Investigación y Educación en Enfermería
ISSN: 0120-5307
revistaiee@gmail.com
Universidad de Antioquia
Colombia

Castillo Avila, Irma Yolanda; Hernández Escolar, Jacqueline; Alvis Estrada, Luis Reinaldo
Effectiveness of an Educational Program on Childhood Tuberculosis Supported on Information and Communication Technologies Aimed at Community Mothers from Cartagena
Investigación y Educación en Enfermería, vol. 34, núm. 3, 2016, pp. 465-473
Universidad de Antioquia
Medellín, Colombia

Effectiveness of an Educational Program on Childhood Tuberculosis Supported on Information and Communication Technologies Aimed at Community Mothers from Cartagena

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Effectiveness of an Educational Program on Childhood Tuberculosis Supported on Information and Communication Technologies Aimed at Community Mothers from Cartagena

Objective. To evaluate the effectiveness of an educational program using ICT to improve knowledge on childhood tuberculosis, in Family Women and Childhood (FAMI, for the term in Spanish) of Cartagena (Colombia). **Methods.** A controlled and randomize prevention trial without blinding was conducted on a sample of 50 community mothers from a location in Cartagena. The educational program combined five face meetings and support from information and communication technologies (ICT). With the control group only five education sessions were developed. **Results.** The average number of users in charge per community mother corresponds to 11 and the average number of children in charge was eight. Although in both groups the total score from the pre-test to the post-test was improved (Intervention = 29.9 to 38.2, and Control = 31.9 to 36.8), this difference in the total and by modules was higher in the intervention group. Module 5 of *Activities to identify suspected cases, monitor children, and care routes* obtained in both groups the biggest difference in score between the pre- and post-test moments. **Conclusion.** The education strategy that involved the virtual information component resulted significantly more effective to improve knowledge than the traditional education strategy.

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Article linked to research: Effectiveness of an Educational Program using ICT to Improve Knowledge on Childhood Tuberculosis, in Family Women and Childhood (FAMI, for the term in Spanish) from Cartagena – Colombia, 2014.

Funding: Research funded by internal call of the SYPRES research group at Universidad de San Buenaventura in Cartagena, conducted in cooperation with the Cuidado a la Salud de los Colectivos group of the Faculty of Nursing at Universidad of Cartagena.

Conflicts of interest: none.

Received on: August 4, 2015.

Approved on: August 31, 2016.

How to cite this article: Castillo IY, Hernández J, Alvis LR. Effectiveness of an Educational Program on Childhood Tuberculosis Supported on Information and Communication Technologies Aimed at Community Mothers from Cartagena. Invest. Educ. Enferm. 2016; 34(3):465-473.

DOI: 10.17533/udea.iee.v34n3a05

Key words: tuberculosis; child health; intervention studies; caregivers; knowledge.

Efectividad de un programa educativo sobre tuberculosis infantil apoyado en Tecnologías de la Información y de la Comunicación (TIC) dirigido a madres comunitarias de Cartagena

Objetivo. Evaluar la efectividad de un programa educativo, que utiliza las TIC, para mejorar los conocimientos sobre tuberculosis infantil en madres integrantes del prohrama Familia Mujer e Infancia (FAMI) de Cartagena (Colombia). **Métodos.** Se realizó un ensayo preventivo controlado y aleatorio sin cegamiento en una muestra de 50 madres comunitarias de una localidad de Cartagena. El programa educativo combinó cinco encuentros presenciales y el apoyo de las Tecnologías de la Información y de la Comunicación (TIC). Con el grupo control se desarrollaron solo cinco sesiones educativas. **Resultados.** El promedio de usuarias a cargo por cada madre comunitaria corresponde a 11; el de niños, 8. Aunque en ambos grupos se mejoró el puntaje total del pretest al postest (Intervención = 29.9 a 38.2, y Control = 31.9 a 36.8), esta diferencia en el total y por módulos fue mayor en el grupo de intervención. El módulo 5 *Actividades para la identificación de casos sospechosos, seguimiento de niños y rutas de atención* obtuvo en los dos grupos la diferencia más grande de puntaje entre los momentos pre y postest. **Conclusión.** La estrategia educativa que involucró el componente informativo virtual resultó ser significativamente más efectiva para mejorar el conocimiento que la estrategia educativa tradicional.

Palabras clave: tuberculosis; salud infantil; cuidadores; estudios de intervención; conocimiento.

Efetividade de um programa educativo sobre tuberculose infantil apoiado em tecnologias de informação e comunicação dirigido a mães comunitárias de Cartagena

Objetivo. Avaliar a efetividade de um programa educativo que utiliza as TICs para melhorar os conhecimentos sobre tuberculose infantil, em mães família mulher e infância (FAMI) de Cartagena (Colômbia). **Métodos.** Se realizou um ensaio preventivo controlado e aleatorizado sem cegamento numa amostra de 50 mães comunitárias, de uma localidade de Cartagena. O programa educativo combinou cinco encontros presenciais e o apoio das tecnologias de informação e comunicação (TICs). Com o grupo controle se desenvolveram só cinco sessões educativas. **Resultados.** A média de usuárias a cargo por cada mãe comunitária corresponde a 11 e a média de crianças a cargo foi de 8. Embora que em ambos grupos se melhorou a pontuação total do pré-test ao post-test (Intervenção = 29.9 a 38.2, e Controle = 31.9 a 36.8), esta diferença no total e por módulos foi maior no grupo de intervenção. O módulo 5 de *Atividades para a identificação de casos suspeitosos, seguimento de crianças e rotas de atenção*, obteve nos dos grupos a diferença maior da pontuação entre os momentos pré e post-test. **Conclusão.** A estratégia educativa que envolveu o componente informativo virtual resultou ser significativamente mais efetiva para melhorar o conhecimento que a estratégia educativa tradicional.

Palavras chave: tuberculose**;** saúde infantil; estudos de intervenção; cuidadores; conhecimentos.

Introduction

Pulmonary tuberculosis is one of the principal health problems in the world; estimates indicate that nearly one third of the global population is infected with *Mycobacterium tuberculosis*. Nevertheless, since 2012 a decrease has been noted in the number of new cases, but control of the disease has still not been achieved, showing a new epidemiological tendency: increased number of cases among the child population.[1] Globally, between 3 and 25% of the cases of tuberculosis occur in in children and in America up to 23.5% of the total number of cases with new positive sputum smears are registered in the child population.[2] Tuberculosis in children is most frequent between the first and fourth year of life.[3] The infection and disease due to tuberculosis in children can imply transmission from adult patients (parents or caregivers) who are near these minors. Often, these adults have not been detected or treated, increasing the disease transmission, which is why it is key to intensify social mobilization actions in all sectors for symptomatic adults to seek health services and accede to early diagnosis.[4-6]

Likewise, for programs of tuberculosis prevention and control, it is important to avoid losing care

opportunities that delay detection of new cases. Many of the barriers associated to the offer of health services derive mainly from flaws in detecting respiratory symptoms, inadequate study of children who are in contact with these patients, inadequate or incomplete evaluation of the child with suggestive symptoms of the disease because the health staff does not suspect or because the relatives or caregivers are not aware of the child's exposure to the disease. This, in turn, implies a late diagnosis and greater complications and risks for the child's health.[4,5]

Difficulties in the care process, added to the peculiarities of the disease in children and the weaknesses of health services in providing adequate care, imply the need to improve the capacities of the community setting, especially of the social players, to identify risk factors and suspect of the disease upon signs and symptoms that suggest it.[7,8] Among these community caregivers, there are the community mothers and the Family Women and Childhood (FAMI, for the term in Spanish). The FAMI mothers program is a program by the Colombian Institute for Family Welfare, conducted in the communities in association with community homes caring for pregnant women and children under two years of age. The program develops activities that seek to promote health and welfare of registered users through strategies of education in health and home monitoring.[9]

Training at the community level, especially of these women – mostly heads of household – cannot depend on long and repetitive meetings; hence, the use of ICT becomes a key factor for the instruction of this resource and permits achieving greater and better social impact. Increasingly, evidence shows that ICT integrated to training processes contribute to the development of creativity and inventiveness, skills necessary to formulate strategies that contribute to setting the information transmitted to the community and to generating significant learning; in this case, on prevention and early detection of tuberculosis in children.[6,10] For health professionals, specifically nursing professionals, the commitment goes beyond educating the families and caregivers only when they are in contact with health services. Taking into account that proposed by the Integrated Management of Childhood Illness (IMCI), which considers that success in reducing infant mortality and morbidity requires active participation from all social sectors and integrated work from the health sector. These communities need to be enhanced with knowledge and skills related to care practices for childhood development, which permit early identification of alarm signals or signs that suggest tuberculosis infection in children.[11] It is important, thereby, to contribute to community empowerment with innovative tools that can be integrated to the daily lives of the social players and favor improving their ways of life to propitiate a healthier environment, which reduce the impact of illnesses prevalent during childhood in the most vulnerable zones of the city of Cartagena and generate better results in preventing a disease that increasingly implies social and health challenges, as is the case of childhood tuberculosis.[4,5,8] Hence, this study sought to evaluate the effectiveness of an educational program that uses ICT to improve knowledge on childhood tuberculosis in FAMI mothers of Cartagena.

Methods

A controlled and random prevention trial without blinding was conducted, which took a measurement before (pre-test) and after (post-test) applying the educational program. The study population of 102 FAMI mothers was from Locality 1, given that it concentrates a high vulnerable population living in several townships and island villages of the city of Cartagena. Fifty community mothers were selected, which complied with the inclusion criteria posed in the study, such as: being over 18 years of age, high school graduate, and having a certification issued by an educational institution of domain and management of Microsoft Word and Excel programs, in addition to having a computer and access to internet at home. Thereafter, they were randomly assigned, using a table of random numbers, to the control group and the intervention group; each of the groups consisted of 25 mothers.

The intervention was carried out in four phases. The *First phase* performed the pilot test for the

program's application, standardization of trainers, design of a measuring instrument, and the call for participation and signing of the informed consent by those who fulfilled inclusion criteria and decided to participate in the study. The *Second phase* was applied to the mothers from both groups, using the instrument to measure prior knowledge on the contents of the educational program on Tuberculosis and the sociodemographic survey. The *Third phase* developed the educational program comprised of five classroom education sessions lasting five hours once per month, for a total of 25 hours of classroom work during five months. For both groups, the classroom information was organized into five modules, thus: Module 1- Tuberculosis, basic concepts on the disease epidemiology and childhood tuberculosis; Module 2- personal, family, and social risk factors for tuberculosis; Module 3- key practices recommended to the family to prevent childhood tuberculosis; Module 4- clinical manifestations of childhood tuberculosis, principal signs and symptoms; and Module 5- activities to identify suspected cases, monitor children and care routes according to the case. For the intervention group, ICT-mediated activities were conducted. For this, a virtual information component was designed, which permitted follow up and positive reinforcement after each module. A site was designed in the university's Moodle platform that permitted development of tasks and which, additionally, required using cell phone messages, web pages, and virtual social networks as participation system. Each of the modules proposed activities, like: crossword puzzles, video analysis, complementary readings, case analysis, and discussion forums. Lastly, the *Fourth phase* conducted a post-intervention measurement, upon ending the application of the program, within a 15-day period to evaluate the results.

A sociodemographic survey was applied to characterize the population according to age, level of education, marital status, and socioeconomic level. Knowledge on tuberculosis was measured with a test composed of 50 multiple-choice questions (ten questions per module) with a single response (four options). The test was based on evidence, conducted and validated by experts (research group), and adapted to the educational level and sociocultural context of the mothers. Each test (pre- and post-intervention) was assigned a score from 0 to 10. Considering scores from 0 to 6 deficient knowledge and from 7 to 10 sufficient knowledge of the theme evaluated.

The SPSSS program (version 21) was used to perform a univariate analysis and determine frequencies and percentages for categorical variables. For quantitative data, central tendency measurements and standard deviation were determined. A bivariate analysis was performed to compare the effect of the confusing variables on the experimental group and the control group through the chi square test and Student's t test. A Mann-Whitney U non-parametric statistical test and an ANOVA test of repeated measurements were performed to identify significant changes in scores in the same subjects. Values reporting a $p < 0.05$ were considered significant changes.[12] Regarding compliance with ethical principles for health research, the mothers who accepted to participate in the study signed an informed consent document and then filled out a survey, which was identified by a code assigned to each participant.

Results

Fifty FAMI mothers, belonging to locality 1 of the City of Cartagena, participated. The average of user mothers in charge of each community mother is 11, while the average of children in charge was eight. The groups resulted similar regarding age, marital status, occupation, and level of education (Table 1). In both groups being single prevailed, as well as exclusive dedication as FAMI mother and the technical or technological education level.

Table 2 shows that, although no statistically significant difference existed between the averages of the totals of knowledge in the pre-test, it did exist in the post-test, with the higher score in the intervention group. This was similar for Module 3, which obtained averages of 7.8 for the control group and 8.7 for the intervention group.

Table 1. General characteristics of the groups of community mothers studied. Cartagena, 2015

Variable	Group		Statistical test	*p* value
	Intervention (*n*=25)	Control (*n*=25)		
Mean age ± standard deviation	36.0 ± 6.4	38.2 ± 7.0	1.451	0.452
Marital status,%			1.511	0.680
Single	50.0	57.1		
Married	32.1	29.8		
Other	17.9	13.1		
Occupation, %				
Student	14.3	15.3	1.4	0.236
Merchant	4.5	6.8		
Level of education, %			1.426	0.700
High school graduate	28.6	42.9		
Technical and technological	64.3	42.9		
University	7.1	14.3		

Table 2. Contrast of average scores per modules among groups of community mothers intervened. Cartagena, 2015.

Test	Group	Mean ± SD	p value
Total Pre-test	Control	31.9 ± 3.8	0.280
	Intervention	29.9 ±6.1	
Total Post-test	Control	36.0 ± 3.0	0.049
	Intervention	38.2 ± 3.7	
Pre-test Module 1	Control	6.9 ± 1.0	0.145
	Intervention	6.3 ± 1.1	
Post-test Module 1	Control	7.4 ± 0.7	0.192
	Intervention	7.7 ± 0.9	
Pre-test Module 2	Control	7.3 ± 1.5	0.947
	Intervention	7.2 ± 2.0	
Post-test Module 2	Control	8.1 ± 1.0	0.532
	Intervention	8.4 ± 1.2	
Pre-test Module 3	Control	7.4 ± 1.3	0.473
	Intervention	7.0 ± 1.7	
Post-test Module 3	Control	7.8 ± 0.9	0.004
	Intervention	8.7 ± 0.9	
Pre-test Module 4	Control	5.6 ± 1.2	0.159
	Intervention	4.9 ± 1.4	
Post-test Module 4	Control	6.3 ± 1.4	0.419
	Intervention	6.8 ± 1.5	
Pre-test Module 5	Control	4.7 ± 1.3	0.514
	Intervention	4.4 ± 1.7	
Post-test Module 5	Control	6.3 ± 1.1	0.251
	Intervention	6.7 ± 1.3	

Note: Module 1- Tuberculosis, basic concepts on the disease epidemiology and childhood tuberculosis; Module 2- personal, family, and social risk factors for tuberculosis; Module 3- key practices to prevent childhood tuberculosis recommended for the family; Module 4- clinical manifestations of childhood tuberculosis, principal signs and symptoms; and Module 5- activities to identify suspected cases, monitor children, and care routes according to the case

Upon closely analyzing the effectiveness of the interventions, Table 3 shows that significant differences existed in the conventional intervention, both globally and in the modules; except for modules 3 and 4. In the group intervened with the virtual information component there were significant differences in score averages at the global level and for all the modules. The ANOVA model for repeated measurements found that significant differences exist in the score obtained before and after the intervention for all the modules for the group intervened with the virtual information component. In the conventional intervention, significant differences were found globally and with the rest of the modules, except for modules 3 and 4. In the intervention group, the difference between both evaluation moments is of 8.3 points, while in the control group it is only 4.1 points.

Table 3. Contrast of average scores before and after intervention in each group intervened. Cartagena, 2015

Test	Intervention group		Control group	
	Average	*p* value	Average	*p* value
Pre-test	29.9 ± 6.1	<0.001	31.9 ± 3.8	<0.001
Post-test	38.2 ± 3.7		36.0 ± 3.0	
Pre-test Module 1	6.3 ± 1.1	<0.001	6.9 ± 1.0	0.024
Post-test Module 1	7.7 ± 0.9		7.4 ± 0.7	
Pre-test Module 2	7.2 ± 2.0	0.003	7.3 ± 1.5	0.005
Post-test Module 2	8.4 ± 1.2		8.1 ± 1.0	
Pre-test Module 3	7.0 ± 1.7	<0.001	7.4 ± 1.3	0.154
Post-test Module 3	8.7 ± 0.9		7.8 ± 0.9	
Pre-test Module 4	4.9 ± 1.4	<0.001	5.6 ± 1.2	0.060
Post-test Module 4	6.8 ± 1.5		6.3 ± 1.4	
Pre-test Module 5	4.4 ± 1.7	<0.001	4.7 ± 1.3	<0.001
Post-test Module 5	6.7 ± 1.3		6.3 ± 1.1	

Discussion

The educational program with support from ICT proved effective to improve knowledge on childhood tuberculosis in FAMI mothers from a locality in Cartagena. In the group intervened with the virtual information component significant differences were found in the initial and final knowledge about tuberculosis, finding after the intervention higher average scores at the global level, as well as for each of the modules imparted. This fact highlights the importance of incorporating new technologies in instruction and education in health, especially when trying to impact upon problems at community levels.[5,8,10]

Women belonging to the FAMI mothers program received training. During the initial evaluation, prior to the intervention, it was found that the mothers had knowledge and information on the basic concepts of the tuberculosis disease in children and on some activities to identify suspected cases. Similar to that found by Maquera and Hernández [13] in a study with community agents from Peru, who upon being evaluated also described the principal aspects of the disease and correctly recognized as suspected case of tuberculosis individuals with cough for over 15 days, with or without phlegm production. This aspect is important for the work of community agents in all the contexts; recognition of the disease's clinical manifestations permit early identification of tuberculosis infection

among adults and help reduce the risk of close contact of these individuals without diagnosis with children living in the family setting.[13]

The lowest level of knowledge prior to the intervention was found in aspects related to the symptomatology of the disease and the principal clinical manifestations. This situation confirms the position by the Colombian Ministry of Social Protection and the National Pneumology Association,[4] who state that among the principal barriers to detecting new cases of TB is the flaw in detecting respiratory symptoms and source cases, as well as flaws in identifying children in contact with adult patients and incomplete evaluation and follow up of children exposed; especially, because the disease is not suspected.[5,14] This reflects weaknesses in providing health services, mainly due to scarce health education related to the first childhood offered to social players in different communities identified as vulnerable.[11,14]

With the application of the educational program on tuberculosis on FAMI mothers, knowledge was enhanced and training improved for early identification of cases; this was confirmed by the difference among averages of scores in evaluations pre- and post-intervention, between both groups. Arias[15] reported similar results in a study conducted with family members and tuberculosis patients who reported positive changes in the level of knowledge on the disease, especially with that related to its definition, the principal signs and symptoms, the mode of transmission and treatment after applying a dynamic educational program.

A significant change in the knowledge of community mothers was shown in modules 3 and 4 that considered aspects like practices to prevent the disease in the family and the principal manifestations of tuberculosis in children. An important element reinforced from the AIEPI strategy is related with improving the skills of caregivers to put into practice prevention activities, like inoculating newborns with Bacillus Calmette-Guérin and restricting contact of children with adults with long-term respiratory diseases and who have not been diagnosed. Likewise, the strategy proposes that early recognition of signs or alarm signals suggestive of a disease may help caregivers to seek timely care outside of the home. Community mothers become important players to support parents in caring for the children, guiding practices to prevent diseases, and helping them to look for care in timely manner.[16, 17]

Globally, the group intervened with the traditional teaching method showed positive changes between initial and final knowledge, but specifically with that related to key practices recommended for the family to prevent childhood tuberculosis, clinical manifestations of childhood tuberculosis, and principal signs and symptoms had lower performance. While the group intervened with the virtual information component had significant differences in knowledge at global level as for all the modules. These results can be attributed to the advantages provided by ICT to the teaching-learning process, like rupture of spatiotemporal barriers (access to information from remote areas), open and flexible formation processes (time and space to develop activities), possibility of interacting with the information when needed available from the program's platform, improved educational effectiveness (incorporating new didactic methodology of formative impact), and raised interest and motivation of the learner, which permits offering higher quality education.[15, 18]

For community nursing, these results help to readjust educational programs from the community level to the incorporation of more novel teaching methods that enhance primary healthcare and incorporate more efficiently forms of sharing knowledge, ideas, tools, and services that lead to long-term positive results.[10] The principal strength of this research lies on the contribution of this educational program to improve knowledge on childhood tuberculosis in community agents and social players, which is important for the care of boys and girls. This program may be led by nursing professionals to support monitoring and community care processes aimed at diminishing and early detection of cases in children who

live with or have contact with someone with the disease. Likewise, the opportunity to replicate it and intervene continually bigger groups becomes an important advantage for health professionals, especially from nursing, who most of the time guide training activities and coordinate health education processes at community level.[16,19]

To conclude, the education strategy involving the virtual information component resulted significantly more effective than the traditional education strategy to provide better knowledge about childhood tuberculosis to the women who participated in the intervention. While the traditional education strategy achieves good results in all the modules, except for Module 3 related to the key practices to prevent the disease and Module 4 that seeks to develop skills to identify the signs and symptoms of the disease, the education strategy involving the virtual component results effective at global level and for all the modules.

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