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Teaching adults how to prevent COVID-19 infection by health workers: The application of intervention mapping approach

Nazila Nejhaddadgar, Hamed Azadi[1], Nafiul Mehedi[2], Razie Toghroli[3], Azam Faraji[4]

Social Determinants of Health Research Center, Ardabil University of Medical Sciences, Ardabil, Iran, [1]Department of Anesthesiology, School of Paramedical Sciences, Ilam University of Medical Sciences, Ilam, Iran, [2]Graduate Student, Department of Social Work, Shahjalal University of Science and Technology, Sylhet, Bangladesh, [3]Social Determinants in Health Promotion Research Center, Hormozgan Health Institute, Hormozgan University of Medical Sciences, Bandar Abbas, Iran, [4]Nursing Department, Nursing and Midwifery School, Kermanshah University of Medical Sciences, Kermanshah, Iran

Address for correspondence:
Azam Faraji, Nursing Department, Nursing and Midwifery School, Kermanshah University of Medical Sciences, Kermanshah, Iran.
E-mail: Faraji.azam@gmail.com

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Abstract:

INTRODUCTION: Education is one of the most important approaches to preventing infectious diseases at the time of the pandemic. The purpose of the study was to develop an intervention-training program using an intervention mapping approach (IMA) to prevent COVID-19 infection in adults at the time of the pandemic by health workers.

MATERIALS AND METHODS: The present study was a study protocol where IMA was used as a planning framework for developing an intervention-training program to prevent COVID-19 infection in adults at the time of the pandemic by health workers in Ardabil city. Six intervention mapping (IM) steps have been described in this protocol. As the first step, needs assessment was performed by reviewing the studies, qualitative evaluation, and interviews. In the second step, the matrix of change objectives was designed from the intersection of performance goals and determinants. Later on, after designing the program and planning the program implementation, the program evaluation plan was developed.

RESULTS: IMA guided us in designing and implementing a control-oriented training program with the participation of the participants along with the definition of outcomes, performance goals and determinants, theoretical methods and practical applications, intervention program, implementation, and step by step assessment.

CONCLUSION: IM is a control-oriented, systematic, participation-based approach to design and implement targeted and on-going health promotion programs based on the needs of the target group at the time of the pandemic by health workers.

Keywords:

Adults, COVID-19, health worker, intervention mapping

Introduction

The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing pandemic of coronavirus disease 2019 caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV2).[1,2] The disease was first identified in December 2019 in Wuhan, China.[3] The World Health Organization declared the outbreak a Public Health Emergency of International Concern on January 30, 2020, and a pandemic on March 11. As yet, more than 28.4 million cases have been reported in more than 188 countries, resulting in more than 915,000 deaths; more than 19.2 million adults have recovered.[4,5]

The virus is spread through small droplets from coughing, sneezing, and talking, droplets are usually not airborne.[6] Adults may also become infected by touching a contaminated surface and then touching their face (eye, nose, and mouth), transmission also occur through aerosols

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that can stay suspended in the air for longer periods.[6] As of May 19, 2020, cases have been reported in all Asian countries except for Turkmenistan and North Korea, although these countries likely also have cases.[7,8] Iran reported its first confirmed cases of SARSCoV2 infections on 19 February in Qom.[9] Iran has been ranked as the fifth country in the world in terms of confirmed COVID-19 cases with about 7.7% mortality, which is around two times of the global level.[10]

Strategies for preventing transmission of the disease include maintaining personal hygiene; washing hands, avoiding touching the eyes, nose, or mouth with unwashed hands, and coughing or sneezing into a tissue, physical distancing,[5,11-13] face mask, surface cleaning, and self-isolation (if you have symptoms of COVID19 disease).[10,14]

It is well-known that public health education plays a crucial role in the prevention and control of infectious diseases, but how health providers advise families or parents to obtain health education information is a challenging question. In the context of a public health emergency, health education practice was often neglected or unprepared therefore, health education is the most important way to prevent this disease, in fact training is a process that bridges the gap between health information and behavior, and given the relationship between knowledge, attitude, and performance improvement in an intervention-training process, the significance of proper information provision and the provision of learning opportunities for adults become evident[15-17] A survey showed health education programs aimed at improving COVID-19 knowledge are helpful for Chinese residents to hold optimistic attitudes and maintain appropriate practices. During the SARS epidemic in 2003, a study evaluated the level of the awareness of SARS among older adults, then provided them with health education by telephone, and assessed the change.[18]

Different models have been developed for designing, implementing, and evaluating training programs by experts, one of which is intervention mapping (IM).[18,19] This approach is a planning approach based on the significance of developing evidence-based programs that assess and intervene in health-related issues adopting an ecological approach. IM has previously been combined with community-based participatory research in adults and adolescents.[18,20] IM has a problem solving-based approach and enables the implementation of the program through six steps: need assessment, objectives matrix design, selection of theory, and practical application-based intervention methods, production of components and materials of the intervention program, adoption planning, implementation and sustainability and evaluation planning of health training and promotion programming.[21] This approach focuses on behavioral change and the individuals who are influential on the behavior of those at risk known as environmental agents and individuals 'health issues at different ecological levels to make changes.[22,23] This is done to change individual behaviors besides focusing on changing environmental agents' behavior to improve the life quality and health of the target group. Thus, it was decided to develop a health education program based on IM approach (IMA) for teaching adults how to prevent COVID-19 infection.

Materials and Methods

Study design

The IM protocol is a planning framework for the development of theory-and evidence-based behavior change programs IM requires interventionists to identify intervention change objectives and specify behavior change methods that have been proven effective to bring about these planned changes. By basing such decisions on previous evidence and documenting the way in which intervention materials are designed, interventionists can communicate clearly about the intervention content, which facilitates replication and subsequent intervention development.

The IM process involves six steps: (1) needs assessment, (2) formulation of change objectives (intervention objectives and their determinants), (3) selection of theory based methods and practical strategies, (4) intervention development, (5) development of adoption and implementation plan, and (6) evaluation planning.[11,23] This paper will focus on steps 1–6, as these represent the progress made on the project thus far.

Step one: Needs assessment

The key purpose of this step was to assess the need for design educational intervention for teaching adults how to prevent COVID-19 infection by health workers in Ardabil (Ardabil is an ancient city in northwestern Iran, and the capital of Ardabil Province) in the year 2020. As the first part of IM, needs assessment is defined as a systematic study to identify the difference between what the status is and what should be in a given group and the intended state.[11] In the current study, the planning group was established to identify the health issue and examine the life quality of adults during the COVID-19 pandemic with the presence of stakeholders (stakeholders are the adults who can express the needs of the target group) stakeholders participating in this study were representative of:

1. Specialists in the field of health education, epidemiology, and psychology
2. Health educators and health workers

3. Family representative of patients with COVID-19
4. Focal point infectious disease University of Medical Sciences.

Using a health needs assessment group, we examined life quality and behavioral and environmental determinants of adults' health behavior during the pandemic using the PRECEDE model. This assessment was done using a review of the studies conducted, and a qualitative study was conducted.

Finally, the results of the needs assessment were determined by identifying the adults' health behavior and life quality outcomes of the evaluation program. In the review of the studies conducted to select the papers, PubMed, Scopus and Google Scholar databases were searched for English papers and Iranmedex, SID, and Google Scholar databases for Persian ones. Given the differences in searching Iranian and foreign scientific databases, various Persian and English keywords were selected. The search was performed based on keywords among the papers of the last 5 years. After extracting the papers from the databases, the ones related to the topic were examined. After coordination, an invitation letter was sent to stakeholders to participate in group discussion sessions to conduct the qualitative study. The samples were selected using purposive and voluntary sampling methods, and the main criterion for the inclusion was the individuals' willingness to participate in group interviews and their interest in working with project executives. After obtaining informed consent, the data were collected through 4 focus group discussions from specialists, health educators and health workers, and Family representative of patients with COVID-19 and focal point infectious disease University of Medical Sciences.

The sessions were conducted by the researcher using a semi-structured index based on how the researcher interacted and discussed. All sessions and interviews were audio-recorded and transcribed by the researcher and analyzed adhering to encoding in a basic thematic method. Finally, the results of the needs assessment were linked to the health planning and quality of life assessment and planning program.

Step two: Matrix

Step 2 of IM is important because in this step the expected change or program outcome is stated. It describes who and what will change as a result of the intervention? The main tool in IMA is a matrix of change objectives.[18] At this step, change objectives determine what to be done to reach performance goals to bring about changes in behavioral and environmental conditions and ultimately improve the life quality of the target group.[19] The planning group sets performance objectives breaking down each behavior and environmental condition into subcomponents. The expected outcomes were performed in two distinct behavioral and environmental levels, focusing on these outcomes, and the next step was the expected outcomes divided by the performance goals[16] where the matrix of change objectives was obtained from the midpoint of the performance goals using determinants. In the present study, this matrix was designed to meet the four expected outcomes according to the results obtained from the first step. Also, in this step to make decisions about determinants that should be targeted with the interventionism guides planners through involving representatives from the target population, stakeholders, and implementers in brainstorming in the planning group.

Stage three: Theoretical methods and practical applications

In the third step, while the planning team predicted the ideas of the plan, the theoretical methods affecting the determinants of change were selected, and practical solutions were selected, and the evaluation program was designed to implement the predicted theoretical methods the planning group discusses initial ideas for the program and selects theory- and evidence-based behavior change. In this way, a number of systematic reviews health promotion programs show that reasonable use of theory-based methods increases intervention effectiveness in changing behavior.[24]

Step four: Program plan

The program plan for the implementation strategy was developed on the basis of the preceding steps: need assessment, the matrix from step two, and the theoretical model from step.[25] At this step of designing the intervention program, while holding a group meeting with the participants and considering their priorities and suggestions, the implementation, and implementation sequence themes of the program were identified along with the constraints.

Step five: Program implementation plan

At this step, the tasks of the individuals and what they must do so that the outcome is fully met and implemented acceptably were determined. Then similar to step two, matrix planning was defined to guide the intervention program.[26] In this matrix, the operational goals and determinants were determined for adoption, implementation, and maintenance of the program. For instance, determinants responded to the question of why do decision-makers decide to use the program and why those in charge try to make sure the program continues over time? The answers to these questions determine the adoption, implementation, and maintenance of the program.[27]

Stage 6: Assessment planning

In the final step, the assessment program was defined to determine the effectiveness of the program and the

extent to which the performance goals and objectives were changed. Assessment questions were identified from the defined outcomes and objectives, and a criterion was identified.[28]

Results

The results of the first step, needs assessment

The results of a review of studies (19 related papers) showed that the majority of adults' need for information on the role of masks in prevention of COVID-19, observance of social distance, hand washing, symptoms of COVID-19 infection and self-isolation is quite high. Moreover, a large majority of adults do not have a proper definition of mask and proper use of it, observe the social distance, hand washing, self-isolation, how to disinfect surfaces and use disinfectants. Results of this qualitative study, besides confirming the results of the literature review, showed the despite good public awareness about COVID-19 disease and ways to prevent it, most of them did not have the correct definition and behavior in the cases mentioned above.

The results were categorized into four outcomes:

1. Improving adults' knowledge and behavior about identifying a good mask and how to use it properly
2. Improving adults' knowledge and behavior about how to properly wash hands
3. Improving adults' knowledge about self-isolation
4. Improving adults' knowledge and behavior about maintaining social distance from each other.

Improving adults' knowledge and behavior about identifying a good mask and how to use it properly

Medical masks are defined as surgical or procedure masks that are flat; they are affixed to the head with straps that go around the ears or head or both.[28] Their performance characteristics are tested according to a set of standardized test methods that aim to balance high filtration, adequate breathability and optionally, fluid penetration resistance. Face masks combined with other preventive measures, such as frequent hand-washing and social distancing, help slow the spread of the virus.[29] The Centers for Disease Control and Prevention recommends that you wear a cloth face mask when you are around adults who do not live with you and in public settings when social distancing is difficult.[28] Of course, in using the mask, the following points should be considered. Wash or sanitize your hands before and after putting on and taking off your mask.[30]

A few educational tips on using a mask:

1. Place mask over mouth and nose
2. Tie it behind your head or use ear loops and make sure it is snug
3. Don't touch your mask while wearing it
4. If you accidentally touch your mask, wash, or sanitize your hands
5. If your mask becomes wet or dirty, switch to a clean one. Put the used mask in a sealable bag until you can wash it
6. Remove the mask by untying it or lifting off the ear loops without touching the front of the mask
7. Wash your hands immediately after removing your mask
8. Regularly wash your mask with soap and water by hand or in the washing machine.[31]

In the results of this study, 72% of adults daily and in crowded places used masks, but 46% of them did not know about the correct use of masks and did not follow them and 69% did not know the appropriate mask.

Improving adults' knowledge and behavior about how to properly wash hands

Hands have a crucial role in the transmission of COVID-19. COVID-19 virus primarily spreads through droplet and contact transmission.[23] Contact transmission means by touching infected adults and/or contaminated objects or surfaces. Thus, hands can spread virus to other surfaces and/or to your mouth, nose or eyes if you touch them. Hand Hygiene is one of the most effective actions you can take to reduce the spread of pathogens and prevent infections, including the COVID-19 virus.[31] Evidence from both the SARS and COVID-19 epidemics, shows that hand hygiene is very important to protect health care workers from getting infected hand washing should be done in the following cases:

1. After an activity outside the home (such as shopping or playing outdoors)
2. Before preparing food
3. Before eating food
4. After going to the toilet
5. After contact with animals
6. When caring for someone who is ill.

In the results of this study, 91% of adults knew the importance of hand washing, but 66% did not know how to wash properly, when to wash their hands.

In the results of this study, 76% of adults knew the importance of hand washing, but 66% did not know how to disinfect surfaces properly, when to wash their hands.

Improving adults' knowledge about self-isolation

Self-isolation is an effective precautionary measure to protect those around you – your family, friends, colleagues – from potentially contracting COVID-19. It means taking simple, common-sense steps to avoid close contact with other adults as much as possible.[32,33] Improving the knowledge of the adults

about self-isolation the issues that needed intervention. 85% participants did not have the correct definition.

Improving adults' knowledge and behavior about maintaining social distance from each other

Social distancing, also called "physical distancing," means keeping a safe space between yourself and other adults who are not from your household.[34] To practice social or physical distancing, stay at least 6 feet from other adults who are not from your household in both indoor and outdoor spaces.[35] Spread happens when an infected person coughs, sneezes, or talks, and droplets from their mouth or nose are launched into the air and land in the mouths or noses of adults nearby the droplets can also be inhaled into the lungs. Recent studies indicate that adults who are infected but do not have symptoms likely also play a role in the spread of COVID-19.[36] Since adults can spread the virus before they know they are sick, it is important to stay at least 6 feet away from others when possible, even if you-or they-do not have any symptoms.[37] Improving the knowledge and behavior of the adults about social-distancing the issues that needed intervention. 74% of participants did not have the correct definition practice.

The results of the Step two: Objectives matrix

The planning team drafted the performance goals based on of Health Belief Model and Theory of Planned Behavior according to the 4 individual outcomes of the program.

Then, they got help from a three-person group including a health education specialist, health worker, psychologist, and a behavioral specialist to evaluate the validity, and based on their views, the drafted performance goals were revised [Tables 1-4].

The results of step three: Defining theoretical methods and practical applications

in this step, the theoretical methods and practical applications for each determinant were defined with the participation of the planning team [Table 5].

The results of step four: Intervention on planning

The intervention planning team identified the intervention implementation plan that includes the program sequence, program training channels, training materials, and how the program was implemented at each level. The intervention program was designed over a period of 2 months for 6 h, 1 h/week according to the specified sequence, and the best channel was selected based on theoretical methods and practical uses, interpersonal communication channels, and mass media.[19] Professional designers and educational resources of the Ministry of Health were used to produce educational materials. In this step, a pretest was designed and implemented to evaluate the overall program. The pretest results showed the efficacy of most of the predicted theoretical methods and their implementation and were applied where necessary. For instance, in a part of the intervention program to remove barriers of

Table 1: Individual-level matrix the first behavioral consequence: Improving adults' knowledge and behavior about identifying a good mask and how to use it properly

Functional goals	Determinant 1 (awareness)	Determinant 2 (self-efficacy)	Determinant 3 (behavior barriers)	Determinant 4 (subjective norms)
Adults know and express tips about suitable mask	Change objectives: adults state the appropriate masks to prevent Covid-19 Adults state when to change mask	-	Change objectives: adults express barriers to use of mask to prevent Covid-19	Change objectives: adults express who encourages them to use the mask
Adults use a mask	Change objectives: adults show how to use the mask properly Adults show how to change the mask	Change objectives: adults are confident in their ability to use the mask properly	Change objectives: adults determine solution barriers to remove barriers use a mask	Change objectives: adults get help who encourages them to use the mask properly

Table 2: Individual-level matrix the second behavioral outcome: improving adults' knowledge and behavior about how to properly wash hands

Functional goals	Determinant 1 (awareness)	Determinant 2 (self-efficacy)	Determinant 3 (behavior barriers)	Determinant 4 (subjective norms)
Adults know and express tips about importance of hand washing	Change objectives: adults state how to wash hands	Change objectives: adults are confident in their ability to wash hands properly	Change objectives: adults state barriers to wash hands properly	Change objectives: adults express who encourages them to importance of regular hand washing
Adults show how to wash hands properly to prevent infection with Covid-19	Change objectives: adults show how to wash hands	Change objectives: adults are confident in their ability to wash hands to prevent infection with Covid-19	Change objectives: adults determine solution barriers to wash hands to prevent infection with Covid-19	Change objectives: adults get help who encourages them to wash hands properly to prevent infection with Covid-19

Table 3: Individual-level matrix the third behavioral outcome: Improving adults' knowledge about self-isolation

Functional goals	Determinant 1 (awareness)	Determinant 2 (self-efficacy)	Determinant 3 (behavior barriers)
Adults know and express tips about self-isolation (when having symptoms)	Change objectives: adults state tips about self-isolation	-	Change objectives: adults determine solution barriers to self-isolation (when having symptoms)

Table 4: Individual-level matrix the third behavioral outcome: Improving adults' knowledge and behavior about maintaining social distance from each other

Functional goals	Determinant 1 (awareness)	Determinant 2 (self-efficacy)	Determinant 3 (behavior barriers)
Adults know and express tips about the importance of observing social distance from each other	Change objectives: adults state must maintain social distance to prevent infection with Covid-19	Change objectives: adults are confident in their ability to observing social distance from each other	Change objectives: adults get help who encourages them to observing social distance from each other

Table 5: Theoretical methods, practical applications, communication tools channels

Determinant	Theoretical method	Definition	Practical application	Channel
Awareness	Group discussion	Encouraging to explore the issue in an open and informal debate	Educational videos and debates	Interpersonal
	Using illustration	Using visual works that have a similar symbol to the theme	Training and debate packages	Interpersonal
Self-efficacy	Setting up categorized activities	Determining simple activities and increasing difficulty until the target behavior is achieved	Educational videos and debates	Interpersonal
	Provision of possible rewards	Encouraging, or providing awards clearly related to the achievement of a particular behavior	Provision of awards	Interpersonal and personal
			Educational videos and debates	Interpersonal and collective communication
Barriers to behavior	Changing guidance	Motivation change training, whether consciously or unconsciously, which describes and identifies a behavior	Educational videos and debates	Interpersonal and collective communication
Subjective norms	Group discussion	This refers to the belief about whether most people approve or disapprove of the behavior. It relates to a person's beliefs about whether peers and people of importance to the person think he or she should engage in the behavior.	Educational videos and debates	Interpersonal

healthy behaviors, the planning team had anticipated the individual commitment, and in the practical application of this theoretical approach, a decision was made to prepare a recognizance.

Thus, some changes were made in the program implementation at this point with some hints. Moreover, the presenters found that engaging in peer-to-peer discussion leads to better feedback and more effective interaction.

Results of Step Five: Adoption and implementation planning

At this stage, the theory of Health Believe Model and Programmed Behavior Plans were used to organize the adoption and implementation plans.[38] The adopter of the intervention program of adults, as well as implementers of health coaches and educators' programs, were considered as well. It should be noted that in carrying out the tasks related to this step, all stated in previous steps concerning the beneficiaries were repeated as well.

Results of the sixth stage evaluation planning

Since one of the significant goals of evaluation is using evaluation results,[35,39] at this stage, the planning team identified the evaluation stakeholders-such as planners, study participants, program managers and executives-to evaluate the effect of the program, designed questions based on outcomes, performance goals, and individual and environmental determinants [Table 6].

In this study, 50 adults were selected to participate in the study performance. Those included attended training sessions for 6 weeks once a week (not more than 5% of participants should have been absent in each training session).

Discussion

This program was done to design and develop the puberty training program using IMA. The results indicated that IMA is a good step-by-step framework for developing a systematic and community-based program in adolescents. Moreover, MA provides a practical and usable guide to adapt and promote health promotion programs for other planners to be used elsewhere.[40] It has to be noted that IMA is highly practical and user-friendly despite its complex and its

Table 6: Evaluation of outcome, effect, and program process (sample questions)

Evaluating program outcomes
Life quality - How much has the adherence to adult's health behavior changed? (use proper mask-social distance-hand washing- self isolation)
Personal level - Do the adults do more healthy behaviors (use proper mask-social distance-hand washing- self isolation) after program implementation compared to before program implementation?
Interpersonal level - Do adults have more verbal and nonverbal communication with their other person (about use proper mask-social distance-hand washing- self isolation) after program implementation?
Assessment of the effect of program based on functional goals
Personal level - Do the adults adhere to health behaviors (use proper mask-social distance-hand washing- self isolation) more after program implementation compared to before?
Interpersonal level - Do family or friends support adults use proper mask-social distance-hand washing after implementing health behaviors more compared to before the implementation?
Assessment of the effect of change-based programs
Personal level - Do the adults state the significance of observing health behaviors (use proper mask-social distance-hand washing-self isolation) after the program is implemented?
Interpersonal level - Do the adults consider it important to have effective conversations after the implementation? (use proper mask-social distance-hand washing-self isolation)
Assessment of program development process
Attainment - What proportion of the adults community participated in the program?
Accuracy - Is the educational curriculum done according to the protocol?
Organizing the program - Has the executive schedule been developed for the health program
Program index
Improving adults behavior by 50% over one period of program implementation
Improving the behavior of adults by 50% over one period of program implementation

time-consuming nature.[41] Our results indicated that IMA can help develop a theory-based and evidence-based problem-solving approach,[20,42,43] produce outcomes, performance goals, change objectives, determinants, theoretical change methods, and practical applications and evaluation.

It is suggested to plan for the effectiveness of training, which is the most important way of prevention in pandemic conditions. IM model is one of the most important strategies for targeted training based on the needs of the audience, which is very effective and targeted in pandemic conditions.

Conclusion

IM has been successfully used to plan, implement and evaluate educational interventions. This study has provided a good understanding of the role of IM in designing educational interventions for adults, and a good foundation upon which subsequent reviews can be guided.

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Conflicts of interest

There are no conflicts of interest.

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