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学位論文

論文題名: Development of Cancer Education Program focusing on
Adolescent health in Nepal
(ネパールにおける Adolescent health に焦点を当てたがん教育プログラムの開発)

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Nursing

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CHAPTER I

BACKGROUND

According to Central Bureau of Statistics (2011) Nepal census, 24.19% of the population are in 10-19 years age group. Raising cancer awareness among adolescents has potential to increase their knowledge and confidence in identifying cancer symptoms and seeking timely medical help in adolescence and adulthood (Kyle, Nicoll, Forbat & Hubbard,2013). World Health Organization (2017) stated adolescent health as the range of approaches to preventing, detecting or treating young people's health and well-being. Adolescents acquire new habits and behaviors during their adolescence phase. There is little understanding about the knowledge levels of the adolescent population regarding cancer in Nepal, even though they are exposed to risk factors. Hence it is important to educate adolescent boys and girls about cancer prevention.

Cancer education is briefly included in grade ten curriculum as a part of Noncommunicable Diseases (NCDs) in Nepal and are mainly taught using teacher-centered traditional lectures. In traditional lectures, students are often passive because there is no mechanism to ensure that they are intellectually engaged with the content (Bonwell,1996). Students learn more when they participate in the process of learning, whether it's through discussion, practice, review, or application (Grunert,1997). This study focuses on the development of new cancer education program which involves students in teaching, learning, discussion and problem solving.

1.1 Introduction

According to the World Health Organization (WHO,2019a), even though the effects of cancer can be reduced with early detection and treatment, the number of new cases is expected to rise by approximately 70% over the next two decades. In other words, the history of cancer indicates that its annual incidence will rise from 14 million in 2012 to 22 million over the next two decades. Therefore, national policies and programs should be implemented to raise awareness, to reduce exposure to cancer risk factors and to ensure that people are provided with the information and support they need to adopt healthy lifestyles (WHO,2019b). Needless to mention, cancer education is another important aspect of cancer prevention

1.2 Cancer and its epidemiology

Cancer is a termed as a large group of diseases characterized by the growth of abnormal cells beyond their usual boundaries that can then invade adjoining parts of the body and might spread to other organs. Cancer can affect almost any part of the body and has many subtypes that require specific management strategies (WHO,2019a).

Globally, one in every six deaths is attributed to cancer; in 2018, cancer was the second highest cause of death in adults, accounting for almost 9.6 million deaths. A report of WHO (2018a) on cancer showed that in Southeast Asia, 1.1 million cancer-related deaths are recorded annually.

Almost 70% of cancer-related deaths occur in low- and middle-income countries. A third of cancer-related deaths are due to leading behavioral and dietary risks: high body mass index,

low fruit and vegetable intake, lack of physical activity, tobacco use, and alcohol use.

Cancer accounts for 9% of mortality in Nepal. The most common cancers are trachea/lung (17%), mouth/oropharynx (12.9%), stomach cancer (9.3%), and leukemia (7.4%) in males, and cervix uteri (18.4%), trachea (14.3%), breast (11.6%), and ovarian (7%) in females. The risk factors are tobacco smoking (21%), physical inactivity (13%), obesity (4%), and household solid fuel use (72%) (WHO,2014).

The cancer country profile (WHO,2018b) showed that cancer of the cervix uteri is a major cause of death among Nepali women, resulting in 18.4% of all deaths. It is the most-frequent cancer among women between ages 15–44. As the per report of NNCTR (2010), each year, 2,332 Nepali women are diagnosed with cervical cancer and 1,367 succumb to the disease. The incidence of cervical cancer is 24.2 per 100,000, which places Nepal among the countries with the highest cervical cancer mortality rate in South Asia (Bruni et al,2019; Gyawali et al,2015; Johnson et al,2014). The risk factors for cervical cancer are early incidence of first sexual intercourse, multiparity, tobacco smoking, and multiple sex partners (Joshi and Mishra,2013). Cervical cancer is highly treatable if diagnosed in early stages; however, in Nepal, most women visit the hospital after the cancer has become invasive, resulting in poor prognosis. NNCTR (2010) showed that the primary reasons for the delay in treatment are lack of awareness and education about screening in communities, limited health workers, and lack of affordable preventive services along with cultural norms, embarrassment, poor access to health facilities

and the prohibition of gynecological tests among unmarried women. Furthermore, other health care- system-related barriers to cervical cancer screening include insufficient skilled health personnel, instruments, and access to proper laboratories (Darj, Chalise & Shakya,2019). Cervical cancer also concerns adolescents, as Nepal has one of the highest rates of child marriage in Asia for girls and boys. Moreover, UNICEF (2018) reported over one-eighth of Nepali women bear children before the age of 18, placing girls at a higher risk of death or injury during childbirth, with concomitant reproductive health threats.

1.3 Cancer awareness

A significant portion of the increase prevalence of cancer is evinced in a number of factors including poor awareness of signs, symptoms, and risk factors of cancer; poor availability of screening programs, and limited access to standard treatment (Yamaguchi,2002). Increasing public awareness is as important to control cancer as diagnostic tools, screening, and new preventive approaches (Parijs,1986). However, studies examining public awareness concerning the warning signs of cancer in relation to early detection and prevention in various countries have indicated that general public knowledge is poor (Kyle et al,2013). A British study found that adolescents had poor cancer awareness, and messages about cancer need to be targeted and tailored to prevent the development of health inequalities in adulthood. Kyle, Forbat & Hubbard (2012) highlighted the need for a rigorous approach to the development of interventions to increase cancer awareness and help-seeking behavior among adolescents, which might

contribute to their own early diagnosis as well as potentially that of friends and relatives, and thereby survival throughout the life course.

An Indian study found that over 53% of the participants believed that radiation treatment meant receiving an electric shock, and almost 23% believed that herbal and expensive tobacco products did not cause cancer. A majority of participants perceived cancerous tumors as not painful (Elangovan, Rajaraman, Basumalik & Pandian,2016). This lack of awareness concerning cancer screening and prevention is important because it contributes to delayed presentation of cancer symptoms and may therefore lead to a delayed cancer diagnosis and treatment. Unfortunately, this is especially problematic in developing countries, where there is poor awareness of risk factors of common cancers and known preventive strategies, including the importance of early detection through screening and the ability to treat precancerous lesions (Bhurgri et al,2008).

1.4 Cancer prevention and education

It is estimated that over 30% of all cancer may be prevented by modifying or avoiding key risk factors, including tobacco use, obesity or being overweight, lack of physical activity, alcohol use, unhealthy diets with low fruit and vegetable intake, sexually transmitted HPV infections, urban air pollution, and indoor smoke from solid fuel use in homes. Public education in cancer control is important because certain life styles are known to be associated with the onset of cancers in various cells (Yamaguchi,2002).

Cancer education is not limited to facts regarding the etiology and treatment of the disease; it also encompasses the humanization of the disease (Parijs,1986). Awareness of the contribution of modifiable risk factors to the onset of disease is a necessary precursor to the promotion of positive health related behaviors, which is also a public health priority (Kyle et al,2013). As prevention is better than cure, education and employment are important aspects of future health and quality of life for all adolescents and young adults.

In developed countries like USA, Australia, different audio- visual aids, e-learning are used to teach about disease and cancer. In developing countries like Nepal, lecture methods, pamphlets, posters are being used for cancer information and health communication. A comprehensive school- based health program in Zambia suggested that program reduced overall average morbidity by 38% and lowered stunting prevalence by 52%. This showed that programs may offer a highly effective way to improve students' health knowledge as well as their health status (Wei et al,2019). Another study showed that school- based health promotion intervention in Peru had a positive effect on vegetable consumption on school adolescents as well as on preventing the increase in sedentary behaviors, fighting and suicide attempts (Sharma, Kim & Nam,2018). An Australian study evaluated a school- based health education program for urban indigenous young people. This study showed that there were mostly significant improvements over time in knowledge, attitudes, and self- efficacy regarding leadership, chronic diseases within the intervention group (Malseed, Nelson & Ware,2014).

Few studies have involved parents in school-based interventions although usually limited to newsletters and homework assignments. Evidence of effectiveness of these interventions in adolescents was strong, although in children the evidence is still inconclusive. Whether the strategy of involving parents in interventions will be as effective for children should be the focus of future research (Van, McMinn & Griffin,2007).

However, cancer education is only present in the curriculum of grade ten under the topic Noncommunicable Diseases in Nepal and are delivered using traditional lecture method. Before reaching grade ten, there are less chances to get cancer education and understand about cancer, risks and its prevention. Hence, there is need of cancer education in school since early classes for students to build healthy behavior which could help in healthy lifestyle and prevent cancer. Although traditional lecture method provides an economical and efficient method for delivering substantial amounts of information to large numbers of student, it does not promote independent learning (CIDDE,2014). Montet (n.d.) stated that reformers advocate a move away from traditional, teacher-centered, (didactic) direct instruction, where students are passive receptors of knowledge, toward more student-centered understanding-based (constructivist) teaching that focuses on exploration and experimentation and reinforces lifelong learning skills. Classroom activities should be valuable to children. It adds a new dimension to instruction and causes students' values to change. Peko and Varga (2014) stated that when interacting with various contents, a student is cognitively active and starts to perceive learning as a challenge. Only then

can it be expected from students to think of knowledge as something valuable and to think that the opportunity to learn is a privilege.

1.5 Health behavior in Nepal

The health behaviors of individuals are related to locally available health care services. Studies in Nepal have demonstrated that people seek different types of health care practitioners, depending on their perceptions and beliefs of the problems (Subedi,1989). Nepalis utilize various traditional systems of treatment in health care besides modern allopathic system. Within the modern health system, people preferred to visit private clinics, distant health centers and even travel to India for treatment rather than avail the facilities of local health care providers and government health centers, which had insufficient infrastructure and poor services (Bhattarai et al, 2015). Thus, Nepalis opt for national and international medical services depending on their economic status, type of disease and treatment facilities.

Studies around the world have focused on the importance of knowledge and health beliefs in health seeking behaviors. In addition to cancer, extensive research has been conducted to evaluate people's knowledge, attitudes, and practices with regards to NCDs. In recent decades, there has been dramatic increase in NCDs. According to WHO (2019a), Cardiovascular diseases (30%), cancer (9%), and Chronic Obstructive Pulmonary Diseases (10%) are among the major NCDs in Nepal. While the treatment and prevention of communicable diseases is still insufficient, an increase in NCDs has placed yet another burden on the health of the Nepali

people. It is therefore important to prioritize issues pertaining to NCDs for research in the development of evidence-based interventions, with a view to translating these into action (Tripathy,2018).

1.6 Key concepts in health education for adolescents

Models and theories that focus on understanding health and health behavior are of key importance for health education and health promotion. Different classes of models and theories can be distinguished, such as planning models, behavioral change models, and diffusion models. Within these models, different topics, ranging from health literacy, attitudes, social influences, self-efficacy, planning, and stages of change to evaluation, implementation, stakeholder involvement, and policy changes are relevant. Ideal health promotion settings are schools, worksites, and healthcare, but also the domains that are involved with policy development. Main health promotion methods can involve a variety of different methods and approaches, such as counseling, brochures, eHealth, stakeholder involvement, consensus meetings, community ownership, panel discussions, and policy development depending upon the settings (Vries, Kremers & Lippke,2018). Centers for Disease Control and Prevention (2019) stated that health education is one strategy for implementing health promotion and disease prevention programs. Providing adolescents with information about increased cancer risks associated with certain behaviors is regarded as one way to encourage protective behaviors to provide the foundation for a healthy adulthood. The methods which are mostly lecture- based,

would at most lead to an improved level of knowledge, and to some extent attitude, but had less effect on influential determinants like beliefs, self-esteem and social influences (Keshani et al,2019). While deaths from noncommunicable diseases mainly occur in adulthood, exposure to risk factors begins in childhood and builds up throughout life (WHO,2017). Hence understanding the benefits of health promoting activities, controlling the modifiable risk factors in daily life, and timely screening practice are important to protect health from adverse effects.

1.6.1 Adolescent health and peer influence

WHO states that adolescent health is the range of approaches to prevent, detect or treat young people's health and well-being (WHO,2017). Many adolescents engage in risky behaviors that affect their health. The cause of ill-health in adolescents are mostly psychosocial rather than biological. Alcohol or tobacco use, lack of physical activity, unprotected sex and exposure to violence can jeopardize not only their current health, but also their health as adults, and even the health of their future children. Promoting healthy behaviors during adolescence and taking steps to better protect young people from health risks are critical for the prevention of health problems in adulthood and for countries' future health (WHO,2017; WHO,2017a).

Decision-making during the phase of adolescence is affected by peer influence. Adolescents spend more time interacting with peers than other age groups and report the highest degree of happiness when in peer surroundings (Albert, Chein & Steinberg,2013). Moreover, adolescents also play an important role in increasing cancer communication with their families (Kyle et

al,2013). Risk-taking behavior and susceptibility to social influence increase when young people are becoming more independent in decision making and action. Initiation and persistence of risk behavior is influenced by an adolescent's perception of the conditional risk associated with specific behaviors, as well as understanding of the potential short term and long- term health consequences associated with such behaviors (Richter,2010).

Simply giving information about an association between specific habits and cancer, even if repeated several times, will lead to increased public awareness and encourage some to make a minimal effort to change their behavior, however, in general the new habit does not persist and continuing and intensifying this approach is found to be effective (Parijs,1986). The shift must be made towards active learning. As active learning enables students to have a high level of autonomy and self- monitoring, construct new knowledge and enhance critical thinking, it enables long lasting retention of information. Hence to sustain the learning, students should plan and prepare the learning process themselves, engage in learning, regulate their learning, control it and persist in the learning activities (Peko and Varga,2014).

A Nepali study conducted among mother-student pairs found that students with high knowledge levels were in the habit of talking to others about cancer, and it was a strong predictor of knowledge among students. Almost 50.6% of students were aware that the habit of smoking was a risk factor, while only 35% students considered having multiple sexual partners as a risk factors for cervical cancer. Only 15% of mothers had taken cervical cancer screening tests. This

study also demonstrated that low knowledge among mothers and students and suggested the need for school-based sexuality education including peer group activities. Additionally, this study focused on educating men- including fathers and boys-about vaccines and cervical cancer to empower health seeking behaviors among women (Poudel and Sumi,2019).

Peer learning is a two-way learning approach in which students explain their ideas, share information, participate in collaborative work and learn from each-other. In essence, students help one another learn. Peer learning acts as a catalyst for subsequent cognitive development.

The passing of information is often observed from father to son, mother to daughter, mentor to learner or teacher to students. Peer learning training conducted prior to classes help students to understand their roles. Peer learning is different because information spreads via learners who are peers and who have recently learned this information.

The advantages of peer learning over traditional learning are in its effectiveness in more effectively integrating students with positive interaction (Albert et al,2013). Collaborative work and assuming responsibility for one's own learning helps students achieve a variety of learning outcomes. Evidence is increasing suggesting that peer learning creates greater confidence and independence in learning, deeper understanding and improved grades for both peer leaders as well as their students (Keenan,2014).

1.6.2 Health Belief Model

The Health Belief Model (HBM) is a conceptual framework to understand health behavior and

possible reasons for non-compliance with recommended health actions (Turner et al,2004). This model has the major subscales of perceived susceptibility, severity, benefits, and barriers. The likelihood that an individual will act to prevent or detect disease is determined by several factors: perceived susceptibility to the health condition, perceived severity of the health threat, perceived benefits of performing the health behavior, and perceived barriers to performing this behavior (Janz and Becker,1984). The model was further expanded to include cues to action, motivating factors, and self- efficacy. The combined levels of susceptibility and severity provided the energy or force to act and the perception of benefits (less barriers) provided a preferred path of action. However, it was also felt that some stimulus was necessary to trigger the decision- making process. This “cue to action” might be internal (i.e. symptoms) or external (i.e. mass media communications, interpersonal interactions, or reminder postcards from health care providers). For the occurrence of behavioral change, an individual must be aware of the potential negative consequences of his/ her current actions. Thus, knowledge alone may not be sufficient to cause behavior change, and without a perception of self- risk, there is little stimulus to change (Winham and Jones,2011).

Several studies have shown the effectiveness of health education program based on HBM on different types of cancer. A quasi experimental study conducted in Iran showed that health education program based on HBM is effective in the development of breast cancer screening behavior among participants (Masoudiyekta et al,2018). Similar finding was observed in oral

cancer prevention in smoking Irani men. The educational program based on HBM model have positive effect on oral cancer prevention with the improvement of subject's knowledge, perceived susceptibility, severity, benefits and self-efficacy (Jeihooni, Dindarloo & Harsini,2019).

A study showed that the education provided to the Turkish students increased their HBM scores, knowledge about breast cancer, and self-breast examination skills although the frequency of regular self- examination was still quite low after training (Kissal and Kartal, 2019).

A Nepali study showed that participants had low perceived susceptibility and severity; which means that people did not feel susceptible to CVDs. Participants did not know much about heart diseases and had high perceived barriers. However, this study showed that health beliefs subscales played an important role in knowledge. Furthermore, this study showed that awareness programs are not sufficient to increase knowledge; hence, the beliefs, cultural practices, health misconceptions, need for change, and hidden barriers to health services should be identified first to make health promoting activities effective (Poudel and Sumi,2017).

Perceived self-efficacy was the last HBM construct. Studies have confirmed a direct relationship between perceived self-efficacy and self-care behaviors in various aspects of nonepidemic diseases (Khorsandi, Fekrizadeh & Roozbahani,2017). Regarding the relationship of self-efficacy and self-esteem, a study suggested that high self-efficacy is predictive of high self-esteem; whereas, low self-efficacy predicts low self-esteem. Therefore, it can be inferred

that self-efficacy predicts self-esteem (rather than self-esteem predicts self-efficacy), particularly in predicting procrastination (Hermann,2005). As our major focus was on adolescents, according to Erikson, an adolescent's main task is developing a sense of self. Hence, we tried to check the self- esteem among adolescents in this study.

1.6.3 Learning partner model

The learning partner model (LPM) is a framework that shows series of processes that evidence-based knowledge is transmitted from a person to a person in daily context (Suketomo,2018). This model shows the diffusion of health information among people near to them. In this study, LPM is used to explore the communication between students and sharing partners. Additionally, it has also explored the diffusion of knowledge from sharing partners to their friends, neighbors and other members of communities.

A study showed that LPM, applied in cancer education and awareness in schools and in communities, might increase the effective dissemination of innovations (Suketomo,2018). However further studies are necessary to build on the experience of this project and refine implementation and evaluation strategies (Suketomo and Navarro,2016).

1.7 Theoretical framework of the study

While focusing on adolescents, proper understanding of their behaviors, social networks are important considerations. Because health education and health promotion should be theory- and evidence-based, personalized interventions are recommended to take empirical findings

and proven theoretical assumptions into account; hence we have included following models and theories to build our study.

A new theoretical framework was prepared based on the HBM and LPM. Perceived susceptibility, perceived severity, perceived benefits of performing the health behavior, and perceived barriers to performing this behavior played an important in initiating healthy behaviors. The content of the education program was based on these subscales of the health belief model. Although the self-efficacy was one of the subscales of HBM, studies have suggested that high self-efficacy is predictive of high self-esteem. As per Erikson, the main task of adolescents is developing a sense of self, therefore self-esteem was added as other important variables in this model. As peer influences play an important role in the decision making of adolescents, sharing of information through peers/ family was considered an important factor in the adolescence phase. The new cancer education program was based on the HBM and LPM which included peer-led active classes, photovoice, and joint assignments.

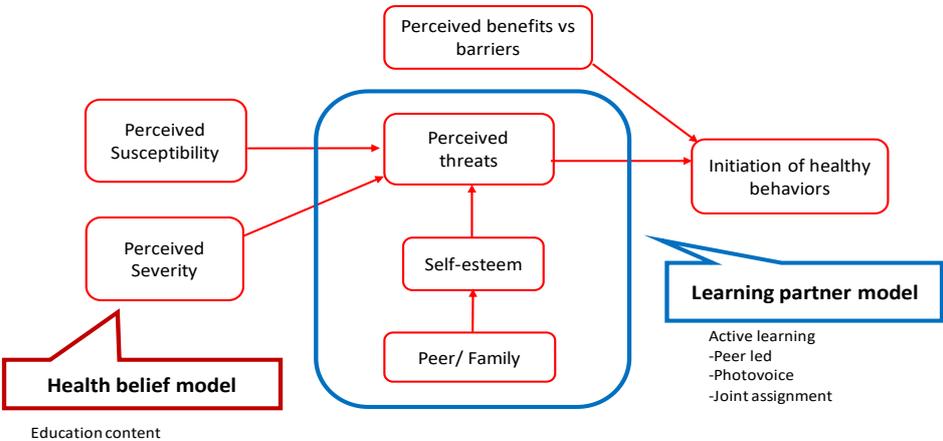


Figure 1: Theoretical framework of the study

1.8 New strategies in health education

The ultimate goal of health education is to influence health positively. Health education strategies are tailored for their target population. Health education presents information to target populations on particular health topics, including the health benefits/threats they face, and provides tools to build capacity and support behavior change in an appropriate setting (Centers for disease control and prevention,2019). Planned learning activities increases participants' knowledge and skills. Several audio-visual aids, and computer-based supports such as slides, projectors, videos, books, posters are been used in health education approach. Health education activities should enhance the overall goal of the health promotion and disease prevention.

Photovoice is a process by which people can identify, represent and enhance their community through a specific photographic technique. It gives cameras to the hands of people to enable them to act a recorder, and potential catalysts for change, in their own communities. It has main three goals: a) to enable people to record and reflect their community's strengths and concerns, b) to promote critical dialogue and knowledge about important community issues through group discussion of photographs, and c) to reach policymakers. Along with these goals, people can use photovoice as a tool for participatory research (Budig et al,2018). Photovoice is a visual research methodology with the intention to foster social change however they are not enough evidence on usage of photovoice as pedagogy. It is highly flexible and can be adapted to specific participatory goals, different groups and communities, and distinct public health issues (Wang

and Burris,1997). Photo voice was found effective to develop self- awareness and ability in adolescents to shape actions to change health behavior (Warne, Synder & Gadin, 2013). Although photovoice has not been used as a pedagogy in cancer education, it intends to increase self- awareness, problem finding and critical thinking. Photovoice method was used in cancer education. Students formed a group, took photographs and then narrated those images from their communities. The students engaged themselves in finding cancer in their communities through photos and later discussed about the ways to solve those problems. The main purpose of photo voice was to enable participants bring classroom outside the school and find the strengths, weaknesses present in their society and to reflect them through posters and group discussion. It also helped to promote critical dialog and knowledge about important issues through group discussion of photographs. From the students, their narrations and their photos, the local needs of society for cancer prevention was assessed.

Cancer education programs conducted involving adolescents, peer groups and their family members are more effective and acceptable when both groups are comfortable in sharing their ideas or opinions (Malseed et al,2014). The school- based health promoting program can have positive effects on students if they are conducted carefully (Wei et al,2019; Sharma et al,2018; Malseed et al,2014; Van Sluijs,2007).

Materials developed for health education programs must be culturally appropriate and tailored to the target populations to ensure cultural competence (WHO,2016). As Nepal is a country

with rich cultures and traditions, cultural beliefs, myths, should be understood to develop the friendly and sustainable education program. So far, there has been no studies conducted in Nepal pairing mothers with their children adding information about cancer communication in families.

1.9 Purpose of the study

The general objective of this study was to develop cancer education program using peer and focus on adolescent health in Nepal.

The specific objectives are as follows:

1. To explore the overall knowledge and diffusion of cancer information between students and their mothers.
2. To evaluate the effectiveness of new cancer education program based on Health belief model and learning partner model.

CHAPTER II

Knowledge, barriers and diffusion of cancer information between students and their mothers in Nepal

This study firstly determined the knowledge of risk factors, symptoms and the prevention of cervical cancer. To check the association of mothers' screening practice and its effect on knowledge of adolescents, mother and student were examined in pairs in this study. We hypothesized that knowledge, cervical cancer screening practices and beliefs of mothers would be associated with cervical cancer awareness of their children. We used the barriers subscale in our study to understand the inhibitory factors of mothers related to screening. (Poudel, K., & Sumi, N. (2019). *Analyzing awareness on risk factors, barriers and prevention of cervical cancer among pairs of Nepali high school students and their mothers*, *Int J Environ Res Public Health*,16;22)

2.1 Methods

A descriptive cross-sectional study was conducted among three secondary schools of the Lalitpur metropolitan area of Nepal. A convenience sampling method was used. Government high schools in the Lalitpur metropolitan were chosen for the study, and permission letters were sent to all school principals. Only those schools that permitted our research were included in this study. The primary participants of this study were adolescents, as students acquire new habits at this stage. Healthy and unhealthy habits learned during adolescence help shape their

future lifestyles. Furthermore, students are likely to drop out after grade 10 because of factors such as work, family responsibilities and marriage. Hence, grades 9 and 10 were our primary target in this study.

An envelope containing the permission letter, consent form, questionnaire and a pen was prepared for mothers. To determine the mother-student pairs, a code was written on the envelope that was only known to the researchers. The permission letter was sent to mothers as well as students. The permission letters were sent to 335 mothers; 258 returned the questionnaire and 270 returned the permission letter along with the questionnaire. Mothers who could read and write completed the questionnaires alone. Mothers who could not read and write were requested to have the questionnaire completed by their husbands or a reliable family member, excluding children or minors. Based on the code provided, the questionnaire was distributed to the 270 students whose mothers approved their participation in this research. After excluding missing data, 253 pairs of students and mothers were included in this study. The data were collected from October to December 2017.

2.1.1 Questionnaire

The questionnaire consisted of items on socio-demographic data, personal health information and knowledge of risk factors, symptoms and preventive measures. The questionnaire provided to the mothers included additional questions related to barriers and screening practices. The knowledge of risk factors and preventive measures were combined for a knowledge score

ranging from 0 to 21. A correct answer was scored 1, while 0 was given for incorrect answers.

A question related to risk factors was prepared using the Cervical Cancer Knowledge Prevention 64 questionnaire (Jaglarz et al, 2014). Another question focusing on the perceived barriers was developed based on the HBM. Questionnaires were translated into Nepali and then reverse-translated into English by experts.

Content validity was established by an extensive literature review, and consultations with a research advisor and medical doctors. The tool was reverse translated into English by two experts to ensure retention of the same concepts. The pre-test was conducted with 20 students and mothers in similar settings to check the validity of the questionnaire. After the pre-test, the internal consistency of the questionnaires was estimated with Cronbach's alpha, whose value was 0.81. The reliability was re-evaluated in the whole analyzed sample. The value of Cronbach's alpha was 0.75, acceptable for the study.

2.1.2 Statistical Analyses

A *t*-test and Analysis of variance (ANOVA) were used to examine the relationship between knowledge scores and the independent variables. Multiple linear regression analyses were performed on variables that were statistically significant during *t*-test and ANOVA to find the predictor of awareness among students and mothers. The level of significance was set at 0.05.

All analyses were performed using the IBM SPSS Statistics for Windows software version 22.0 (IBM Corp., Armonk, NY, USA).

2.2. Results

A total of 253 pairs of mothers and students were included in this study. The mean ages of the students and mothers were 15.0 ± 1.0 and 40.4 ± 5.5 years, respectively.

2.2.1. Demographic Information

2.2.1.1. Students

Out of 253 students, 50.6% of the students were female and 54.2% were studying in grade 9;

The mean knowledge score of students was 11.1 ± 4.6 .

2.2.1.2. Mothers

The mean age of mothers when they married was 19.7 ± 3.3 years. The median number of children that mothers had was 2. Only 32.4% of mothers had heard about cervical cancer screening and 15% had taken the screening test. The mean knowledge score for mothers was 10.3 ± 4.7 .

2.2.2 Knowledge on Risk Factors of Cervical Cancer

Multiparity was considered the main risk factor for cervical cancer by students (51.4%) and mothers (47%). Use of hormonal contraceptives was considered the least important risk factors by both students and mothers. Detailed information is provided in Figure 2.

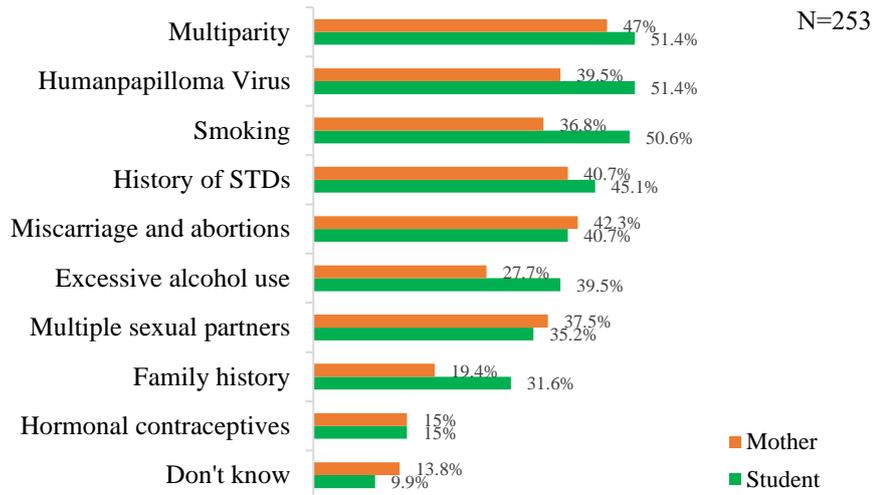


Figure 2: Knowledge of students and mothers about risk factors of cervical cancer

2.2.3. Knowledge on Prevention of Cervical Cancer

The students considered cleanliness and personal hygiene (66.8%) the major preventive measures. For mothers, cancer screening tests (65.2%) were indicated to be the most effective preventive measure. It was interesting to see that the HPV vaccine was the preventive measure least considered by both students (14.6%) and mothers (17%) as shown in Figure 3.

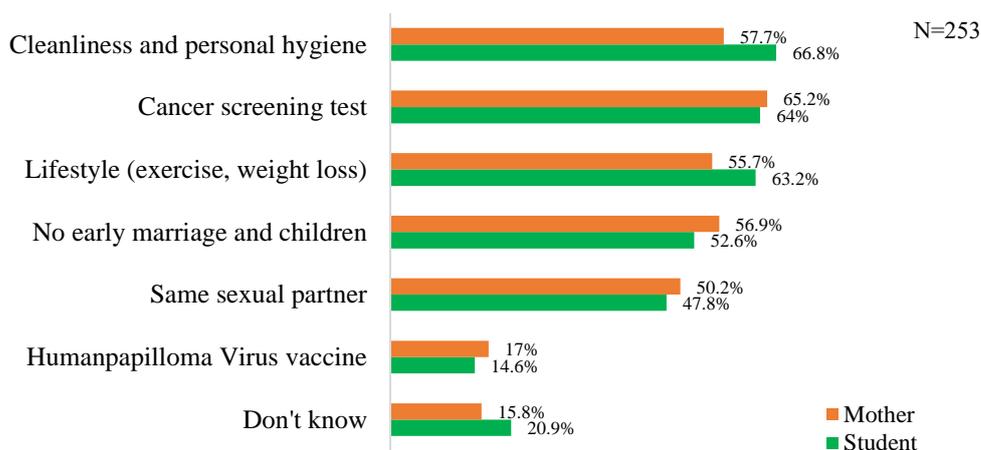


Figure 3: Knowledge of students and mothers about prevention of cervical cancer

2.3. Total Cervical Cancer Knowledge Score

2.3.1. Students

Female students had better knowledge than males ($p < 0.01$). Grade 10 students had better knowledge than grade 9 students ($p < 0.02$). Students who followed a healthy diet ($p < 0.00$) were more knowledgeable. Students who had a habit of talking about cancer with family or friends, had more knowledge about cervical cancer than students who did not talk about cancer with anyone ($p < 0.00$). Further information is provided in Table 1.

Table 1. Relationship between the demographic variables of students and the total cervical cancer knowledge score.

N=253			
Variables	Category (N)	Mean ± SD	p-value
Sex	Male (125)	10.4 ± 5.2	0.010
	Female (128)	11.9 ± 3.9	
Education Level	Grade 9 (137)	10.5 ± 4.7	0.021
	Grade 10 (116)	11.8 ± 4.3	
Area of Residence	Rural (79)	10.4 ± 5.0	0.107
	Urban (174)	11.4 ± 4.5	
Healthy Diet Consumption Per Week	Not much (30)	8.9 ± 5.5	<0.000
	Sometimes (76)	11.0 ± 4.9	
	3 to 4 times (106)	11.9 ± 3.8	
	Every day (41)	11.9 ± 4.9	
Family History of Illness	No (197)	11.1 ± 4.6	0.881
	Yes (56)	11.2 ± 4.8	
Cancer Talk with Others	No (187)	10.6 ± 4.9	<0.000
	Yes (66)	12.6 ± 3.4	
Mother's Age during Marriage	Before 20 years (164)	10.9 ± 4.6	0.315
	After 20 years (89)	11.6 ± 4.6	
Mother's Cancer Screening Practice	No (215)	10.7 ± 5.2	0.568
	Yes (38)	11.4 ± 4.6	

N = 253. t-test, ANOVA; Total knowledge score range: 0–21.

Multiple linear regression ($R^2=0.10$, $p=0.00$) that was performed to identify the predictors of awareness among students showed that cancer talk ($\beta=0.19$, $p=0.00$) was a major predictor. Beside cancer talk, education level ($\beta=0.19$, $p=0.01$), sex ($\beta=0.16$, $p=0.01$) and healthy diet consumption ($\beta=0.13$, $p=0.04$) were other important predictors of awareness. Further information is provided in Table 2.

Table 2. Multiple linear regression to identify the predictors of awareness on students

N=253

Variables	B	β	p -value
Sex ^a	1.45	0.16	0.010
Cancer Talk with Others ^b	2.01	0.19	<0.000
Education Level ^c	1.49	0.19	0.013
Healthy Diet Consumption ^d	0.65	0.13	0.042

^a [1: Female], ^b [1: Yes], ^c [1: Grade 10], ^d [4: Every day]. Dependent variable: Total cervical cancer knowledge score.

2.3.2. Mothers

Education level, age at the time of marriage and living area had significant effects on awareness ($p < 0.00$). Mothers who had taken a cervical cancer screening test (mostly a pap test) had better knowledge levels than mothers who had not taken any screening test yet ($p < 0.00$). Mothers who had shared information or talked about cervical cancer with family members or friends had better knowledge than mothers who had never talked about cervical cancer with anyone ($p < 0.02$). Further information is provided in Table 3.

Table 3. Relationship between the demographic variables of mothers and the total cervical cancer knowledge score

N = 253

Variables	Category (N)	Mean ± SD	<i>p</i>-value
Age	Less than 49 years (225)	10.2 ± 4.9	0.432
	Above 49 years (28)	11.0 ± 3.8	
Education Level	Illiterate (104)	9.9 ± 5.5	<0.001
	Up to grade 8 (39)	8.9 ± 4.4	
	Up to grade 12 (86)	11.5 ± 3.7	
	University and above (24)	13.2 ± 3.1	
Number of Children	Less than 3 (177)	10.5 ± 4.7	0.517
	More than 3 (76)	10.0 ± 4.9	
Area of Residence	Rural (79)	9.0 ± 5.2	<0.001
	Urban (174)	10.9 ± 4.5	
Smoking Habit	No (226)	10.3 ± 4.8	0.962
	Yes (27)	10.3 ± 4.9	
Drinking Habit	No (194)	10.3 ± 5.0	0.894
	Yes (59)	10.4 ± 3.9	
Family History of Illness	No (178)	10.4 ± 4.6	0.846
	Yes (51)	10.5 ± 5.1	
Exercise Habit Per Week	No (200)	9.8 ± 4.9	<0.001
	Sometimes (18)	11.6 ± 3.5	
	3 to 4 times (9)	11.9 ± 3.4	
	Every day (26)	13.2 ± 3.3	
Healthy Diet Consumption	No (24)	8.9 ± 4.1	0.089
	Yes (229)	10.5 ± 4.8	
Cancer Screening Habit	No (215)	9.9 ± 4.9	0.018
	Yes (38)	12.8 ± 3.0	
Talk on Cancer	No (152)	9.8 ± 5.0	0.029
	Yes (101)	11.2 ± 4.2	
Age during Marriage	Before 20 years (164)	9.8 ± 5.0	0.015
	After 20 years (89)	11.4 ± 4.2	
Sex of Children	Male (125)	9.3 ± 4.2	0.050
	Female (128)	10.9 ± 4.5	

t-test, ANOVA; Total knowledge score range: 0–21.

Multiple linear regression was performed on variables (education level, area of residence,

exercise habit, cancer screening habit, talk on cancer, age during marriage and sex of children) to find the predictor of awareness among mothers. Multiple linear regression ($R^2=0.17, p=0.00$) showed that cancer screening habit ($\beta=0.17, p=0.01$) as the strongest predictor. Further information is provided in Table 4.

Table 4. Multiple linear regression to identify the predictors of awareness on mothers.

N=253

Variables	B	β	<i>p</i> -value
Area of Residence ^a	1.29	0.13	0.042
Exercise Habit ^b	0.80	0.16	0.010
Talk on Cancer ^c	0.33	0.03	0.589
Age during Marriage ^d	0.70	0.07	0.268
Sex of Children ^e	1.07	0.11	0.061
Cancer Screening Habit ^f	2.23	0.17	0.010
Education Level ^g	0.66	0.15	0.032

^a [1: Urban], ^b [4: Every day], ^c [1: Yes, talked], ^d [1: More than 20 years], ^e [1: Female], ^f [1: Yes], ^g [4: University and above]. Dependent Variable: Total Cervical Cancer Knowledge Score

Mothers were also asked questions concerning barriers. Mothers with a low knowledge level showed less perceived susceptibility towards cervical cancer ($p < 0.01$). Lack of information about cervical cancer was another barrier among mothers ($p < 0.00$). Further information on barriers to screening is provided in Table 5.

Table 5. Relationship between the total cervical cancer knowledge score and the barriers to screening perceived by mothers.

N = 253

SN	Barriers	Category (<i>N</i>)	Mean ± SD	<i>p</i> -value
1	I have low risk of cervical cancer.	No (67)	12.1 ± 4.1	<0.001
		Yes (186)	9.7 ± 4.8	
2	I will get stressed after finding the result of cancer screening.	No (242)	12.7 ± 4.5	0.082
		Yes (11)	10.2 ± 4.7	
3	Screening is not necessary since there is no certainty of cancer.	No (238)	11.1 ± 4.9	0.546
		Yes (15)	10.3 ± 4.7	
4	Screening test is expensive.	No (247)	11.7 ± 4.0	0.285
		Yes (6)	10.3 ± 4.7	
5	I don't know where to go for screening.	No (214)	10.5 ± 4.7	0.090
		Yes (39)	9.1 ± 5.1	
6	I don't have time to go for screening.	No (240)	10.5 ± 4.8	0.040
		Yes (13)	7.7 ± 5.3	
7	I don't have much information about screening.	No (122)	11.6 ± 4.2	<0.001
		Yes (131)	9.2 ± 4.9	

t-test; Total knowledge score range: 0–21.

Summary

This study assessed cervical cancer awareness among both sexes in Nepal. The awareness of cervical cancer's risk factors, prevention was low among students and their mothers. Lack of proper information and less perceived seriousness were barriers hindering cervical cancer screening among mothers. These barriers should be addressed using qualitative as well as longitudinal studies to check the types and stability of barriers.

CHAPTER III

Evaluation of new cancer education program among high school students

The main objective was to develop new cancer education program among high school students based on health belief model and learning partner model.

3.1 Methods

3.1.1 Development process of new cancer education program

The brief information about cancer and other Noncommunicable Diseases is provided in curriculum of grade ten in Nepal. It was first time for grade 9 students to take cancer class in their school. While the curriculum included short information about risks, symptoms, and prevention, there was no information on cancer screening, treatment methods and its prognosis. Majority of schools in Nepal follow the traditional lecture for teaching learning technique. Teachers impart knowledge to students through oral language. There is least or sometimes absence of students' participation in class making learning passive and boring. According to Dale's Cone of experience (1969), students remember about 10% of what they read, 20% of what they hear, but 90% of what they do. It reveals that action learning techniques result up to 90% retention. The new education program differs from traditional program in several ways as mentioned below.

Table 6: Differences between traditional and new cancer education program

<i>Elements</i>	<i>Traditional program</i>	<i>New program</i>
Participants	Active teachers	Active students (teacher as facilitator)
Mode of teaching	Teachers to students	Students to students
Teaching aids	Oral lectures	PowerPoint, group discussion, participation in problem solving in community using Photovoice
Assignment	Students' only	Student- parent
Contents	General information on risk factors, prevention	In addition, treatment, screening activities in Nepal and student's role in cancer prevention

There was a need to introduce students about cancer before reaching final year of their school education. Furthermore, there was a need to teach them about the screening, what could they do as students and activities being conducted to prevent cancer in Nepal. When students share ideas, they learn to build stronger logic, recognize various presumptions and improve critical thinking. It was not possible with the traditional lecture method.

Therefore, intensive literature reviews were done to find audio-visual aids used in education. Videos, paper handouts, role-plays, games, demonstration, e-learning were used several times to teach health education in developed countries. The search began for methods which was flexible and sustainable in Nepali school settings. Traditional lecture methods had overtaken teaching learning methods in Nepal. Hence, to promote active learning, peer learning method

was adopted for this study. Research has also shown that adolescents are more likely to modify their behavior if they receive health messages from peers who face similar concerns and pressures. Students would be asked to be peer leader and teach their friends in a class setting. They would form a group to conduct photovoice and engage in problem findings. The advantage of this method is the ability to increase knowledge in a large number of persons in a short period of time with minimal resources.

The impact of this strategy is likely to be more as the adolescents would be encouraged to discuss the information received with family members and with friends who are not in their schools. The power point slides for cancer education was developed after having literature review and several meetings with supervisor and medical doctor. Photovoice was added as a pedagogy. In this study, students would get in group with the objective to learn about their communities using cancer theme. Based on the photos taken during photovoice, group discussion would take place.

3.1.2. New peer-led cancer education program

3.1.2.1. Objectives of new cancer education program

The general instructive and specific behavioral objectives along with the tasks are shown in table 7.

Table 7: Objectives and tasks of new cancer education program

<i>General Instructive Objectives</i>	<i>Tasks</i>
To identify and increase health promoting behaviors among adolescents	It includes involving students in new cancer education program using several approaches and increase their healthy habits.
<i>Specific Behavioral Objectives</i>	<i>Tasks</i>
To describe and discuss overall cancer knowledge with other students using active learning approach and summarize it. (understand)	It includes volunteer participation of some students as peer leaders and remaining as group members. Peer leaders will use PowerPoint slides, chart papers as audio visual aids to teach about cancer. The whole class will engage in group discussion. By the end of session, all students will be able to discuss about cancer and summarize it.
To search cancer in the surrounding through photo voice, engage students in group discussion, produce a poster (apply)	This objective is a part of critical thinking session. It consists of group formation. 6-8 students will form a group. After proper instructions about photography rules and usage of camera, camera will be provided to group. Students will form groups and take photos based on flash question “How is cancer present in your surrounding?”. Each student will have one photo to narrate during the group discussion session. Based on group discussion, students will make a poster and share it with other groups.
To analyze the importance of healthy behavior, share with partners and adopt healthy habits (create)	It includes health communication session which will help students connect their learning outside their school. Students will complete a joint assignment with their sharing partners.

Cognitive domain (Bloom, 1956), Revised cognitive domain (Anderson and Krathwohl, 2001)

3.1.2.2 Steps of cancer education

I. Peer leader training

Before conducting any steps, Informed consent was taken from peer leaders, other students and their sharing partners. In control group, peer-leaders were not included, and class was to be taken by researcher using typical lecture method. The program was to be conducted by peer-

leaders in the intervention group. Peer leaders referred to students who were willing to take training and teach their friends about cancer. Peer leaders were selected voluntarily with the self-participation of students. From each school, 6-8 students took peer leader training from the researcher. The baseline test of peer leaders was taken prior to training. The training sessions were based on HBM. The contents for peer leader training are presented in table 8.

Table 8: Contents for peer leader training

Contents	Materials	Methods	Time
Session 1: Susceptibility and severity	Epidemiology of cancer (global and national)	-Quizzes -PowerPoint slides	45 minutes per session
Session 2: Benefits	Preventive measures, cancer screening and its types, benefits of screening	-Group discussion	
Session 3: Barriers	Barriers to screening and measures to reduce them as a student		
Facilitator: Researcher			

II. Peer- led cancer education

The peer- led cancer education was conducted in intervention group. Peer leaders took the classroom. The contents for peer- led cancer education are presented in table 9.

Table 9: Contents for peer-led cancer education

Contents	Materials	Methods	Time
Peer leaders to students			
Susceptibility and severity, benefits, and barriers session	Epidemiology of cancer (global and national) Preventive measures, cancer screening and its types, benefits of screening Barriers to screening and measures to reduce them as a student.	-Quizzes on disease and common cancer -PowerPoint slides -Group discussion	70 minutes
Students to students			
Critical thinking session	How is Cancer present in your surrounding?	Photo voice (Students formed groups. Each group was given camera to take photos. Each student had to take one photo for narration. It was followed by group discussion and poster making).	-90 minutes for group work and poster making
Students to sharing partners			
Diffusion of information based on Learning Partner Model	5 questions to be completed with sharing partners -What common cancer you have discussed? -Do you share cancer-related news inside family? -Did you both talk about family history/genetics in contracting cancer? -Did you share your cancer screening habit with family members? -Do you wish to share cancer related information with family members in future?	-Joint assignment to be completed by students and their sharing partners	10 minutes

Facilitators: Teacher, Researcher

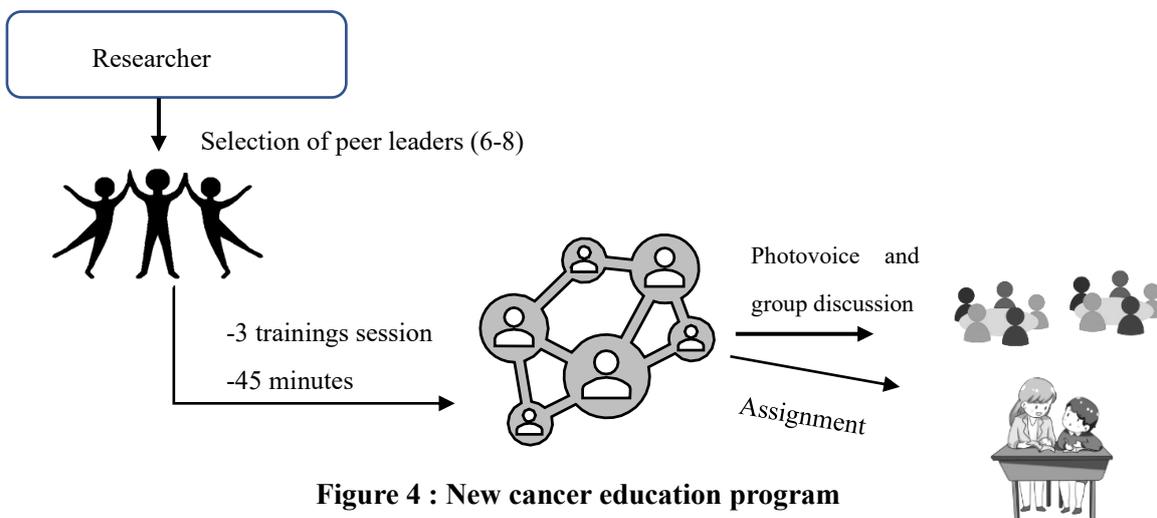


Figure 4 : New cancer education program

Newness about this study

This program is based on new framework which includes health beliefs, self-esteem and influence of peer/family in likelihood of initiating new habits. This program consists of cancer education which involves students as peer leaders who engages in teaching their friends about cancer. The photovoice used in this program encourages critical thinking session by seeking problems in their community using cameras. This program also involves communication of students with their sharing partners. Till date, this combined form of education program has not been conducted ever so is new and believed to be sustainable.

3.1.2.3 Pilot study

To check the understanding of questionnaire and education content, pre-test was conducted among 35 (Control-19; Intervention-16) high school students studying in grade 9. Questions were responded well by participants. Some questions were changed and edited on the basis of level of understanding of the respondents. However as two different schools were chosen as control and intervention, the baseline knowledge score of students in those two groups was statistically significant. To avoid those differences, students from same school but different sections were chosen as control and intervention groups. The PowerPoint slides were shown and approved by medical doctors.

3.1.3 Research Design

This study is quantitative, longitudinal, non-randomized control group pre-test-post-test design.

Cluster sampling technique was used; all students present in the class were selected as sample. This method was used when natural group exist in the population (e.g.: schools) to select participants. The term mixed methods refer to an emergent methodology of research that advances the systematic integration or mixing of quantitative and qualitative data within a single investigation or sustained program. Longitudinal study refers to continuous or repeated measures to follow individuals over prolonged periods of time. They are generally observational in nature, with quantitative and/or qualitative data being collected on any combination of exposures and outcomes, without any external influence being applied. In randomly assigned control group studies, at least two separate groups are evaluated-one of which receives the intervention of interest and another that serves as a control or comparison group.

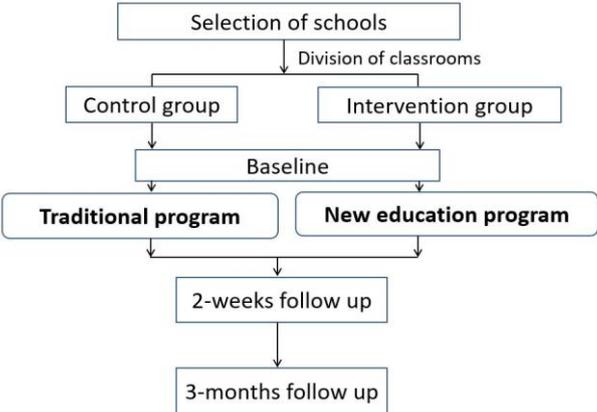


Figure 5: Flowchart of the study

3.1.4 Study area, population and sampling unit

This study was conducted in 3 schools of Lalitpur metropolitan city of Lalitpur district. Lalitpur metropolitan city, popularly known as Patan is one of the three major cities located inside

Kathmandu valley, besides Kathmandu and Bhaktapur. This city has diverse groups of people with varieties in occupation, age-group, ethnicity, educational level as well as life style patterns. Around 51,674 population are from 15-19 years age group representing 11% population (Central bureau of statistics, 2011). A study showed that cancer incidence rate is higher in Lalitpur district (Saud, Adhikari & Awasthi, 2018). There are total 40 government schools in Lalitpur metropolitan city including primary, lower secondary and secondary schools. Students studying in grade nine in these schools were included in this study. All participants were of same age group, same education level. The total students of all government schools in Lalitpur metropolitan city will be study population.

Adolescents or high school students are the major target of this study. As students of grade 10 will appear SEE examination and are busy with their courses, they will be excluded from this study. Hence class 9 will only be included.

3.1.5 Sample size calculation

The sample size calculation is as follows: (based on Donner, Birkett, & Buck, 1981)

α (two tailed) = 0.050 Threshold probability for rejecting the null hypothesis.

Type I error rate $\beta = 0.200$ (Probability of failing to reject the null hypothesis under the alternative hypothesis.)

Type II error rate $q_1 = 0.500$ (Proportion of subjects that are in Group 1) (exposed)

$q_0 = 0.500$ (Proportion of subjects that are in Group 0) (unexposed);

$1 - \alpha = 0.500$ (Effect size)

$S = 1.000$ (Standard deviation of the outcome in the population)

The standard normal deviate for $\alpha = Z_\alpha = 1.960$

The standard normal deviate for $\beta = Z_\beta = 0.842$

$A = (1/\alpha + 1/\beta) = 4.000$

$B = (Z_\alpha + Z_\beta)^2 = 7.849$

Standardized Effect Size = $(E/S) = 0.500$

Without correction for clustering: Total group size = $N_{\text{total}} = AB/(E/S)^2 = 125.58$

$N_1: 63$ $N_0: 63$

$N_{\text{total}}: 126$

Considering the response rate of 50%, sample size is recalculated as $= 126 * 2 = 252$

Based on the sample size and considering 50% of response rate, number of participants are recalculated as 252. Hence, combining all students 313 students and their sharing partners participated in this study.

3.1.6 Sampling technique:

The list of the total government schools was obtained from Lalitpur metropolitan city. Out of 40 schools, 13 schools were taken out as they were primary or lower secondary school. 1 school was removed from the group as it was only girls' school. 2 schools were removed as pilot study had been conducted there.

Out of 24 schools, 11 schools were removed because of less than 30 students in class. Further 6 schools were removed because they had only one section at class 9. Out of remaining 7 schools, 3 schools were randomly chosen. These selected schools had at least 2 to 3 sections in each class. Lottery method was used to select control and intervention group. Only principal of the school knew about the control and intervention group. Students were not told anything about division of groups. The data collection was done in May-September 2019. Cancer education program was conducted in June 2019.

3.1.6.1 Criteria for sample selection:

Inclusion criteria for students:

- a. Senior high school students studying in their respective school
- b. Students whose parents approved their children to participate in the study
- c. Those who are present during the survey
- d. Students who are physically and mentally sound
- e. Students who does not have history of cancer

Inclusion criteria for sharing partners:

- a. Parents or family members of high school students
- b. Parents or guardians who are present during this survey.

3.1.7 Data collection procedure:

Permission and Informed consent

Simple random sampling was done to select schools of Lalitpur metropolitan city. Permission letter was sent to the principals of all schools. Permission was obtained from the principals of the schools. After knowing about the sections, lottery method was used to select the intervention group. Only Principals were aware about the control and intervention groups.

Prior to baseline test, the researcher explained the purpose of the study and sent permission letter to the parents/ guardians. If parents were not present, then guardians were asked to fill out the questionnaire. Also, students were asked to choose a sharing partners with whom they could share knowledge about cancer. Sharing partners could be parents or siblings. Students were requested to choose same sharing partners throughout the study. Written consent form was obtained from all students and sharing partners.

To determine the student- sharing partner pairs, a code was written on the envelope that was only known to the researchers. As the peer leaders have already been pretested, they were refrained from taking pre- test with other students.

Baseline phase:

The structured, self-reported questionnaire was distributed to students. After distributing the questionnaire, teachers and researchers left the classroom, protecting the right of students to participate in this study. A box was kept in the class for students to drop off their questionnaires.

After 30 minutes, the researcher collected the box from the class. In control group, baseline test was conducted without peer leader's selection.

Intervention phase:

New education program was applied in this phase. Peer leaders conducted class in the intervention group. After class, assignments were sent to complete with sharing partners. The assignment included a few questions related to cancer prevention and screening.

During the class, the purpose and ethics of photo voice was explained to the students. Then, students were asked to form a group. The flash question for photo voice was 'How is cancer present in your surrounding?'. A camera was distributed in each group to take photos based on the pitch question. Each group kept camera for 3 days which was later collected. A photo voice theme discussion day was provided by the Principal based on feasibility of school. Students were asked to choose their photos for the narration. SHOWED checklist was distributed among students to narrate their photos followed by group discussion. Students were asked to draw poster based on their discussion.

In control group, the researcher conducted cancer class using traditional lecture method. Students were taught about cancer epidemiology, risk factors, prevention, screening, activities done in Nepal and what students could do to prevent cancer.

Post intervention phase:

An immediate post-test was conducted after two weeks of education program in both control

and intervention groups along with their sharing partners.

A second post- test was conducted three months later to check knowledge retention and initiation of healthy behaviors. All groups were given a note in which they were asked to write the most important behavioral changes after education intervention.

3.1.8 Data collection tools

The self- administered questionnaire was used to assess the knowledge on cancer among high school students and their sharing partners. The demographic, socio- personal questions were included. Questions for cancer awareness was derived from Cancer Awareness Measures (CAM, 2007). Questions related to health beliefs were prepared using Health Belief Model. Rosenberg Self Esteem Scale (RSES, 1965) was used to measure both positive and negative feelings about the self. Questions were added about health promoting activities based on extensive literature reviews. The cancer education content was developed by an extensive literature review, and consultations with a research advisor and medical doctor with expertise in cancer medical education.

3.1.8.1 Cancer Awareness Measures

Cancer Awareness Measures (CAM) is a questionnaire designed to assess awareness of cancer among the population. It is widely used in research to understand people's opinion on cancer. The measure includes awareness of warning signs and symptoms, risk factors. It also includes attitudes towards help- seeking, awareness of the link between cancer and age. Based on CAM,

we prepared original questionnaire to check the knowledge on cancer. Total knowledge score of cancer awareness ranged from 0-14. A correct answer was scored 1, while 0 was given for incorrect answers.

3.1.8.2 Health beliefs related to cancer

This section contains original 18 questions based on four subscales of HBM. Total health belief subscales score was calculated based on 1-4 Likert scale (4- Strongly Agree; 3- Agree; 2- Disagree; 1- Strongly Disagree). The perceived susceptibility consists of 4 items (For e.g.: I might get cancer in future; I will try my best to avoid cancer).

The perceived severity (range: 4-16) consists of 4 items (for e.g.: It is easy to get cancer in future; Even after getting cancer, I will get treated and get back to normal). The perceived benefit consists of 6 items (range: 6-24) (for e.g.: It is important to talk with family, friends about cancer prevention; I will look for new information to improve my health; It is important to exercise, eat healthy diet which will improve my health). The perceived barrier consists of 4 items (range: 4-16) (for e.g.: If I am destined to get cancer, screening test will not prevent me; Screening tests might be expensive to afford.)

3.1.8.3 Rosenberg self-esteem scale (RSES)

Rosenberg self- esteem scale is a self- esteem measure developed by sociologist Morris Rosenberg. It measures global self- worth by measuring both positive and negative feelings about the self. This scale is considered a reliable and valid quantitative tool for self- esteem

assessment. It uses a scale of 0 to 30 where a score less than 15 may indicate a problematic low self-esteem. The score ranges from 0 to 3 (3- Strongly Agree, 2- Agree, 1- Disagree, 0- Strongly Disagree). The statement 2,5,6,8, and 9 were reversely- coded.

3.1.8.4 Validity and reliability of tool

Questionnaires were translated into Nepali and then reverse-translated into English by experts. Content validity was established by an extensive literature review, and consultations with a research advisor and medical doctors. The cancer education content was developed by researcher. It was checked and confirmed by clinician specialized in medical education in Japan. The tool was reverse translated into English by two experts to ensure retention of the same concepts. Reliability was measured in a pilot test. After the pre-test, the internal consistency of the questionnaires was estimated with Cronbach's alpha, whose value was 0.80 (knowledge), 0.89 (health beliefs) and 0.82 (self-esteem). The reliability was re-evaluated in the whole analyzed sample. The value of Cronbach's alpha was 0.77 (knowledge), 0.88 (health beliefs), and 0.73 (self-esteem). As the estimate was greater than 0.70, it was considered acceptable for the study.

3.1.8.5 Ethical considerations and Potential bias

This study was approved by the Hokkaido University, Japan and Nepal Health Research Council (2805). Before conducting research, written consent was obtained from all participants. The names, addresses, and contact numbers of students, and names of schools and parents who

would disclose their personal information were not collected during data collection. Each student was given a unique code number by a researcher to pair the students with their sharing partners. The participants were free to quit at any time during data collection. Data privacy was maintained after data collection. The data will be stored for five years. Cancer education using peer leaders and photo voice was provided in experiment groups. To reduce the biasness, cancer education was conducted in all control groups. There was possibility of recall bias. To reduce the recall bias, students were not informed about the study hypotheses being tested. There was possibility of self-learning error while conducting peer-led cancer education. Hence, researcher as well as teachers were present in the class to avoid learning errors.

3.1.9 Data analysis

After each data collection, questionnaires were checked for its completeness. Each survey item was coded and entered at Statistical Package for the Social Sciences, Version 20.0 (IBM, Armonk, NY, USA). Means, percentages, and chi-square, paired t-tests were used to describe the distribution of demographics between the study groups (control vs intervention) and over study stages (baseline, 2-weeks and 3-months). Also, two-way ANOVA repeated measures tests were utilized to measure the main and interaction effects in groups. Probability level alpha will be set at 0.05 level of significance which means confidence interval is 95% (5% change of Type I error or rejecting null hypothesis). Power of statistical test (1- β) is set at 0.80 which means 20% chance of making Type II error (accepting null hypothesis, when it is false in fact).

3.2 Results

3.2.1 Students

3.2.1.1 Socio- personal information

The median age of students was 14. There was no difference observed between sex, importance of cancer talks, talk on cancer, wish to take cancer screening between two groups. Detailed information is presented in table 10 and 11. Total 313 students and sharing partners were included. The response rate of students was 93.18% and of sharing partners was 88.92%.

Table 10: Socio demographic information of students

Variables	Category	Control (N=161)	Intervention (N=152)	p-value
		N (%)	N (%)	
Sex	Male	82 (50.9)	70 (46.1)	0.388
	Female	79 (49.1)	82 (53.9)	
Members in health field	No	140 (87.0)	132 (86.8)	0.976
	Yes	21 (13.0)	20 (13.2)	

Chi-square test

Table 11: Cancer related information of students

Variables	Category	Control (N=161)	Intervention (N=152)	p-value
		N (%)	N (%)	
Importance of cancer talk	Very important	34 (21.2)	20 (13.2)	0.093
	Somehow important	111 (68.9)	121 (79.6)	
	Not so important	16 (9.9)	11 (7.2)	
Talked about cancer before	No	113 (70.2)	106 (69.7)	0.931
	Yes	48 (29.8)	46 (30.3)	
Wish to take cancer screening	No	48 (29.8)	40 (26.5)	0.573
	Yes	113 (70.2)	112 (73.5)	

Chi-square test

3.2.1.2 Knowledge on cancer

In control group, around 35.4% students realized cancer is said when abnormal cell proliferates randomly and spread around. In intervention group, about 39.5% knew about cervical cancer screening test during baseline. There has been change in awareness of cancer during two-week and 3-month follow up as seen in figure 6. The mean score of total cancer knowledge was 6.4 ± 2.4 and 6.4 ± 2.3 in control and intervention group during baseline which was statistically insignificant. During 3-months, the mean score decreased to 9.8 ± 2.5 in control group and 11.3 ± 1.9 in intervention group. This showed that knowledge retention decreases with time.

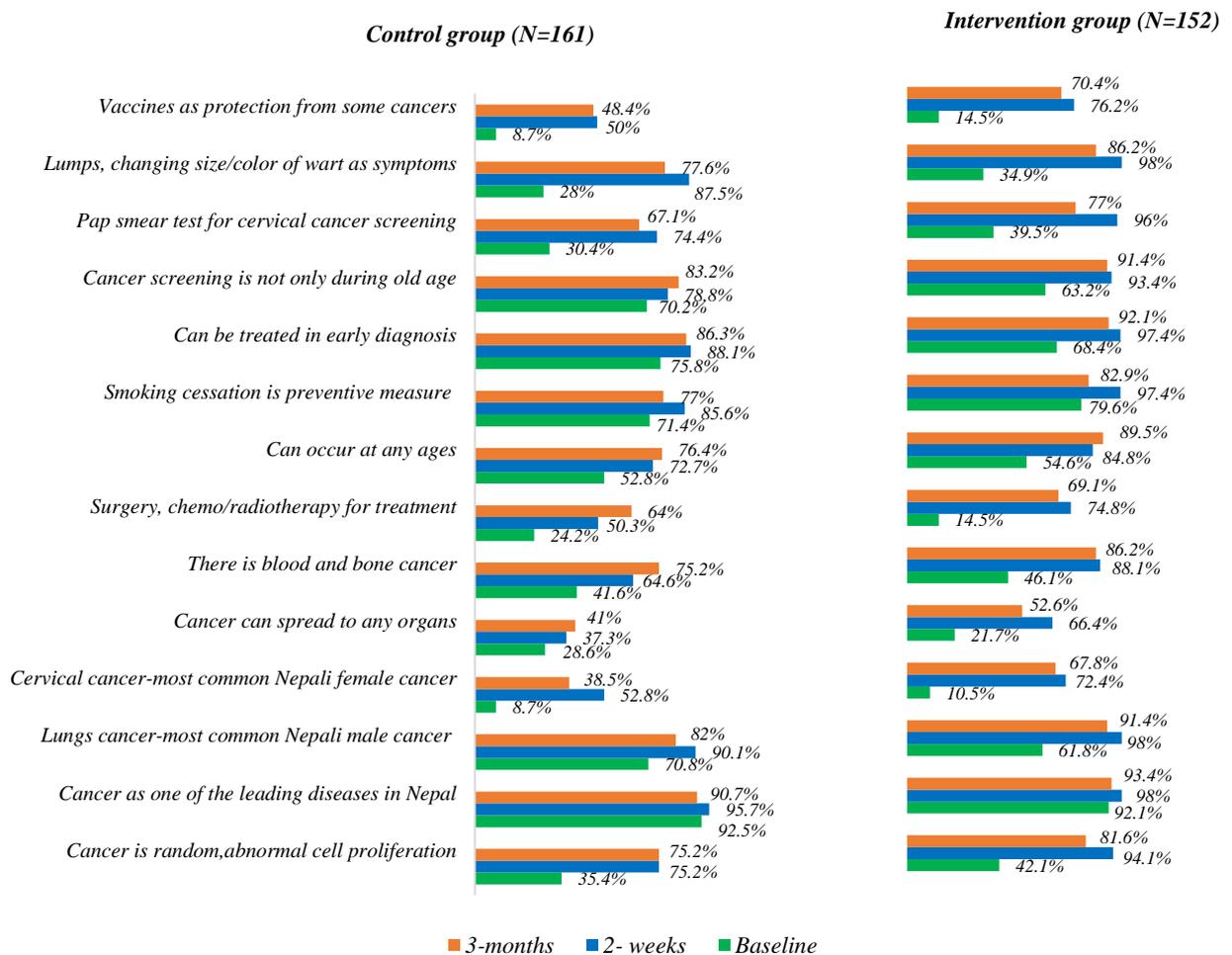


Figure 6: Change in cancer knowledge during three-time phases among students

3.2.1.3 Knowledge on risk factors

In both groups, students considered tobacco as major risk factors during baseline. There has been significant rise and fall in the awareness about risk factors with time in both groups.

Detailed information is provided in figure 7.

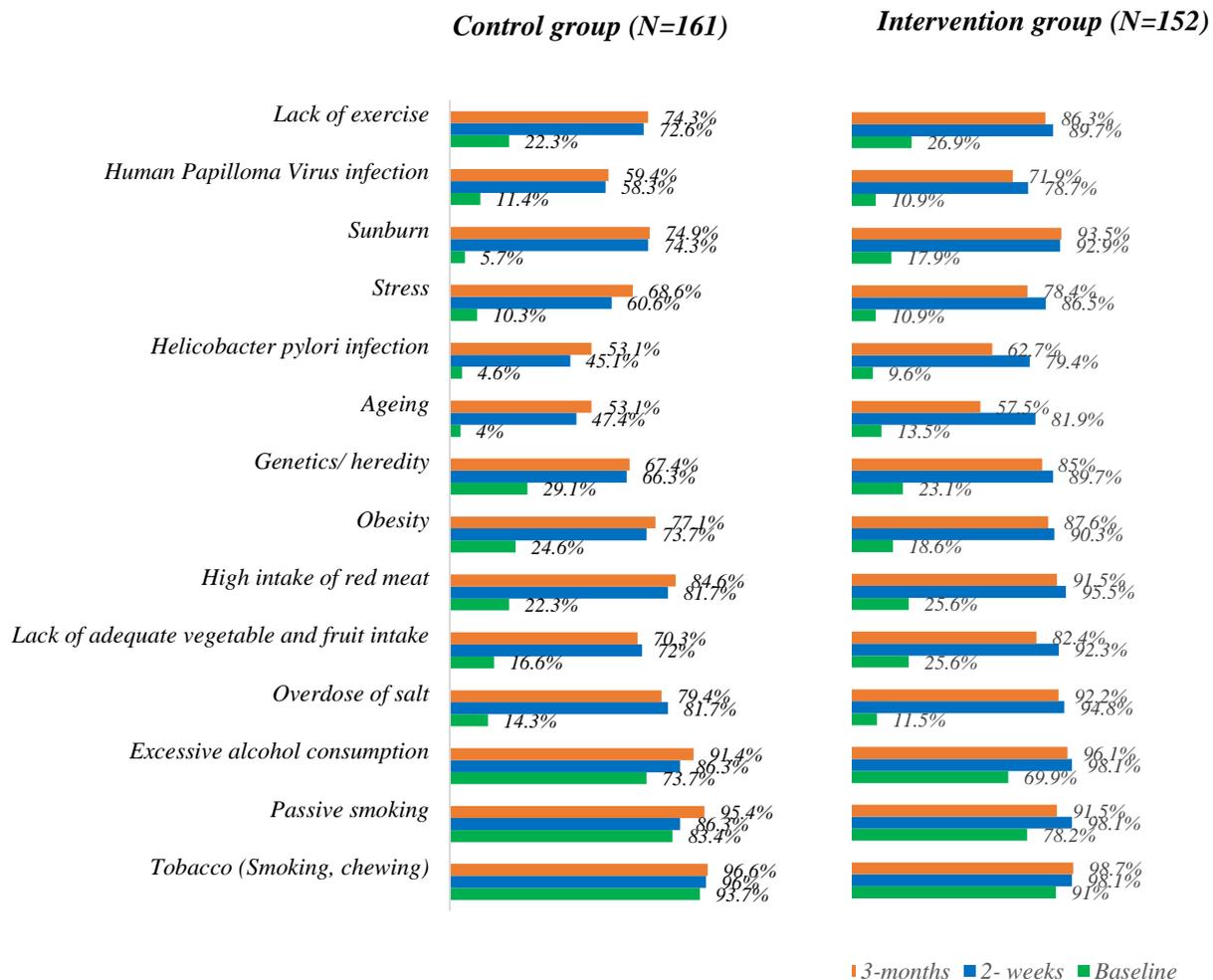


Figure 7: Change in risk factors knowledge during three-time phases among students

The paired t-test showed baseline score on knowledge, risk factors, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self- esteem and health promotion of control and intervention students' group was statistically insignificant. There was change in the

scores of in both groups during 2-weeks and 3-months follow up. Figure 8 showed the change in knowledge on cancer and its risk factors during different time phases.

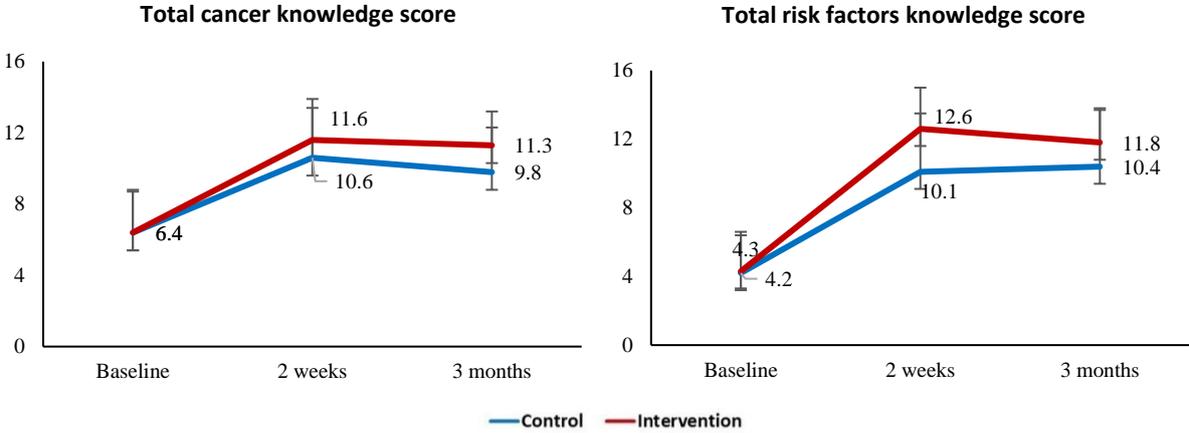


Figure 8: Changes in cancer knowledge and risk factors score of students over time

A two-way repeated measures ANOVA showed that there was effect of intervention, time, and interaction in all scores. The table 12 shows the effects of intervention, time and interaction upon knowledge, health beliefs subscales, self-esteem and healthy practice in students’ groups.

3.2.1.4 Health beliefs related to cancer

The difference in total health belief subscale scores over time is provided in figure 9.

Perceived susceptibility:

The total perceived susceptibility mean score ±SD among control and intervention was 10.8±1.9 and 11.1±1.9 respectively during baseline. After 2-weeks, the perceived susceptibility increased to 11.1±1.8 and 13.9±1.8 ($p<0.001$) in control and intervention group. During 3-months follow up, it decreased to 11.0±1.7 in control group while it further increased to 14.1±1.8 ($p<0.001$) in intervention group. This indicated that intervention group perceived

more susceptibility than control group.

Table 12: Effect on variables of students' groups at repeated time measures

		Main effect ^{a)}				Interaction ^{a)}	
		Intervention		Time		Intervention × Time	
		F	p-value	F	p-value	F	p-value
Knowledge	Intervention group	22.6	p<.001	396.9	p<.001	8.6	p<.001
	Control group						
Risk factors	Intervention group	50.6	p<.001	929.6	p<.001	17.5	p<.001
	Control group						
Perceived susceptibility	Intervention group	274.7	p<.001	73.7	p<.001	55.2	p<.001
	Control group						
Perceived severity	Intervention group	46.6	p<.001	47.0	p<.001	22.5	p<.001
	Control group						
Perceived benefits	Intervention group	35.5	p<.001	306.0	p<.001	17.6	p<.001
	Control group						
Perceived barriers	Intervention group	53.2	p<.001	28.2	p<.001	25.0	p<.001
	Control group						
Self-esteem	Intervention group	221.2	p<.001	106.2	p<.001	59.5	p<.001
	Control group						
Healthy practice	Intervention group	30.4	p<.001	71.5	p<.001	24.1	p<.001
	Control group						

Data were shown as mean (SD)

Knowledge score: 0-14 (14 items)

Risk factors score: 0-14 (14 items)

Health belief sub scales score; perceived susceptibility: 4-16 (4 items), perceived severity: 4-16 (4 items), perceived benefits: 6-24 (6 items), perceived barriers: 4-16 (4 items)

Self- esteem score: 0-30 (10 items)

Healthy practice score:0-5 (exercise habit, sleeping hours, healthy diet, cancer talk, salt consumption)

a) Two-way repeated measures ANOVA

Perceived severity:

The total perceived severity mean score \pm SD among control and intervention was 12.3 \pm 1.8 and 12.0 \pm 2.2 respectively during baseline test. It increased to 12.6 \pm 2.0 and 12.8 \pm 1.7 ($p=0.4$) in

control and intervention group respectively although it was statistically insignificant. Both groups perceived severity more than it was during 2-weeks follow up however, as the time passed by, intervention group perceived more severity to cancer than control group.

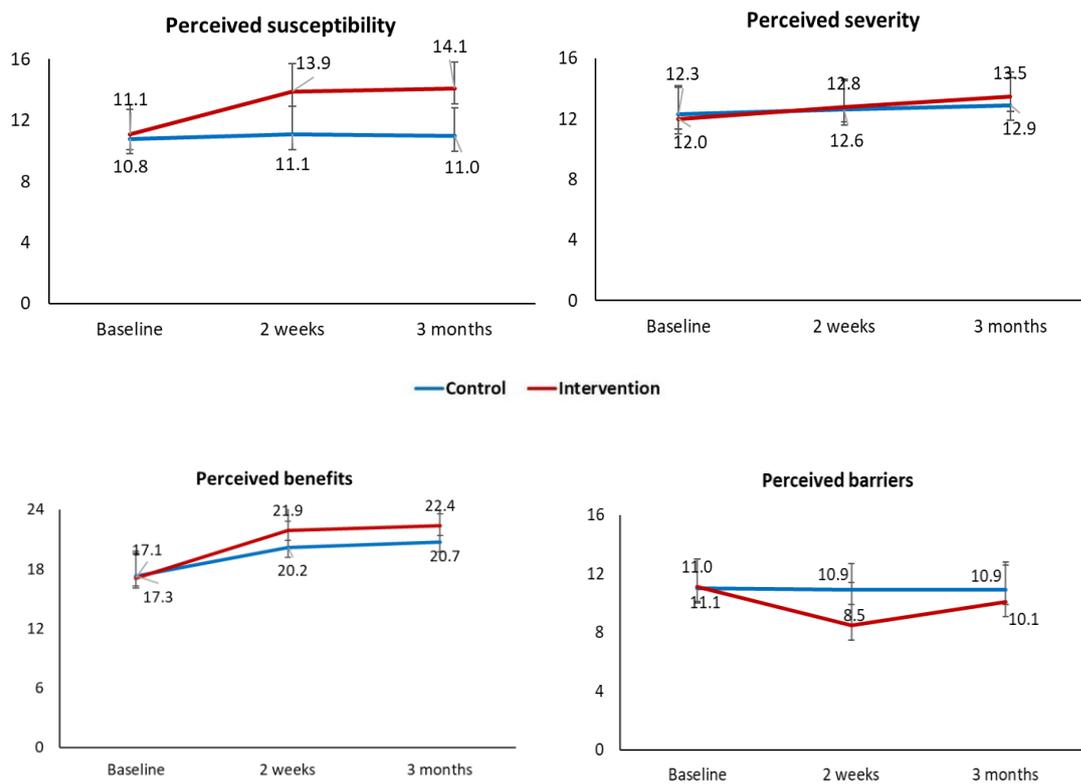


Figure 9: Changes in total health belief subscale scores of students over time

Perceived benefits:

The total perceived benefits mean score \pm SD among control and intervention was 17.3 ± 2.5 and 17.1 ± 2.5 respectively during baseline. After 2-weeks, the perceived benefits increased to 20.2 ± 2.6 and 21.9 ± 2.4 ($p < 0.001$) in control and intervention group respectively. During 3-months follow up, it increased to 20.7 ± 2.9 in control group and further increased to 22.4 ± 1.9 ($p < 0.001$) in intervention group. This indicated that intervention group perceived more benefits

to reduce risk of cancer than control group.

Perceived barriers:

The total perceived barriers mean score \pm SD among control and intervention was 11.0 ± 2.0 and 11.1 ± 1.9 respectively during baseline test. When followed up after 2-weeks, the perceived barriers decreased to 10.9 ± 1.8 and 8.5 ± 2.9 ($p<0.001$) in control and intervention group respectively. During 3-months follow up, it remained static in control group while it increased to 10.9 ± 1.7 ($p<0.001$) in intervention group. This indicated that intervention group perceived less barriers after cancer education, however, their thoughts on barriers increased after three months.

3.2.1.5 Rosenberg self- esteem

The total Rosenberg score was statistically insignificant during baseline in control (16.5 ± 3.3) and intervention group (16.8 ± 2.8). In control group, the mean score did not change with big figures which was 16.8 ± 3.8 in 2-weeks and 16.6 ± 2.3 in 3-months. In intervention group, the self- esteem score increased to 22.5 ± 5.8 and 22.7 ± 4.3 during two follow ups. The results showed that new cancer education program was more effective in increasing and sustaining self-esteem in intervention group ($p<0.001$). Figure 10 showed change in self-esteem of two groups over time.

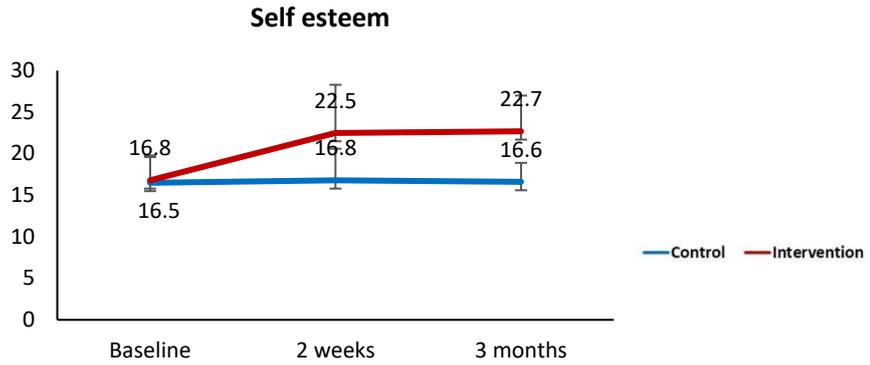


Figure 10: Changes in self-esteem score of students over time

3.2.1.6 Healthy practice

Habit of exercise, sleeping hours of at least 7 hours, more than 4-5 servings of green vegetables, fiber, cereals per week, cancer talk, and proper care on salt consumption was considered as healthy practice. Figure 11 showed changes in healthy practice in two groups over time.

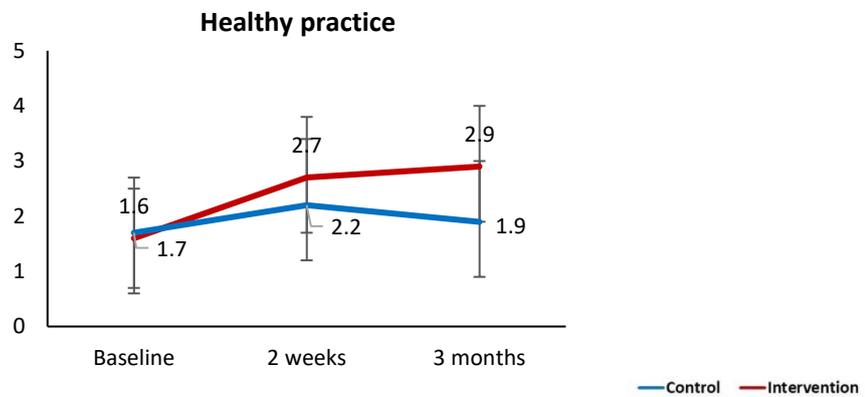


Figure 11: Changes in healthy practice of students over time

During baseline there was no significant difference regarding healthy practice except sleeping hours in students. Students in intervention group increased self-reported exercise habit, healthy diet consumption and cancer talk when followed up after 3-months. Further information is provided in table 13.

Table 13: Healthy practice among students

Variables	Category	Baseline			2- weeks			3- months		
		Control (161)	Intervention (152)	p-value	Control (161)	Intervention (152)	p-value	Control (161)	Intervention (152)	p-value
Exercise habit	No	111 (68.9)	89 (58.6)	0.056	104 (64.4)	23 (15.2)	<0.001	123 (76.4)	47 (30.9)	<0.001
	Yes	50 (31.1)	63 (41.4)		57 (35.6)	129 (84.8)		38 (23.6)	105 (69.1)	
Sleeping hours	At least 7	71 (44.1)	37 (24.3)	<0.001	55 (34.2)	42 (27.6)	0.210	53 (32.9)	54 (35.5)	0.627
	Less than 6	90 (55.9)	115 (75.7)		106 (65.8)	110 (72.4)		108 (67.1)	98 (64.5)	
Healthy diet servings per week	More than 5	34 (21.1)	21 (13.8)	0.875	91 (56.5)	50 (32.9)	<0.001	53 (32.9)	54 (35.5)	0.019
	Less than 5	127 (78.9)	131 (86.2)		70 (43.5)	102 (67.1)		108 (67.1)	98 (64.5)	
Talked about cancer	No	113 (70.2)	106 (69.7)	0.931	92 (57.1)	19 (12.5)	0.019	111 (68.9)	16 (10.5)	<0.001
	Yes	48 (29.8)	46 (30.3)		69 (42.9)	133 (87.5)		50 (31.1)	136 (89.5)	
Salt consumption	No	86 (53.4)	78 (51.3)	0.710	73 (45.3)	89 (58.6)	<0.001	79 (49.1)	82 (53.9)	0.263
	Yes, always	75 (46.6)	74 (48.7)		88 (54.7)	63 (41.4)		65 (42.8)	87 (57.2)	

3.2.2 Sharing partners

3.2.2.1 Socio- personal information

There was no statistical significance between gender ($p=0.871$), family history of chronic illness ($p=0.298$), importance of cancer talks within family ($p=0.490$), history of cancer classes ($p=0.303$), and wish to take cancer screening ($p=0.087$) in control and intervention group.

Sharing partners in intervention group had talked about cancer with others during baseline ($p=0.008$). Table 14 showed the socio- personal information of sharing partners during baseline.

Table 14: Socio personal information of sharing partners

Variables	Category	Control (161)	Intervention (152)	p-value
		N (%)	N (%)	
Age (Mean±SD)		35.2±8.6	36.5±9.0	
Sex	Male	60 (37.3)	58 (38.2)	0.871
	Female	101 (62.7)	94 (61.8)	
Sharing partners	Mother	79 (49.1)	67 (44.1)	0.335
	Father	42 (26.1)	37 (24.3)	
	Sister	22 (13.7)	27 (17.8)	
	Brother	18 (11.2)	21 (13.8)	
Family history of chronic illness	No	139 (86.3)	137 (90.1)	0.298
	Yes	22 (13.7)	15 (9.9)	
Cancer talk partner	With all	42 (26.1)	61 (40.1)	0.008
	With friends only	14 (8.7)	21 (13.8)	
	With family only	18 (11.2)	21 (13.8)	
	With kids only	6 (3.7)	2 (1.3)	
	With all except kids	1 (0.6)	2 (1.3)	
	With none	85 (52.8)	49 (32.2)	
Importance of cancer talk within family	Not important	17 (10.6)	14 (9.2)	0.490
	Somewhat important	101 (62.7)	105 (69.1)	
	Very important	43 (26.7)	33 (21.7)	
Ever taken cancer class	No	144 (89.4)	141 (92.8)	0.303
	Yes	17 (10.6)	11 (7.2)	
Wish to take cancer screening	No	51 (31.7)	35 (23.0)	0.087
	Yes	110 (68.3)	119 (77.3)	

3.2.2.2 Knowledge on cancer

Around 87.9% sharing partners in control group knew that cancer as one of the leading causes of death in Nepal. The percentage increased to 90.1% during 2-weeks and to 85.7% during 3-months. Around 29.2% of sharing partners in intervention group were aware of cervical cancer as the major female cancer during baseline which increased to 57.2% in 2-weeks and later 55.9% in 3-months. Detailed information is provided in figure 12.

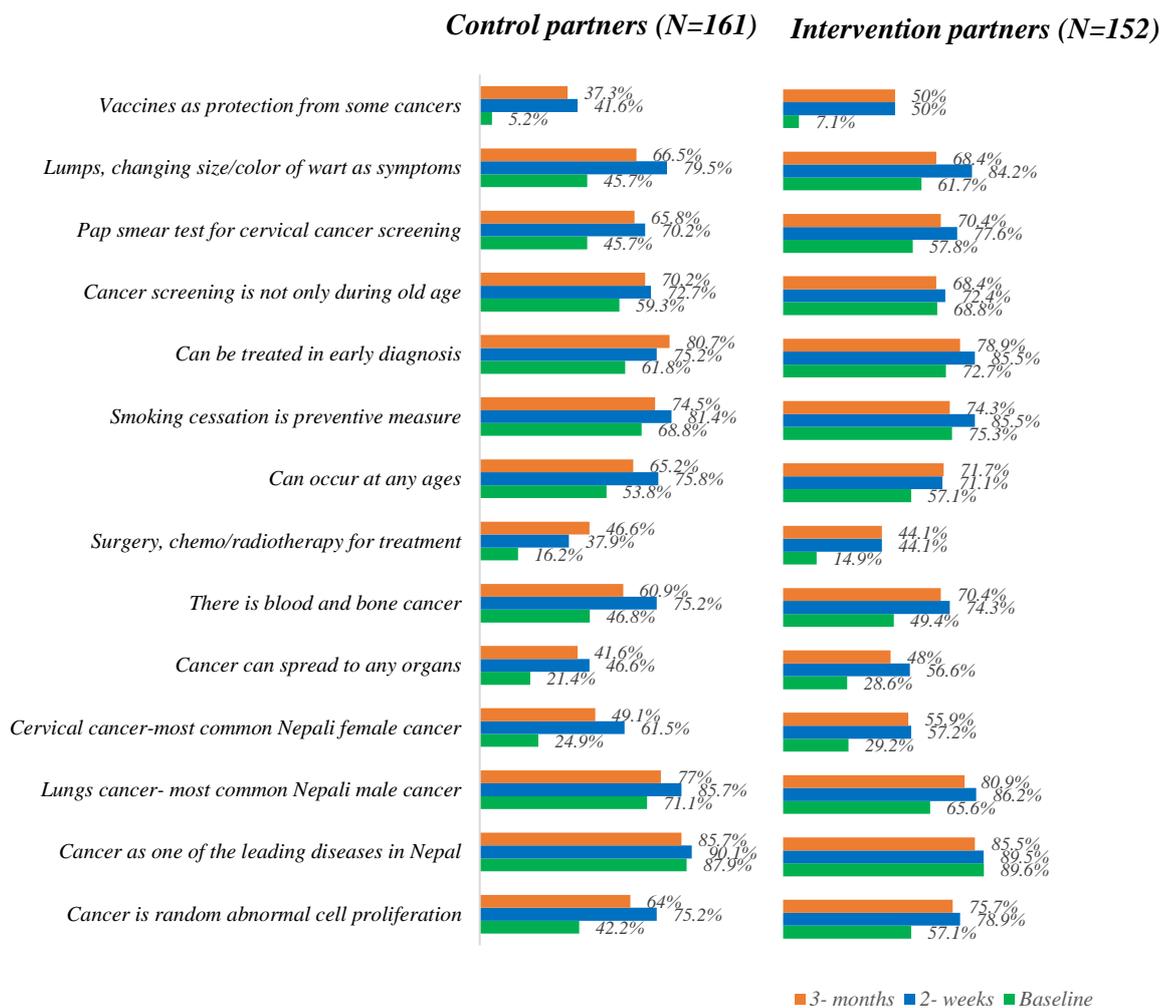


Fig 12: Bar graph showing change in cancer knowledge score over time among sharing partners

3.2.2.3 Knowledge on risk factors

Tobacco was considered as major risk factors by sharing partners in both groups during baseline test. Helicobacter pylori, Human Papilloma virus infection, and ageing were least considered as risk factors. Further detailed information is provided in figure 13.

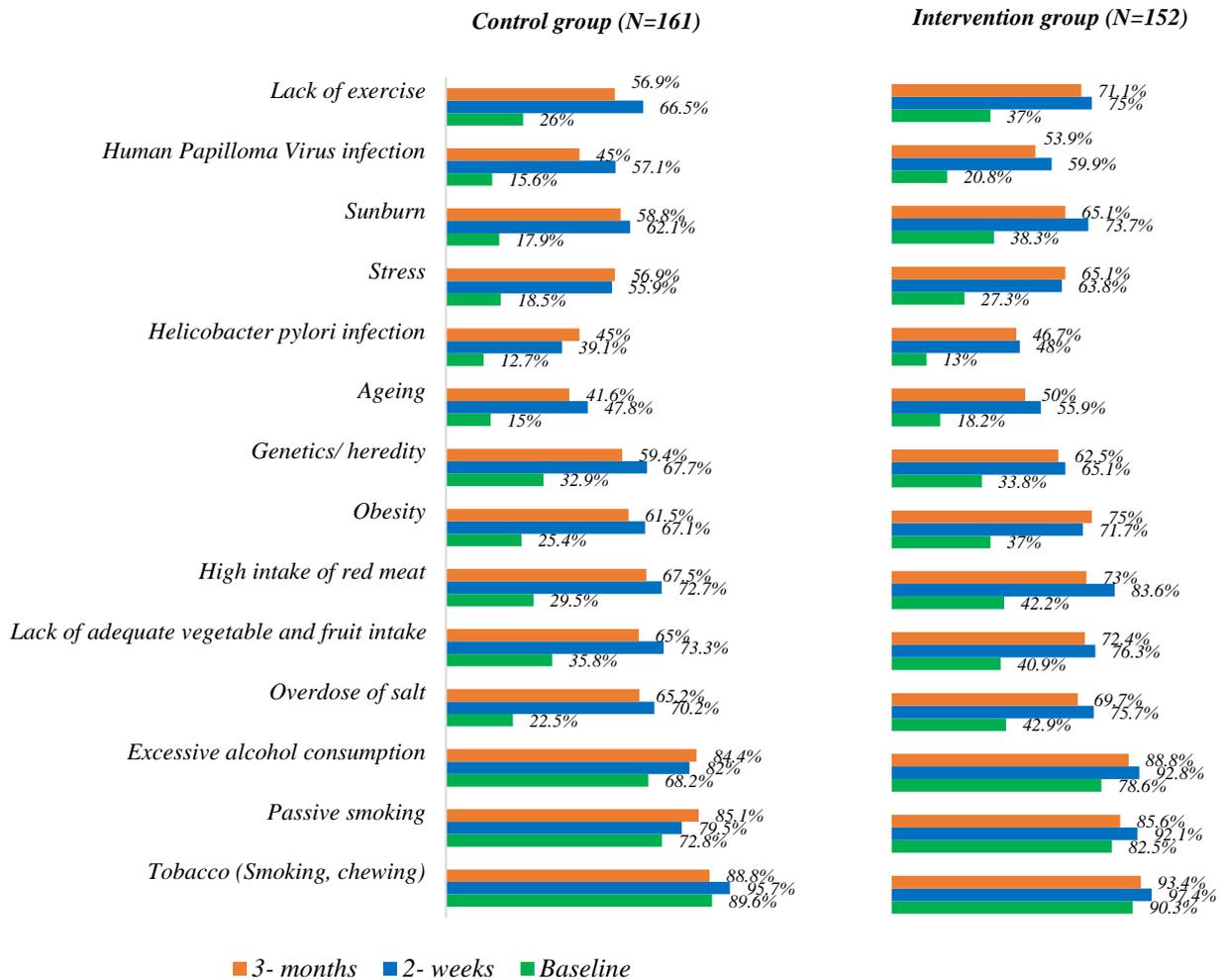


Figure 13: Bar graph showing change in risk factors knowledge over time among sharing partners

The mean score of total risk factors was 4.9 ± 3.2 and 6.0 ± 3.6 in control and intervention group during baseline test which was statistically significant. The paired t-test showed baseline score on knowledge, perceived susceptibility, perceived benefits, perceived barriers, self- esteem and healthy practice of control and intervention group was statistically insignificant among sharing partners. Figure 14 showed the changes in knowledge scores over time in sharing partners.

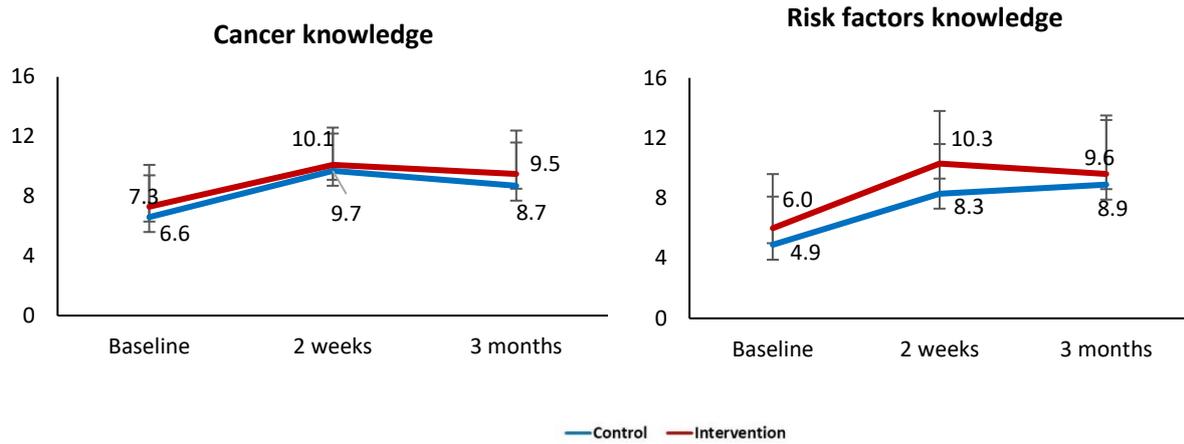


Figure 14: Changes in cancer knowledge and risk factors score of sharing partners over time

The paired t- test showed baseline risk factors knowledge and perceived severity between two groups were statistically significant. The new-cancer education program included cancer communication between students and sharing partners through joint assignment. A two-way repeated measures ANOVA showed that there was effect of intervention, time, and interaction in some scores of sharing partners. The table showing the effects of intervention, time and interaction upon variables are presented in table 15.

Table 15: Effect on variables of sharing partners' groups at repeated time measures

		Main effect ^{a)}				Interaction ^{a)}	
		Intervention		Time		Intervention × Time	
		F	p-value	F	p-value	F	p-value
Knowledge	Intervention group	10.20	p<.001	96.30	p<.001	0.26	0.791
	Control group						
Risk factors	Intervention group	14.10	p<.001	166.32	p<.001	0.25	0.776
	Control group						
Perceived susceptibility	Intervention group	32.17	p<.001	24.06	p<.001	6.46	p<.001
	Control group						
Perceived severity	Intervention group	31.58	p<.001	25.24	p<.001	0.48	0.616
	Control group						
Perceived benefits	Intervention group	5.30	0.022	4.98	0.016	2.68	0.070
	Control group						
Perceived barriers	Intervention group	18.31	p<.001	5.21	0.006	1.60	0.249
	Control group						
Self-esteem	Intervention group	2.72	0.100	7.41	p<.001	3.22	0.040
	Control group						
Healthy practice	Intervention group	43.19	p<.001	34.32	p<.001	6.92	0.002
	Control group						

Note: Data were shown as mean (SD)

Knowledge score: 0-14 (14 items)

Risk factors score: 0-14 (14 items)

Health belief sub scales score; perceived susceptibility: 4-16 (4 items), perceived severity: 4-16 (4 items),

perceived benefits: 6-24 (6 items), perceived barriers: 4-16 (4 items)

Self- esteem score (range): 0-30 (10 items)

Healthy practice score (range):0-6 (Smoking habit, drink alcohol, exercise habit, healthy food consumption, care about salt intake, cancer screening test)

a) Two-way repeated measures ANOVA

3.2.2.4 Health beliefs related to cancer

The changes in health belief subscales over time is presented in figure 15.

Perceived susceptibility:

The total perceived susceptibility mean score \pm SD among control and intervention was 10.8 ± 2.4 and 10.9 ± 2.4 respectively during baseline. The sharing partners in intervention group perceived more susceptibility to cancer when followed up during 3-months.

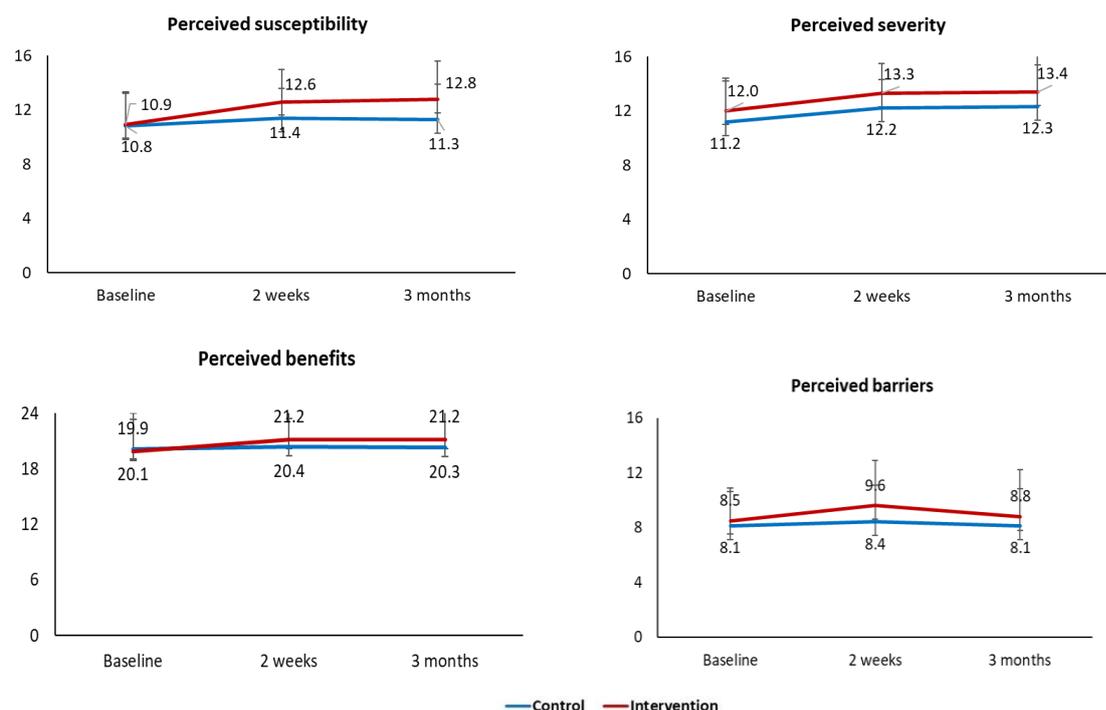


Figure 15: Changes in health belief subscales score of sharing partners over time

Perceived severity:

The total perceived severity mean score \pm SD among control and intervention was 11.2 ± 3.0 and 12.0 ± 2.4 ($p=0.04$) respectively when tested baseline. Follow-up comparisons indicated that pairwise difference was significant during all three tests.

Perceived benefits:

The total perceived benefits mean score \pm SD among control and intervention was 20.1 ± 3.9 and 19.9 ± 3.4 respectively during baseline ($p=0.66$). The follow up results indicated intervention

group perceiving more benefits to reduce risk than control group.

Perceived barriers:

The total perceived barriers mean score \pm SD among control and intervention was 8.1 ± 2.5 and 8.5 ± 2.4 respectively when tested during baseline. When followed up, the perceived barriers increased in 2-weeks but later decreased in second follow up. The intervention group perceived more barriers during 2-weeks but reduced with the time phase.

3.2.2.5 Rosenberg Self esteem

The total Rosenberg score was statistically insignificant during baseline in control (18.2 ± 4.1) and intervention group (18.3 ± 4.1). The results showed that self- esteem increased on the sharing partners compared to control group ($p<0.001$). Figure 16 showed the change in self-esteem scores of sharing partners over time.

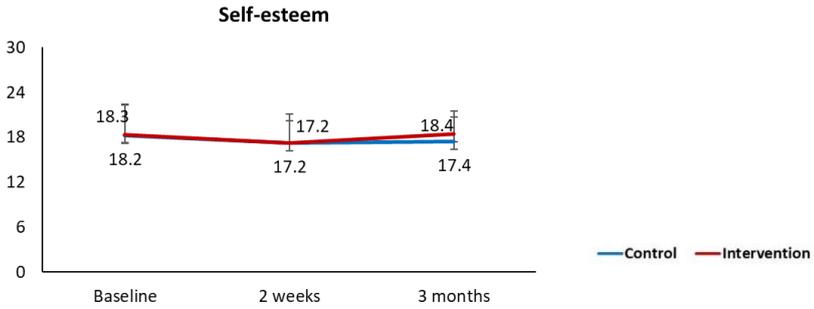


Figure 16: Changes in self-esteem score of sharing partners over time

3.2.2.6 Healthy practice:

Non- smoking, non- alcohol drinking, exercise, proper consumption of healthy food, precaution on salt intake and cancer screening test were considered as healthy practice among sharing

partners. Figure 17 showed changes in healthy practice of sharing partners over time.



Figure 17: Changes in healthy practice score of sharing partners over time

More sharing partners had done cancer screening test in intervention group than control during baseline test. During 3-months, there was statistical differences in exercise habit between control and intervention groups. This possibly suggested that cancer communication was more in intervention group which could connect sharing partners in health promotion. Detailed information is presented in table 16.

Table 16: Healthy practice among sharing partners

Variables	Category	Baseline			2- weeks			3- months		
		Control	Intervention	p- value	Control	Intervention	p- value	Control	Intervention	p- value
		(161)	(152)		(161)	(152)		(161)	(152)	
Smoking habit	No	135 (83.9)	131 (86.2)	0.564	148 (91.9)	137 (90.1)	0.578	145 (90.1)	137 (90.1)	0.984
	Yes	26 (16.1)	21 (13.8)		13 (8.1)	15 (9.9)		16 (9.9)	15 (9.9)	
Drink alcohol	No	106 (65.8)	105 (69.1)	0.541	110 (68.3)	110 (72.4)	0.434	118 (73.3)	127 (83.6)	0.028
	Yes	55 (34.2)	47 (30.9)		51 (31.7)	42 (27.6)		43 (26.7)	25 (16.4)	
Exercise habit	No	141 (87.6)	128 (84.2)	0.392	121 (75.2)	105 (69.1)	0.230	137 (85.1)	76 (50.0)	<0.001
	Yes	20 (12.4)	24 (15.8)		40 (24.8)	47 (30.9)		24 (14.9)	76 (50.0)	
Healthy food consumption per week	Sometimes	55 (34.2)	42 (27.6)	0.212	24 (14.9)	25 (16.4)	0.708	24 (14.9)	16 (10.5)	0.246
	Frequently	106 (65.8)	110 (72.4)		137 (85.1)	127 (83.6)		137 (85.1)	136 (89.5)	
Care about salt intake	Sometimes	75 (46.6)	58 (38.2)	0.132	74 (46.0)	34 (22.4)	<0.001	76 (47.2)	50 (32.9)	<0.001
	Always	86 (53.4)	94 (61.8)		87 (54.0)	118 (77.6)		85 (52.8)	102 (67.1)	
Cancer screening test	No	159 (98.8)	144 (94.7)	0.043	157 (97.5)	128 (84.2)	<0.001	157 (97.5)	124 (81.6)	<0.001
	Yes	2 (1.2)	8 (5.3)		4 (2.5)	24 (15.7)		4 (2.5)	28 (18.4)	

CHAPTER IV

DISCUSSION

This chapter includes discussion of two chapters.

4.1 Awareness and cancer communication between Nepali students-mothers

Our study explored the overall knowledge and diffusion of cancer information between students and their mothers. This is the first study conducted in Nepal, pairing mothers with their children, adding information about cancer communication in families and linking student knowledge and mothers' screening practices. Our study showed that students and mothers had low knowledge on risks and prevention of cervical cancer.

Cancer talk was the strong predictor of knowledge among students. During adolescence, peers play a crucial role in changing the personality, attitudes and behavior of a person (Albert et al,2013). Hence, cervical cancer education programs as well as other health education programs including peer group activities might be more effective in the adolescent group.

This study revealed that women who had discussed cervical cancer with other people were more active in taking screening tests. They also had greater motivation and reduced barriers and encouraged other women to take screening tests. Education programs collaborating with mothers and children might help in increasing their perception of susceptibility to cervical cancer and in increasing their cancer screening uptake in the future. Students can share knowledge about the education program with their mothers and other family members,

increasing their knowledge levels, resulting in the diffusion of cancer knowledge, which supports the Learning Partner Model (Suketomo et al,2016).

Our study showed cancer screening habit as a strong predictor of knowledge among mothers.

While about 32.4% of the mothers had heard about screening, only 15% had taken the cervical cancer screening test. Disease prevention programs can be quickly undermined by rumors and misinformation if the reasons for targeting girls only are not fully and sensitively communicated.

Therefore, educating men, including fathers and boys, about HPV vaccines and cervical cancer screening is particularly important in this regard (WHO,2013). Apart from an individual's attitudes and self-concept, support systems, social rules and regulations, peer groups, informal networks, national laws and policies can be employed to understand the causes and possible actions to modify health-related behavior changes.

Summary

This study demonstrated a lack of awareness about cervical cancer and HPV infection among Nepalese adolescents and their mothers. There was no association between knowledge of students and screening practices of mothers; however, cancer communication between mothers and students helped to increase awareness regarding cervical cancer. As talk on cancer was strong predictor of knowledge among students, students and mothers' communication should be increased to reduce the knowledge gap between parents and children. There is a strong need for a government- supported, school-based cancer education program to address the issues of

HPV vaccination, cervical cancer screening and the reduction of risk factors. While the government has yet to address all these challenges, health care providers can play an important role in effective counseling and explanation to people of screening tests and vaccines. Mothers who have had cervical cancer screening were not able to maintain the screening practice. Unless a trigger is present, mothers are less likely to take and continue screening tests.

Since fathers and husbands play an influential role in female's decision to screening, studies are important to understand the knowledge as well as attitudes of males on cervical cancer and screening behaviors. An education program, by collaborating with family members and students, might help to address the issue of vaccine for students and screening tests for mothers. This study suggested the need of programs involving adolescents, peer groups and their family members to make effective and acceptable; which is only possible when both groups are comfortable in sharing their ideas or opinions.

4.2 Evaluation of new cancer education program

Based on the findings that cancer communication increased knowledge of mothers on cervical cancer, this study incorporated students and their sharing partners, most of whom were family members. Although there are several studies done in Nepal to explore the cancer awareness of adults, little have been known about the impact of cancer communication among adolescents and their partners. Furthermore, this is the first study being carried out in Nepal, pairing adolescents with their sharing partners, linking cancer talk among family members.

This study was conducted in Lalitpur, Nepal. In our study, 51.4% of students were female which was little more than the national census of Lalitpur metropolitan city, 49.1%. The literacy rate among youths (15-24 years) in Nepal was 89.95% while the literacy rate of male and female for 15-25 age groups are 88.2% and 76.7% respectively (Central Bureau of Statistics,2011). There was no significant difference between knowledge and sex of students in both groups. As all students were of same age, the relationship between dependent variables and age were not checked.

Impact of new cancer education program on students

The main objective was to develop new education program using Health Belief Model and Learning Partner Model which could be easily adaptable in Nepali classroom settings. Health motivation is the central focus of HBM (National Cancer Institute,2005). Bryan et al(2016) stated that adolescents were known to be highly motivated to live up to important values that are shared with their peers. However, in preventive health behaviors, HBM does not suggest a strategy for changing health-related actions. Hence, in order to address the peer roles, Learning Partner Model was integrated with HBM to develop new education program. The integration of these two health models addressed the health behaviors of students and diffusion of information in families. As adolescence brings significant physical, psychological, and social changes, unhealthy habits like tobacco or alcohol use, lack of physical activity, can jeopardize their current and future health. Therefore, promoting healthy behaviors, and taking steps to

protect oneself from health risks are critical for disease prevention (Bonnie, Stroud & Breiner, 2014).

The HBM assumed that students' willingness to change their health behaviors is primarily due to perceived susceptibility, severity, benefits, barriers, self-efficacy and cues to action. The LPM focused on connecting family members in this program through joint assignment. Our results showed this integrated model was effective in increasing subscales of health belief, initiation of healthy practice and in sharing of information among family members and neighbors during two follow ups. The increment in health belief subscales and cancer screening practice among sharing partners showed the associations between LPM and HBM. Therefore, we could draw the inference that our integrated model was a good fit for this study.

The general objective of new program was to make students aware and to encourage adolescent-family communication on cancer. The sole purpose of specific behavioral objectives was to involve student take part individually and in groups through different tasks. To reach the goal, our program engaged students in three different sessions based on HBM. Several interventions based on HBM has been effective compared to studies without any model (Masoudiyekta et al, 2018; Kissal and Kartal, 2019; Jeihooni et al, 2019).

4.2.1 Describe and discuss overall cancer knowledge with other students using active learning approach and summarize it

The first session included sharing of information from peer leaders to students in which students

trained as peer leaders conducted the classes using active learning methods. During the second session, students formed groups and conducted photovoice research on the theme of cancer followed by narration and group work which could trigger students to develop feeling of belonging and self- confidence. The third session involved students and their sharing partners to complete a joint assignment which could promote diffusion of information based on LPM. Our results showed that there was significant increase in knowledge, health beliefs, self-esteem, health promoting activities as compared to baseline tests. It was further interesting as students reported change in exercise habit, cancer talking behaviors more during 3- months follow up. Ajzen (1991) proposed the theory of planned behavior which states that intention towards behavior, subjective norms, and perceived behavioral control, together shape an individual's behavioral intentions and behaviors. There was slight change in the health promotion and cancer screening practice of partners. It is obvious that more information will lead to increased public awareness and will encourage some minimal effort by them to change their behaviors. However, the new habit tends to not persist. Students were directly involved in teaching-learning process, which helped them to start and continue healthy behaviors even after completion of education programs.

Having knowledge is the first key and important element in developing healthy behavior. The most appropriate source of information is a school- based program. School-based health promotion can be particularly valuable in developing countries facing the challenges of low

health literacy and high burden of disease (Mukamana and Johri,2016).

There was significant interaction between intervention and time. There was a substantial main effect for time with both groups increasing all dependent variable score across three time periods. The main effect comparing the two types of intervention was significant ($p < 0.001$) suggesting difference in the effectiveness of the two program approaches. This result suggested that this new program was effective than traditional lecture methods in the classes.

4.2.2 Search cancer in the surrounding through photovoice, engage in group discussion and produce a poster

Several studies have supported the idea that adolescents were more likely to modify their behaviors and attitudes if they receive health messages from peers who face similar concerns and pressure (Abdi and Fatemah,2013; Wye et al,2006; Yamaguchi et al, 2011). A Nepali study by Mahat and Ayres (2011) showed significant positive impact of peer-led intervention in increasing self-efficacy and reduce potential risk behaviors related to sexually transmitted diseases among students. Another study showed efficacy of the classroom-based intervention for improving social-behavioral and positive aspects of wellbeing indicators among subgroups of children exposed to armed conflict in a low-income country (Jordans et al, 2010). Since peers play an important role in psychological development of most adolescents, peer education is

considered as a health promotion strategy in adolescents (Dhimal et al, 2018; Tome et al,2012). Kissal and Kartal(2019) found that using video format was more effective than traditional methods of health education in creating short- term knowledge but offered no advantages in improving long-term knowledge retention. Studies focused on use of e-learning for medical education in low- and middle-income countries showed limitations to reach its full potential due to restricted financial resources and sustainability (Barteit et al,2020). As this new cancer education program does not require additional materials like video, mobile, the effectiveness and long-term impact of health messages ultimately depend on how well the end users can identify with the content that is presented.

Our study showed decrease in knowledge score compared to first follow up. These findings are similar to another study where there was a declining of sufficient knowledge at after 3 months group compared to immediate group (Bardosono et al,2018). Although knowledge can decrease with time, it is important to keep the healthy beliefs and healthy practice behaviors.

Our study showed that school- based programs are effective in addressing knowledge of students. During baseline test about 11% were aware of lungs cancer as not the most common cancer among Nepali female. It might be due to lack of information about other types of cancer.

Although government and some organizations are conducting various programs to make people aware of different cancers, Lungs cancer is the major highlight in Nepal, leading cancers might have shadowed information about other cancers (Poudel and Sumi,2018).

Students in both groups agreed that smoking cessation as one of the preventive measures of cancer. Binu et al(2010) highlighted that students were aware of smoking and its relation to cancer. A study further showed that friends as the most influential factor to influence smoking among adolescents. The fact that peers are influential over smoking habit highlighted the importance of peer- education in getting rid of the habit.

The baseline test showed that there was no difference in knowledge, health beliefs, self-esteem and health promotion habits of students in both groups. The students in traditional lecture groups increased their knowledge, health beliefs, self-esteem and health promoting activities similar to intervention group. However, the effect was seen more sustainably in the intervention group. The new program tried to support student as an individual and as a team to address the opportunities to learn both in and out of classroom based on a shared developmental framework uniting with families and communities as a whole. Studies have suggested that students are more likely to attend school and get attached to learning, when they have strong, trusting connection to adults (Darling-Hammond et al,2019)

Students felt more susceptible, serious, beneficial during 3- months follow up than during baseline. There was decrease in perceived barriers after 2- weeks however it increased during 3- months follow up. It might be possible that knowledge about risk factors, preventive measures helped in reducing barriers after cancer class. However, as students were aware of the risks and preventions, they might have thought that they could not change things immediately

resulting in increased barriers.

The Rosenberg self- esteem score was 16.5 in high school students which was more than the mean score. There was no difference between self-esteem of boys and girls during baseline test in our study. It might be because adolescent girls are getting equal opportunities like boys in recent years. This finding is in contrast with a Pakistani and Bulgarian study where boys showed higher self- esteem level than girls (Farid and Akhtar,2013; Minev et al,2018). Another Nepali study conducted among nursing students showed the low self-esteem was due to stress in academic environment (Acharya and Chalise, 2015). Orth, Robins & Widaman (2012) stated that for both genders, self-esteem is relatively high in childhood, drops during adolescence, rises gradually throughout adulthood before it tends to decline in old age.

4.2.3 Analyze the importance of healthy behavior, share with partners and adopt healthy habits

Students in new program actively took part in group discussion, problem finding and poster making. By experimenting, learning, students come to identify their characteristics, abilities and needs. Group works can increase self-esteem and enhance empathy and social skills. Participating in teaching- learning, group activities, communicating with family members increases self- confidence, identity, feeling of belonging and competence which are four components of self- esteem. Wahyuningsih (2018) recommended that group activities inside classroom could increase feeling of competence, feeling to be respected, and confidence as well

as students' morale and motivation.

The repeated ANOVA showed that there was significant interaction between program type and time ($p < 0.005$) and a substantial main effect for time ($p < 0.005$) with both groups increasing knowledge, beliefs, self-esteem and practice across three time periods. The main effect comparing the two types of intervention program was significant ($p < 0.001$) suggesting difference in the effectiveness of the two program approaches. Our model-based education program appeared to have been effective in increasing the perceived susceptibility, severity, benefits and self-esteem among intervention group of students. This showed that active learning methods are useful in increasing health beliefs subscales, self-esteem and practice of students by engaging students directly into actions. The aim of health education should not only be to change knowledge level but also people's health behaviors by their own participation. This finding is in contrast with the study conducted among nursing students in Turkey which showed that the difference in susceptibility, seriousness, health motivation, benefits, barriers during three different time phases were statistically insignificant (Kissal and Kartal, 2019).

The health promotion increased when checked after 3-months and is statistically significant between control and intervention group. The problem-based learning in intervention group allowed students to define, analyze, evaluate and present their ideas on cancer prevention using active learning method (Ku, Phillipson & Phillipson, 2015). This helped students to use their skills to make decisions and solve problems. Hence this might have triggered to start new

practice for good health among intervention group. Although control group also said to have started the new habit, they could not continue longer. This might be because of the difficulty in continuation of exercise habits. Also, this might be because of traditional teaching method which inputs knowledge but does not lead to change behavior. This finding is different to the study where there was no improvement in level of self-reported physical activity in intervention and control group (Sharma et al,2018). Our findings support the diffusion of innovation theory by Rogers (1962) which found that adoption of new behavior does not have simultaneously in a social system; rather it is a process whereby some people are more opted to adopt the innovation than others.

Impact of new cancer education program on sharing partners

Majority of sharing partners were mothers, followed by fathers, sisters and brothers. During baseline, only 3.9% sharing partners reported for cancer screening. This finding is less than another Nepali study where 15% of participants had taken the cervical cancer screening test. Less screening practice was related to lack of knowledge and awareness on screening in communities, cultural norms, fear of cancer, non-existent of laboratories in rural areas, and embarrassment (Poudel and Sumi,2019). Sharing partners in intervention group had talked about cancer more than control group during baseline. Many variables such as interests, awareness, education, socioeconomic factors, culture and family practices might have played role in increasing talks with other.

The self-reported screening practice increased to 10.2% after cancer education program during 3- months follow up. The increment was seen more in intervention group than control group. It showed that cancer communication among students and sharing partners might have played a key role and encouraged them to go for screening tests. Health communication contributes to health promotion by providing health- related information and influence the health behaviors of individuals, and communities (Nkanunye and Obiechina,2017; Poudel and Sumi,2019). The total knowledge score of sharing partners was lower than the average during baseline. This finding is similar to another Nepali study in which adults had less awareness on cancer risk factors (Poudel and Sumi,2018).

A Nepali study conducted to understand health behavior related to cardiovascular diseases showed that Nepali adults have low perceived susceptibility and severity (Poudel and Sumi, 2017). In this study as well, perceived susceptibility score was low among sharing partners and students. It can be implied that Nepali students have low perceived susceptibility and it is still low when they reach adulthood. People less tend to start healthy habits unless they feel susceptible to diseases. Therefore, it is important to increase susceptibility from adolescence using various methods. As this new program was successful in maintaining susceptibility after 3-months of intervention, this kind of education program involving students and parents can support children and families to increase susceptibility towards diseases.

The repeated measures ANOVA showed that there was impact of new cancer education program

on sharing partners. Although there was no effect of interaction between intervention and time on knowledge, perceived severity, benefits and barriers, the main effect of intervention was seen in knowledge, health promotion and health belief subscales. As our main targets were not sharing partners, we could see increase in their beliefs, self-esteem and practice. Many variables such as culture, socioeconomic factors, family practices and current trends might affect the health behavior of adults. Hence efforts should be applied to involve family- based approaches in health promotion. Vedanthan et al. (2016) showed that family-based approaches to health promotion related to cardiovascular diseases have beneficial effects. Our findings supported the idea of diffusion of innovations where communication is made through certain channels over time among the members of the family and community (Rogers,1962). The students might have acted as innovators. When students shared the information with their families, majority of participants adopted the idea in intervention group. However, it might drop gradually with time. As this study was limited to 3-months follow up, it would be interesting to find the changes in longer term, 6-months or a year. By identifying the characteristics of people in adopting new habits, researchers can plan more effectively and implement strategies (Sharma et al,2019).

In this study, students were asked to choose a sharing partners with whom they are comfortable to talk about cancer. The impact of cancer education was also checked in partners. Poudel and Sumi (2019) also supported communication with mothers as strong predictor for knowledge among students. There was change in different subscales of health belief of sharing partners

after 3-months follow up which might suggest communication between students and them. The students could retain their knowledge, beliefs and initiate new habits which might be because of communication and support from family members. This could indicate the chain of communications among family members in protecting and promoting family health. The learning partner model used in this study possibly enhanced the diffusion of health information to friends or family members of the individuals attending the cancer education sessions (Navarro, Raman, McNicholas & Loza, 2007).

Our study showed that students can be an important adopter for initiating change in knowledge, attitudes, practices of the whole family and community by sharing the health knowledge they have learned in school and acting in community. The social and behavior change communication plays essential role in addressing all behavioral and social aspects of disease prevention and control. Individuals are more likely to practice desired behaviors when the community believes in their importance and if proper information are available (Hong, Shin, & DeGagne,2019). Hence, as family plays a central role in developing and maintaining behaviors related to health promotion, future research trails on families and health should be seriously considered. Adhikari et al (2016) suggested the need of multilayered intervention based on socio-medico model and focus on continuum of care at the family, community, and health facility level to address adolescent's vulnerability and complex health hazards. As adolescents are progressing towards young adulthood, program should involve comprehensive, multilevel

strategies using ecological approaches in multiple channels and venues to influence at the individual, organizational, and societal levels that can be sustained over time (Bonnie et al, 2014).

4.3 Summary

Classroom teaching for health promotion is less relevant when technologies have given access to greater level of information. Therefore, knowledge, attitudes and skills being taught need to be revisited in order to be redeveloped to be able to respond to modern challenges. Using peer-learning strategies do not require abandoning the lecture format. Adding small active learning strategies can make lecturing more effective for student learning inside classroom settings and is also helpful in large classrooms. There is no denying that peer works has several benefits to the development of skills of students. Despite this, limited time for classes, huge curriculum to complete within time, lack of manpower and support groups to provide trainings, might limit the use of this new program. It might add additional burden to subject-teachers as well as school while developing lesson plan integrating peer-group. Therefore, this new program needs joint efforts from community, organizations, survivors, medical personnel, volunteer health workers, youth clubs and students to make this program easy to conduct in schools.

The Ministry of health and population brought a provision for ‘One health worker per school policy’ in 2017 started its implementation at private schools in Nepal. Later the program expanded to public schools and since then there is one health worker, mostly nurse, in each

school throughout the province to improve health outcome of children. The school-based nurses can act as a facilitator to promote peer-trainings in school students. In order to make it sustainable, school health management committee and community should also be involved.

4.4 New sights

The new program was developed by designing a new framework which was efficient in increasing knowledge, beliefs, health promoting behaviors and self- esteem of students and sharing partners. It is important to connect students with their families and friends in order to address the behavior change needs. The joint assignments were successful in diffusing information between students and family members and showed the relationship between social networks and health promoting behaviors. This new program has the potential to be a beneficial method in Nepali settings to connect high school students with health promoting behaviors with the supports from community and other groups.

4.5 Theoretical contribution in the Nursing Sciences

A new theoretical framework was developed using Health belief model and Learning partner model. This framework connects health belief and practice among adolescents and their sharing partners which encompasses community health and well-being. Community health nursing includes health promotion, illness prevention and protection of health of individuals, families and communities. The nursing theory focuses on four major concepts of person, environment, health and nursing. In many cases, nursing theories guide knowledge development and directs

education, research, and practice although each influence the others. This study involves working with communities, and school students to provide education, and focusing on primary prevention and health promotion which is one of the major perspectives of community health nursing.

4.6 Limitations

1. The cervical cancer survey was a cross-sectional study; hence, it cannot be used to analyze behavior over a longer period to time. Second, convenience sampling was used for data collection in this study, which might have caused biases.
2. In the school-based cancer education program, we used pre- post- test design, so it cannot be presumed to illustrate cause and effect as participants' knowledge on the cancer topic may have changed as a result of other factors. The main problem with this design is that it improves internal validity but sacrifices external validity to do so.
3. We prepared original questionnaire as there was no valid Nepali version questionnaire available to measure cancer knowledge as well as health beliefs and self-esteem. The instrument needs further evaluation and development based on Nepali settings.
4. One of the most common limitations was the time taken for this study. Being longitudinal study, the non- response rate of sharing partners during 3-months follow up was high. Hence, we excluded data of participants who did not submit questionnaire of their sharing partners or vice versa.

5. An increased number of follow ups would have enabled a more detailed evaluation of the changes in students' knowledge, beliefs, self-esteem and practice over time.
6. The main problem in self-esteem questionnaires, including the Rosenberg scale, is the social desirability, that is, the defensive self-esteem, denying personal problems and inadequacies, and making a false good impression.

4.7 Recommendations

The following recommendation was made after the completion of this research.

1. This study used new peer-led cancer education which can be adopted as a teaching-learning method in low budget classroom settings. However, to make it more sustainable, there should be the development of training manuals, guidelines, videos for peer-training. These manuals can be adopted by any school/ teacher making it easy to carry out without feeling burdened.
2. Knowledge about cancer was low during baseline. Although knowledge level, protective behaviors had increased than baseline during 3-months follow up, we cannot confirm the sustainability of the findings. Hence, there should be regular conduction of health-seeking programs in the community. Health should be included in the curriculum since early school days.
3. As this study showed diffusion of information from students to families and neighbors, a multi-dimensional program including the family as well as the community shows a promising role in improving the overall health of the community.

4. The school health workers can play a crucial role in arranging intervention programs by creating and providing training to peer-educator groups within their services. By collaborating with clubs, and organizations, and utilizing local resources, the health promotion programs can be conducted in the long run.

5. Community-based participatory action research is a collaborative approach that will help to understand the real community needs and learning by directly engaging communities in the research process and outcomes.

6. As Provinces of Nepal are focusing on health promotion strategies, future programs should consider involving comprehensive, multilevel approaches to influence at the individual, organizational, and societal levels that can be sustained over time.

7. This study also suggests the development and evaluation of questionnaires adaptable in Nepali settings.

CONCLUSION

This study showed the awareness of cervical and general cancer among students and their family members. The school-based cancer education program showed that school is a potential venue for cancer education and increasing cancer awareness among children may be an investment for future health as well as the quality of life. This study showed that this new cancer education program has the potential to be a beneficial method in Nepali classroom settings. It not only encourages active learning but also helps students to participate visibly in problem-solving and reflecting more sustainably. Using peer-learning strategies do not require abandoning the lecture format. Adding small active learning strategies can make lecturing more effective for student learning inside classroom settings and is also helpful in large classrooms. Health communication with parents, neighbors or communities was effective in the dissemination of information about cancer in this study. Health communication is a multifaceted and multidisciplinary approach to reach different audiences and share health-related information to influence and support individuals, communities to improve health outcomes. Hence, an efficient health communication approach can be adopted while conducting different health programs/ interventions which might help in the health protection of family, communities, and populations. A multilevel approach to promoting physical activity, combining school-based interventions with family and community involvement and educational interventions with policy and environmental changes, is likely to be effective among adolescents and should be

promoted. Interventions incorporating community and family-based approaches using local support systems are not only effective to reduce the social barriers for behavior change among the school-children but are also helpful in reinforcing adolescent's self-perception on harmful behaviors. This study showed an increase in knowledge, retention of health belief subscales, an increase in self-esteem and initiation of healthy practice among students in a new cancer education program. Hence, this new program was effective in these settings.

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REFERENCES

- Abdi, F., & Simbar, M. (2013). The peer education approach in adolescents- Narrative review article. 42 (11).
- Acharya, R.P., Chalise, H.N. (2015). Self- esteem and academic stress among nursing students. Kathmandu University Medical Journal. 52 (4): 298-302.
- Adhikari, R.P., Upadhaya N., Pokhrel, R., Suwal, B.R., Shrestha, M.P., Subedi, P.K. (2016). Health and social vulnerability of adolescents in Nepal. SM Journal of public health and epidemiology. 2(3).
- Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes.50: 179-211
- Albert, D., Chein, J., Steinberg, L. (2013). Peer influences on adolescent decision making. Current Directions in Psychological Science. 22(2):114.
- Bardosono, S., Hildayani, R., Chandra, D.N., Basrowi, R.W., Wibowo, Y. (2018). The knowledge retention after continuing health education among midwives in Indonesia. Medical Journal of Indonesia. 27 (2).
- Barteit, S., Guzek, D., Jahn, A., Barnighausen, T., Jorge, M.M., Neuhann, F. (2020). Evaluation of e-learning for medical education in low- and middle-income countries. A systematic review. Computers and Education. 145
- Bhattarai, S., Parajuli, S.B., Rayamajhi, R.B., Paudel, I.S., Jha, N. (2015). Health seeking behavior and utilization of health care services in the village development committees of Ilam district of Nepal. Journal of college of medical sciences.11 (2).

Bhurgri, H., Gowani, S.A., Itrat, A., Samani, S., Zuberi, A., Siddiqui, M.S. (2008) Awareness of cancer risk factors among patients and attendants presenting to a Tertiary Care Hospital in Karachi, Pakistan. *Journal of Pakistan Medical Association*. 58(10):584

Binu, V.S., Subba, S.H., Menezes, R.G., Kumar, G., Ninan, J., Rana, M.S., Chettri, S.K., Sabu, K.M., Nagraj, K. (2010). Smoking among Nepali Youth- Prevalence and predictors. *Asian Pacific Journal of Cancer Prevention*. 11.

Bonnie, R.J., Stroud, C., Breiner, H. (2014). Investigating in the health and well-being of Young adults. The National Academics Press. [Book]

Bonwell, C.C. (1996). Enhancing the lecture: Revitalizing a traditional format. *New Directions for Teaching and Learning*. 67, 31. doi: 10.1002/tl.37219966706

Bruni, L., Albero, G., Serrano, B., Mena, M., Gomez, D., Munoz, J., Bosch, F.X., de Sanjose, S. (2019). Papillomavirus and Related Diseases in Nepal; Summary Report; Human ICO/IARC Information Centre on HPV and Cancer (HPV Information Center).

Bryan, C.J., Yeager, D.S., Hinojosa C.P., Chabot, A., Bergen, H., Kawamura, M., & Steubing, F. (2016). Harnessing adolescent values to motivate healthier eating. *Psychological and cognitive sciences*. 113 (29).

Budig, K., Diez, J., Conde, P., Sastre, M., Hernan, M., Franco, M. (2018). Photovoice and empowerment: evaluating the transformative potential of a participatory action research project. *BMC Public Health* .18: 432.

Centers for Disease control and Prevention (2019).
<https://www.cdc.gov/healthyyouth/index.htm> (accessed 2019.10.10)

Central Bureau of Statistics, Government of Nepal. National Population and Housing Census 2011 (National Report). <https://unstats.un.org/unsd/demographic-social/census/documents/Nepal/Nepal-Census-2011-Vol1.pdf>

Cancer Awareness Measures Questionnaire.

https://www.cancerresearchuk.org/sites/default/files/health_professional_cancer_awareness_measure_toolkit_version_2.1_09.02.11.pdf (accessed 2019.01.19)

CIDDE (2014). Instructional development and distant learning. The lecture method.

<http://www.uq.edu.au/teach/teachingpracticeinventory/documents/Lecture-Method-CIDDE.pdf> (accessed 2019.11.7)

Dale, E. (1969). Audiovisual methods in teaching. Dryden Press. NY.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., Osher, D. (2019). Implications for educational practice of the science of learning and development. Applied developmental sciences.

Darj, E., Chalise, P., Shakya, S. (2019). Barriers and facilitators to cervical cancer screening in Nepal: A qualitative study. Sexual Reproductive Healthcare. 20, 20–26,

Disease, nutrition, tobacco, alcohol and drug. (Noncommunicable diseases, 2017)

(<https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/429> (accessed

2019.11.7)

Dhimal, M., Chalise, B., Jahan, I., Thapa, S., Neupane, T., Timsina, A., Jha, B.K., Bista, B., Pandey, A.R., Jha, A.K. (2018). School based health workers in Nepal: supporting evidence-based decision making. Final Report. May. Nepal Health Research Council.

Donner A, Birkett N, Buck C. Randomization by cluster. Sample size requirements and analysis. *Am J Epidemiol* 1981;114: 906-14.

Elangovan, V., Rajaraman, S., Basumalik, B., Pandian, D. (2016). Awareness and perception about cancer among the public in Chennai, India. *Journal of Global Oncology*.

Farid, M.F., Akhtar, M. (2013). Self-esteem of secondary school students in Pakistan. *Middle east journal of scientific research*.14(10).

Grunert, J. (1997). *The course syllabus: A learning-centred approach*.

Gyawali, B., Keeling, J., Teijlingen, E. van, Dhakal, L., & Aro, A. R. (2015). Cervical cancer screening in Nepal: ethical considerations.

Hermann, K.S. (2005). *The influence of social self-efficacy, self-esteem, and personality differences on loneliness, and depression [Dissertation]* Columbus Ohio: The Ohio State University, Department of Psychology

Hong, M., Shin, H., De, Gagne, J.C. (2019). Social networks, health-promoting behaviors, and health-related quality of life in older adults with and without arthritis. *PLoS One*.14.

Jaglarz, K., Tomaszewski, K.A., Wojciech, K., Mirosława, P., Krzemieniecki, K. (2014).

Creating and field testing the questionnaire for the assessment of knowledge about cervical cancer and its prevention among schoolgirls and female students. *Journal of Gynecological oncology*.

Janz, N.K., Becker, M.H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*.11(1).

Jeihooni, A.K., Dindarloo, S.F., Harsini, P.A. (2019). Effectiveness of Health belief model on oral cancer prevention in smoker men. *Journal of cancer education*. 34(5): 920.

Johnson, D.C., Bhatta, M.P., Smith, J.S., Kempf, M.C., Boker, T.R., Vermund, S.H., Chamot, E., Aryal, S., Lhaki, P., Shrestha, S. (2014). Assessment of high-risk human papillomavirus infections using clinician- And self-collected cervical sampling methods in rural women from far Western Nepal. (n.d.). Retrieved from <http://scholars.uab.edu/display/pub437493>.

Jordans, M.J.D., Komproe, I.H., Tol, W.A., Kohrt, B.A., Luitel, N.P., Macy, R.D., DeJong, J.T.V.M. (2010). Evaluation of a classroom based psychosocial intervention in conflict-affected Nepal: a cluster randomized control trial. *The journal of child psychology and psychiatry*.51(7).

Joshi, M., Mishra, S.R. (2013). Cervical cancer screening in Nepal. *J. Public Health*. 12.

Kailasam, M., Hsann, Y.M., Vankayalapati, P., Yang, K.S. (2019). Prevalence of community health- promoting practices in Singapore.

Keenan, C. (2014). *Mapping student led peer learning in UK*. [Book]

Keshani, P., Kaveh, M.H., Faghieh, S., Salehi, M. (2019). Improving diet quality among adolescents, using health belief model in a collaborative learning context: a randomized field

trial study. *Health education research*. 34(3)

Khorsandi, M., Fekrizadeh, Z., Roozbahani, N. (2017). Investigation of the effect of education based on the health belief model on the adoption of hypertension- controlling behaviors in the elderly. *Clinical Interventions in Aging*.12: 233.

Kissal, A., Kartal, B. (2019). Effects of health belief model- based education on health beliefs and breast self- examination in nursing students. *Asia- Pacific Journal of Oncology Nursing*.6:4, 403.

Ku, K.Y.L., Phillipson, S., Phillipson, S.N.(2015). Educational Learning Theory. *International encyclopedia of the social and behavioral sciences*.238.

Kyle, R.G., Forbat, L., Hubbard, G. (2012). Cancer awareness among adolescents in Britain: a cross- sectional study. *BMC Public Health*.12:580

Kyle, R. G., Nicoll, A., Forbat, L., & Hubbard, G. (2013). Adolescents awareness of cancer risk factors and associations with health-related behaviours. *Health Education Research*, 28(5), 816.
doi: 10.1093/her/cyt055

Mahat, G., Ayres, C. (2011). HIV/AIDS knowledge and self-efficacy among Nepalese adolescents: a peer education program. *Research and theory for nursing practice*. 1(25).

Malseed, C., Nelson, A., Ware, R. (2014). Evaluation of a school-based health education program for urban indigenous young people in Australia. *Health*.

Masoudiyekta, L., Bayatinyani, H.R., Dashtbozorgi, B., Gheibizadeh, M., Malehi, A.S., Moradi, M. (2018). Effect of education based on health belief model on the behavior of breast cancer

screening in women. *Asia Pacific Journal of Oncology Nursing*. 5(1): 114

Minev, M., Petrova, B., Mineva, K., Petkova, M., Strebkova, R. (2018). Self-esteem in adolescents. *Trakia Journal of Sciences*.2:114.

Montet, M. What is scaffolding in teaching? Retrieved from <https://classroom.synonym.com/scaffolding-teaching-5162695.html>(accessed2019.10.8)

Mukamana, O., & M.Johri. (2016). What is known about school-based interventions for health promotion and their impact in developing countries? A scoping review of the literature. *Health Education Research*. 31 (5).

National Cancer Institute. *Theory at a glance*. (2005). National Institute of Health. US Department of Health and human services.

Navarro, A.M., Raman, R., McNicholas, L.J., Loza, O. (2007). Diffusion of cancer education information through a Latino community health advisor program. *Preventive medicine*.45(3):135.

Nkanunye, C.C., & Obiechina, G.O. (2017). Health communication strategies as gateway to effective health promotion and well-being. *Journal of medical research and health education*.1(3)

Nepal Network for Cancer Treatment & Research (NNCTR, 2010). *Cervical and Breast Cancer Screening Activities in Nepal*.

Orth U, Robins RW, Widaman, KF. Life-span development of self-esteem and its effects on important life outcomes. *Journal of Personality and Social Psychology*. 2012. 102, 1271–1288.

Parijs, L.G.V. (1986). Public education in cancer prevention. *Bulletin of the world health organization*.64(6):912.

Peko, A., & Varga, R. (2014). Active learning in classrooms. *Zivo I skola*.60; 59

Poudel, K., & Sumi, N. (2019). Analyzing Awareness on Risk Factors, Barriers and Prevention of Cervical Cancer among Pairs of Nepali High School Students and Their Mothers. *International Journal of Environmental Research and Public Health*, 16(22), 4382.
doi: 10.3390/ijerph16224382

Poudel, K., & Sumi, N. (2017). Health behavior regarding Cardiovascular Diseases among Nepali adults. *Journal of Community Health*. 42(6)

Poudel, K., & Sumi, N. (2018). Knowledge about risk factors for cancer among adults in Nepal. *KnE Life Sciences*.4:126

Richter, M. (2010). Risk behavior in adolescence: patterns, determinants and consequences.
Retrieved from : 10.1007/978-3-531-92364-2

Rogers, E.M. (1962). *Diffusion of innovations*. The free press. Third edition

Rosenberg, M. (1965). *Rosenberg Self-esteem scale*.

Saud, B., Adhikari, S., Awasthi, M.S. (2018). Cancer burden in Nepal: a call for action. *MedCrave online journal of proteomics & bioinformatics*.7(5).

Sharma, B., Kim, H. Y., & Nam, E. W. (2018). Effects of School-based Health Promotion Intervention on Health Behaviors among School Adolescents in North Lima and Callao, Peru.

Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/30474002>.

Sharma, D., Goel, N.K., Sharma, M.K., Walia, D.K., Puri, S. (2019). A community- based study on awareness of cancer and anticipated barriers in seeking help. *Indian Journal of Community and Family Medicine*.5(1):61

Subedi, J.(1989). Modern health services and health care behavior: a survey in Kathmandu, Nepal. *Journal of Health and social behavior*.30(4), 412.

Suketomo, H.Y. (2018). Learning Partner Model for diffusing health promotion actions through health education: case studies on cancer education and awareness. *Japanese Journal of Health education and promotion*.26(1):93.

Suketomo, H.Y., Navarro, A,M. (2016). Diffusion of cancer knowledge through the Learning Partner Model: Feasibility and potential of community workshops hosted by Japanese municipalities. *Japanese Journal of Health education and promotion*. 24 (1).

Tome, G., Matos, M.G. de., Simoes, C., Camacho, I., AlvesDiniz, J. (2012). How can peer group influence the behavior of adolescents: explanatory model. *Global Journal of Health Science*. Retrieved from: 10.5539/gjhs.v4n2p26

Tripathy, J.P. (2018). Research priorities in non-communicable diseases in developing countries: time to go beyond prevalence studies. *Public health action*.8 (2):98

Turner, L.W., Hunt, S.B., Dibrezzo, R.O., Jones, C. (2004). Design and implementation of an osteoporosis prevention program using the health belief model. *American Journal of Health Studies*.19(2):15.

UNICEF. Ending child marriage in Nepal. (UNICEF, 2018). Available online: <https://www.unicef.org/rosa/media/151/file> (accessed on 2019.09.28).

Van, Sluijs, E.M., McMinn, Am., & Griffin, S.J. (2007). Effectiveness of interventions to promote physical activity in children and systematic review of controlled trials. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/17884863>

Vedanthan, R., Bansilal, S., Soto, A.V., Kovacic, J.C., Latina, J., Jaslow, R., Santana, M., Gorga, E., Kasarskis, A., Hajjar, R., Schadt, E.E., Bjorkegren, J.L., Fayad, Z.A., Fuster, V. (2016). Family-based approaches to Cardiovascular health promotion. *Journal of the American College of Cardiology*. 67(14),1725.

Vries, H., Kremers, S.P.J., Lippke, S. (2018). Health education and health promotion: Key concepts and exemplary evidence to support them. *Principles and concepts of behavioral medicine*. 489.

Wahyuningsih, S.K. (2018). Group work to improve classroom interaction and students' self-esteem of stain gpa. *Research and innovation in language learning*. 1(3).

Wang, C., & Burris, M.A. (1997). Photovoice: Concept, Methodology, and use for participatory needs assessment. *Health education & behavior*. 24(3):369.

Warne, M., Snyder, K., & Gadin, K.G. (2013). Photovoice: an opportunity and challenge for students' genuine participation. *Health Promotion International*. 28(3). 299.

Wei, D., Brigell, R., Khadka, A., Perales, N., & Fink, G. (2019). Comprehensive school-based health programs to improve child and adolescent health: Evidence from Zambia. 14(5).

Winham, D.M., & Jones, K.M. (2011). Knowledge of young African American adults about heart disease: a cross sectional survey. *BMC Public Health*.11:1

World Health Organization. Cancer. (WHO, 2019a). Retrieved October 10, 2019, from <http://www.who.int/mediacentre/factsheets/fs297/en/>

World Health Organization. Global Action Plan for the prevention and control of Noncommunicable diseases. (WHO, 2019b)

World Health Organization. Noncommunicable diseases. (WHO, 2018a). Accessed from http://www.searo.who.int/entity/noncommunicable_diseases/about/en/

World Health Organization. Cancer Country Profile: Nepal. (WHO, 2018b). Available online: http://www.who.int/cancer/country-profiles/npl_en.pdf (accessed on 2019.10.23)

World Health Organization. (WHO, 2017). Recommendations on adolescent health: guidelines approved by the WHO Review, Geneva: World Health Organization.

World Health Organization. Adolescents: health risks and solutions. (WHO, 2017a) (Accessed 2019.12.19)

World Health Organization. A guide to implementation research in the prevention and control of noncommunicable diseases. (WHO, 2016)

World Health Organization. Cancer mortality rate- Nepal. (WHO, 2014). http://www.who.int/cancer/country-profiles/npl_en.pdf (accessed 2019.11.11)

World Health Organization. Comprehensive Cervical Cancer Prevention and Control: A

Healthier Future for Girls and women (WHO, 2013).

World Health Organization. Health education: theoretical concepts, effective strategies and core competencies. (WHO, 2012)

Wye,S.Q., Madden, A., Poeder, F., McGuckin, S., & Shying, K. (2006). A framework for peer education by drug- user organizations, Australia.

Yamaguchi, K. (2002). Overview of Cancer control programs in Japan. Japan Journal of Clinical Oncology;32

Yamaguchi, N., Tsukamoto, Y., Shimoyama, H., Nakayama, K., Misawa, S. (2011). Effects of peer education interventions aimed at changing awareness of cervical cancer in nursing students.

Niigata Journal of Health Welfare.11,32.