer.

According to population census 2010 (Instituto Nacional de Estadística y Geografía (INEGI), 2010), there were 112,336,538 Mexicans and 57,481,307 were women. The population between 10 and 19 years was 5,742,075 and all middle school students are found in this age group. In Mexico, basic, mandatory education includes preschool, elementary and middle school education. The children must start elementary school at age 6. Thus, at age 15, they are expected to have completed their basic studies, otherwise it is considered educational backwardness. In 2000, 53.1% of the population 15 years and older was in educational backwardness. In the population aged

15–29 years, 39.1% of men and 39.4% of women were in educational backwardness (Instituto Nacional de Estadística y Geografía (INEGI), 2004). Although not all Mexicans finish the middle education, at least, they study the first year. Therefore, we believe that introducing health education modules at this stage is important because it may be the last opportunity to receive formal information in this area. The proposal of implementing health education modules at middle school may contribute to increase knowledge in the students that allow them in the future, to make correct decisions in the area of prevention of diseases (Yadav and Jaroli, 2010).

The study has some limitations. First, we used the pretest–posttest design with only one group. The fundamental limitation of this design is the lack of independent control group. However, the instrument had acceptable reliability of 0.80 and the fact that the post-test was applied one week after the intervention, made us think that at least in most cases, the difference in the increased knowledge was due to the intervention. On the other hand, designs like Solomon, with 4 groups, are more difficult to implement due to the limitations of time, space and budget in middle school programs. The study did not determine whether the apparent learning was kept over time. However, the operational design includes these modules in the 3 years of high school, which would serve as learning reinforcement. In relation to the role as health promoter, the evaluation was based on the efficiency of students to deliver a questionnaire to their mothers and return it completely answered. Although barely 50% of the students returned it, we considered it a good initial response that may be improved. The fact that a student does not return the questionnaire can be multifactorial, but ultimately the results give us a general idea of the initial efficiency of this pathway. The questionnaire included an invitation to attend the health center, but the study design did not include the monitoring of what percentage of women attended for examination of early cancer detection, after this invitation. With these considerations in mind, the study showed that students had a significant learning after the educational intervention. This finding is important because it shows that middle school adolescent students are mature enough to receive, understand and to apply knowledge related with cancer prevention. It also showed that at least in the studied population, women preferred to attend a health prevention talk at children's school and not at their clinic; this brings out a niche of opportunity for a teamwork between educational and health authorities.

The educational strategy "participative learning" (Tippelt and Amorós, 2011) promotes the development of skills in the student. Although in our country there are no studies of health education in middle school students, there are experiences in other countries with health education with good results in high schools (Peters et al., 2009) specially related to sex education, preconception (Charafeddine et al., 2014 Jul 31) and mental health (Iizuka et al., 2014).

Conclusions

In order to reduce the vulnerability of women to cancer, a culture of prevention must be promoted and comprehensive health programs for women must be strengthened. With the results obtained in this study we propose to establish, in Mexico, at middle school level, health education modules that can be integrated into the Natural Sciences program. This model can be extended to other serious health problems and probably can be applied in other developing countries where these problems are a priority to solve.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.pmedr.2015.02.006.

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