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# Effectiveness of an Intervention for Oral Health Promotion of Disadvantaged Women

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**A B S T R A C T**

**Objectives:** Community health volunteers (CHVs) are expected to empower the population, particularly women, for a better health status. This study aimed to assess the effectiveness of an intervention by CHVs for oral health promotion of disadvantaged women.

**Materials and Methods:** This quasi-experimental study recruited 22 CHVs (n=11 in each group) and 216 women (n=108 in each group) from two health centers in disadvantaged neighborhoods in Zahedan, Iran, in 2020. CHVs received a training package, including a flip chart and a dental model in the intervention group, while the control group received a conventional lecture-based training. Next, CHVs trained women in these areas. The women's oral health literacy (OHL) and oral health behaviors were evaluated using the Oral Health Literacy-Adult Questionnaire (OHL-AQ). The plaque index (PI) was determined through clinical oral examinations. Data were collected before and at 6 weeks after the intervention. Generalized estimating equation (GEE) and Chi-square test were utilized for data analysis using SPSS version 25 (alpha=0.05).

**Results:** All women completed the study, and had a mean age of 26.7 ± 5.03 years. GEE revealed a significant increase in OHL score (P<0.001), and a significant reduction in PI (P=0.03) of the intervention group compared to the control group. The Chi-square test indicated a significant improvement in oral health behavior of the participants in the intervention group (P=0.02).

**Conclusion:** The oral health educational program delivered by CHVs significantly improved the OHL and behavior of disadvantaged women, suggesting that such programs can effectively promote oral health in disadvantaged populations.

**Keywords:** Oral Health; Health Literacy; Poverty Areas; Women; Community Health Services

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## INTRODUCTION

In developing countries, the increasing trend of urbanization without development in economic and social indices has caused many problems, including slum dwellers [1]. Despite residing within the city's geographical, economic, social, and cultural boundaries, slum dwellers have a different life that lacks coordination with the urban community [2]. Slum residents are characterized by various factors, such as poverty, unsafe housing, overcrowding, exposure to environmental hazards, unhealthy lifestyle, social discrimination, and limited engagement in cultural activities [2,3]. By 2030, about 2 billion individuals of the world's projected population, which would be 8.1 billion, will be living in slums, especially in African and Asian

countries [4]. In 2015, the population of slums in Zahedan, the largest city in the southeast of Iran, was estimated at 422,149 people. This number was part of a larger figure of 10,280,270 people who lived in slums throughout Iran, a developing country. The problem of slums is a significant issue faced by Zahedan and the whole country [5,6].

Poor oral health behavior, lack of awareness, and limited access to dental services due to low socioeconomic status are significant obstacles against oral health promotion of disadvantaged individuals [7-9]. Therefore, dental caries is a prevalent dental condition in such areas [10,11]. Oral diseases are classified as behavioral diseases, and personal oral health care can largely prevent them [12,13].

The disadvantaged and low-income populations and societies usually have insufficient knowledge about the importance of oral health; moreover, they do not follow health measures [10]. Lack of access to health information influences health consequences. Accordingly, the health literacy skills are necessary to empower the individuals to improve their health status [14]. Hence, health literacy is considered not only a personal trait but also a pivotal determinant of health at the community level [15].

Involvement of local people as facilitators in health education activities can enhance the awareness of individuals at the community level. In this regard, contribution of community health volunteers (CHVs) can be considered as an opportunity that promises the achievement of better health [16]. Establishment of female health volunteers, as a new healthcare category, was initiated by a study conducted in 1990 on reproductive behavior, morbidity, mortality, living conditions, and environment in slums of southern Tehran by the Ministry of Health and Medical Education of Iran [3]. This program was designed to improve people's health and is considered a national program due to its important achievements in 1993 [17]. In the CHV program, the CHVs were selected among women in the related regions with the minimum required level of literacy, appropriate social acceptance, and sufficient time, interest, and motivation to carry out health activities. Every CHV supports 10 households living in their neighborhood, and participates in training and transferring the health contents and information to people through effective communication [18].

The fundamental issue is to transfer information to CHVs, increase their awareness, and promote positive health-related attitudes to provide this information correctly to the families. Different methods have been introduced in the literature for training at the community level such as the Analyze, Design, Develop, Implement, and Evaluate (ADDIE) model [19]. Accordingly, the scheme and structure of the training should be provided in advance. The training design includes checking many factors that may be effective in performing a training scheme [20]. The ADDIE model is a general structure or rule that allows the developer to make changes in the program. Depending on whether the training subject is micro- or macro-scale, the developer can make the necessary changes in the model [19].

The Lancet published a series of articles that highlighted insufficient interventional research on the disadvantaged populations, encouraging the researchers to fill this gap [4, 21]. Building on this recommendation and based on the current knowledge about the lack of oral health educational interventions by local people in disadvantaged areas, this study aimed to investigate the impact of CHVs training on oral health literacy (OHL) and behavior of women living in disadvantaged neighborhoods of Zahedan, Iran, in 2020.

## MATERIALS AND METHODS

***Ethical approval:***

The Ethics Committee of the School of Dentistry of Tehran University of Medical Sciences approved this study (code: IR.TUMS.DENTISTRY.REC.1398). After obtaining informed consent from literate participants and the guardians of illiterate participants, they were ensured about the confidentiality of their identification and responses.

***Study design:***

This study was a quasi-experimental study with a

parallel-group design. In the intervention group, a training package, including a flip chart and a dental model, was delivered. The control group received the conventional routine of the health centers as lectures derived from the CHVs' oral health book [22] delivered by CHV instructors.

***Study participants:***

The present study was performed in the health centers of the disadvantaged neighborhoods of Zahedan City, in Sistan and Baluchestan Province, Iran, in 2020. Each CHV delivered health messages to 10 female participants. Women willing to participate who were able to comprehend the scientific concepts and practice skills were enrolled. It means that they could learn the concepts taught by the CHVs, and had the practical skills to learn to brush their teeth.

***Sampling:***

Out of 8 health centers in the disadvantaged neighborhoods of Zahedan City, two centers were voluntarily chosen, one as the intervention group and the other as the control group. To select CHVs, the volunteer CHVs working in the health centers for at least 6 months were selected (non-randomly) to provide the instructions. Then, all families covered by each CHV (n=10) were included in the study. Finally, during the home visits, mothers from families with children, wives from husband-and-wife families, and women from single-person households were selected to participate in the study. The study ultimately comprised 11 CHVs and 108 women in each group.

***Sample size:***

The sample size was calculated using the following formula to compare two mean values [23]:

$$N = \frac{2(Z_{\alpha/2} + Z_{\beta})^2 \, o^2}{\epsilon^2}$$

Considering a power equal to 0.8, a confidence interval of 0.95, and a standard deviation of 3.39 [24], at least 46 participants per group were required to detect a 15% difference between the study groups. After considering a design effect of 1.8 and 20% loss to follow-up, the final sample size was estimated as 104 per group.

***Interventions:***

This study was performed in 3 phases according to the ADDIE model [25]:

***Phase I:*** Rapid assessment, problem identification, and compilation of the oral health content delivered according to the ADDIE 5-stage model [19,25]:

*1. Analysis stage*

Identifying the oral health problems in the deprived areas was done based on acquiring information from a literature review and interviewing the regional healthcare staff. Accordingly, regarding the women's key role in the family, those older than 18 years interested in participating in the study with the ability to obtain scientific concepts and practical skills were included. Since access to women living in deprived areas was difficult due to the cultural obstacles of these regions and also the difficulty of physical access to them, the research team accessed them through the CHVs of the region, who acted as a communication bridge between people of the region and the health centers; also, the research team decided to provide training by the CHVs and through speaking with the local language of the disadvantaged population. Since these people live in deprived areas and have low socioeconomic and educational levels, their training package had to contain the basic and main concepts of oral health, which had to be presented in a very simple and clear manner and with non-electronic tools to be understandable and useful for ill-educated and illiterates. To do this, the research team considered a flip chart and a dental model to teach the oral health concepts and the correct way of toothbrushing to the CHVs and women.

*2. Design stage*

The training course was designed according to the following main headings:

1) The number and time of eruption of primary and permanent teeth
2) The relationship between oral and systemic diseases
3) Stages of progression of dental caries and periodontal disease
4) Methods of preventing oral diseases
5) How to brush the teeth
6) How to floss
7) How to take care of primary teeth

During the analysis stage, it was decided that

educational materials for the intervention group should be presented as illustrations on a flip chart. This would allow CHVs to easily transfer the materials to women's homes and enable them to utilize the content effectively. Additionally, the correct technique of tooth brushing by using a dental model was included as part of the intervention.

*3. Developing stage*

The training package was reviewed by four community oral health specialists from Tehran University of Medical Sciences and two regional CHV supervisors, and the necessary corrections were made. Four CHVs, not involved in the main study, were selected to pilot-test the package.

*4. Implementation stage*

The implementation stage included phases II and III of the study.

*5. Evaluation stage*

A previously validated tool [26] was used to evaluate the OHL and oral health behavior. In addition, the first author recorded the plaque index (PI) [27] of the participants through a clinical examination.

Data were collected in 2 stages before and six weeks after the intervention.

***Phase II:*** Training of women by CHVs:

The training intervention for CHVs was performed during a 3-hour session in the form of a workshop for the intervention group in the target health center. First, the researcher taught the oral health concepts to the CHVs using a flip chart. Also, CHVs were trained to brush correctly using a dental model. Next, the CHVs practiced what they had learned with each other in a role-play practice. The first author supervised the process and corrected the errors made by the CHVs. The control group was trained using the conventional training method employed by health centers, which included teaching of the content of oral health book in 1-hour lectures by their instructors.

***Phase III:*** CHV training sessions

The training content (flip chart and dental model) was delivered to the CHVs in the intervention group after finishing phase II. Next, the CHVs transferred the educational content to the women using their local language. The CHVs in the control group used a conventional method in health centers to present the learned topic verbally in Persian to the women, without utilizing any educational aid.

The training was done face-to-face and at the door of the women's homes. As a reward, oral healthcare packages (toothbrush and toothpaste) were delivered to all participating women in both groups.

***Outcome measures:***

Information about the women's OHL and oral health behavior was collected by the validated Oral Health Literacy-Adult Questionnaire (OHL-AQ) (26). The CHVs asked each woman at the door of her home to respond to the questions of the questionnaire. The CHVs read out all the questions to the women and recorded their responses in the questionnaire.

Moreover, the first author measured the PI [27] at the door of each woman's home.

***Questionnaire:***

The OHL-AQ was used to collect data about OHL, oral health behavior, and demographic variables [26]. The OHL part of the questionnaire comprises four sections designed to evaluate various skills related to oral health. In total, 17 questions cover reading comprehension, numeracy, listening effectiveness, and decision-making ability. The reading comprehension section assesses the capacity to comprehend knowledge related to oral health. The numeracy section measures the ability to calculate numbers in the dental prescription and understand mouth rinse instruction. In the listening section related to the OHL part, the CHVs read a text aloud twice before asking the questions, and then the respondent answered two relevant questions. The decision-making section assesses the ability to apply literacy skills in addressing common oral health problems and items extracted from the medical history form. Each correct answer was scored 1, while incorrect and I don't know answers were scored 0. The total score for each person's OHL ranged from 0 to 17.

The oral health behavior section had five questions about the frequency of toothbrushing, use of fluoride toothpaste, dental visits, sugar consumption, and smoking.

Each question had 4 to 7 answer choices. The oral health behavior's total score was calculated considering the weighted score of the options according to the opinion of seven community oral health experts (Table 1).

Table 1. Weight of answer choices related to five oral health behavior questions according to the opinion of the experts

| Answer choice | Weight |
|---|---|
| **Frequency of tooth brushing** | |
| Less than once a day | 0 |
| Once a day | 3 |
| Twice a day | 5 |
| **Fluoride toothpaste use** | |
| Rarely or never | 0 |
| Almost or always | 5 |
| **Time of last dental visit** | |
| Never or more than 5 years ago | 0 |
| Within the past 5 years | 2 |
| Sometime last year | 4 |
| **Consumption of sugary snacks between meals** | |
| Twice daily or more | 0 |
| Once daily | 3 |
| Not every day or rarely | 3 |
| **Smoking** | |
| Current smoker | 0 |
| Ex-smoker | 2 |
| Non-smoker | 3 |

Health-promoting behaviors were given higher weights. Subsequently, the total oral health behavior score was determined based on the responses to five questions. The total score for each person's oral health behavior ranged from 0 to 20. According to the experts, women acquiring 80% of the total score have appropriate oral health behavior. In the present study, a cutoff point of 16 (range: 0-20), which was 80% of the score of 20, was used to determine the oral health behavior status. Thus, scores above 16 indicated good oral health behavior, and scores below or equal to 16 indicated poor oral health behavior. To assess the oral health behavior between the two groups, improvement in women's oral health behavior was measured compared to point 16. Any increase in the oral health behavior score above 16 was considered "improvement in behavior," while equal or lower scores indicated "no improvement in behavior."

Demographic data comprised various parameters such as age, educational level, living area, and number of family members living in the house. Educational level was recorded based on the latest academic degree achieved. Residential area per capita was calculated based on the living area in square meters per person ($m^2$/p) serving as a valid and reliable indicator of financial status in Iran [28,29].

***Clinical examination:***

The Loe and Silness index was used to determine the PI score [27]. Plaque accumulated on the distobuccal, buccal, mesiobuccal, and lingual surfaces of the selected teeth (numbers 12, 16, 24, 36, 32, and 44) was examined using a disposable probe and scored 0 to 2. The PI for each person was the total score of the teeth divided by the number of the examined teeth.

***Statistical analysis:***

To evaluate the changes in OHL total score and PI between the two groups, the generalized estimating equations (GEE) analysis was used [30]. Fixed effects included time (before and 6 weeks after the intervention), group (intervention and control groups), and group-time interaction. The significance of group-time interaction indicated the effectiveness of the intervention. Paired sample t-test was used to assess within-group changes in OHL and PI. Baseline and post-intervention oral health behavior change in the control and intervention groups were compared by the Chi-square test. The data were analyzed using SPSS version 25 (SPSS Statistics for Windows, IBM Corp., Armonk, NY, USA). P-values less than 0.05 were considered statistically significant.

## RESULTS

At baseline, 216 women entered the study, and they all were re-examined after 6 weeks.

Table 2 shows the baseline information of the control and intervention groups. The mean age of women was 26.72 ± 5.46 years in the control group and 26 ± 4.58 years in the intervention group.

**Table 2.** Demographic and clinical characteristics of the participants in the control and intervention groups

| | Control (n=108) | Intervention (n=108) |
|---|---|---|
| **Age (years)** | 26.72±5.46 | 26±4.58 |
| **Years of education** | | |
| 0-5 | 47(43.5%) | 40(37%) |
| 6-12 | 47(43.5%) | 50(46.2%) |
| ≥13 | 14(13%) | 18(16.8%) |
| **Residential area per capita ($m^2$/p)** | 27.82±15.73 | 29.24±10.93 |
| **OHL** | 7.84±2.61 | 7.54±2.32 |
| **Oral health behavior** | 12.87±4.26 | 12.05±4.47 |
| **PI** | 1.33±0.33 | 1.33±0.29 |

OHL: Oral health literacy; PI: Plaque index

The mean total OHL score of women in the control group was 7.84±0.25 (range: 0–17) at baseline, which increased to 9.65±0.26 at the follow-up. In the intervention group, the women's OHL score was initially 7.55±0.22, which increased to 10.97±0.19 at the follow-up. Table 3 shows the mean score of OHL, oral health behavior, and PI in disadvantaged women at baseline and at the six-week follow-up.

Table 4 shows the results of the GEE analysis for OHL and PI in the two groups. According to the group-time interaction P values, there was a significant difference between the two groups regarding the OHL score (P<0.001) and PI (P=0.03). The intervention group showed a significantly higher OHL score compared to the control group, while the PI was significantly lower in the intervention group than in the control group.

Table 5 shows changes in the mean scores of women's OHL and PI over time in the two groups assessed by paired sample t-test. Both OHL and PI improved significantly in the control and intervention groups at the follow-up time compared with baseline (P<0.001).

The oral health behavior of the participants in the intervention group significantly improved compared to the control group after six weeks (27.8% vs. 14.8%, P=0.02).

**Table 3.** Statistical Summary: Mean, Standard Error, and 95% Confidence Intervals for Oral Health Literacy, Oral Health Behavior, and plaque index in Women from Zahedan

| Groups | | | OHL | Oral health behaviors | PI |
|---|---|---|---|---|---|
| **Control** | **Baseline** | Mean±SE | 7.84±0.25 | 12.87±0.41 | 1.34±0.03 |
| | | 95% CI | 7.34,8.34 | 12.06,13.68 | 1.28,1.40 |
| | **Follow up** | Mean±SE | 9.65±0.26 | 14.52±0.36 | 1.24±0.03 |
| | | 95% CI | 9.14,10.16 | 13.81,15.23 | 1.19,1.40 |
| **Intervention** | **Baseline** | Mean±SE | 7.55±0.22 | 12.06±0.43 | 1.34±0.03 |
| | | 95% CI | 7.10,7.99 | 11.20,12.90 | 1.28,1.39 |
| | **Follow up** | Mean±SE | 7.10,7.99 | 15.18±0.34 | 1.20±0.02 |
| | | 95% CI | 10.59,11.36 | 14.49,15.86 | 1.15,1.25 |

SE: Standard error; OHL: Oral health literacy; PI: Plaque index

**Table 4.** Comparison of OHL and PI of women in Zahedan in the control and intervention groups

| | β | 95% Confidence interval | Standard Error | P value* |
|---|---|---|---|---|
| **OHL** | -1.62 | -1.97, -1.27 | 0.18 | <0.001 |
| **PI** | 0.04 | 0.00, 0.07 | 0.01 | 0.03 |

*Group × time interaction P value by GEE analysis; OHL: Oral health literacy; PI: Plaque index

**Table 5.** Changes in women's OHL and PI in Zahedan in the control and intervention groups

| Groups | Outcome | Mean difference | SE | 95% Confidence interval | P value* |
|---|---|---|---|---|---|
| **Control (conventional method)** | OHL | 1.80 | 0.10 | 1.60,2.01 | <0.001 |
| | PI | -0.09 | 0.01 | -0.12, -0.07 | <0.001 |
| **Intervention (flipchart and dental model)** | OHL | 3.42 | 0.10 | 3.21,3.63 | <0.001 |
| | PI | -0.13 | 0.12 | -0.16, -0.19 | <0.001 |

*Paired sample t-test; OHL: Oral health literacy; PI: Plaque index; SE: Standard Error

## DISCUSSION

This study assessed the effectiveness of an educational intervention based on the ADDIE model delivered by CHVs to improve OHL and behavior among disadvantaged women. The study results showed that the intervention successfully improved OHL, PI, and oral health behavior in the intervention group compared to the control group. The control group showed some improvement in OHL, oral health behavior, and PI to some extent, although it was not significant compared to the intervention group. The conventional training of oral health by CHVs in health centers probably contributed to improvement of OHL and behavior in the control women. Additionally, the clinical examination conducted during the baseline phase might have indirectly influenced the reduction in PI scores, as it prompted the women in the control group to brush their teeth more frequently during the follow-up phase.

Selecting CHVs from local people created a comfortable environment for women to learn about oral health issues, as well as other health issues [31,32]. Recruiting CHVs for community education in Iran has a long history; several studies have shown the effectiveness of CHVs in promoting the health knowledge, attitude, and performance of the public in various fields (such as diet and mental health) [33,34]. However, limited studies in the field of oral health have been conducted on CHVs and the people supported by them in Iran. Haerian-Ardakani et al. [32] showed that CHVs efficiently provided oral health education to the community, which aligned with the present findings.

The present findings are consistent with the results of Villalta et al, [35] who documented positive changes in parents and children's oral health attitude resulting from an educational program for community oral health workers to reduce early childhood caries. These findings suggest that CHVs can be trained to deliver effective oral health education to increase OHL and promote sustainable health behaviors in a slum setting.

The use of the ADDIE model is a notable strength of this study as it ensured that the intervention was tailored to the target population's needs. The research team utilized an ADDIE model to explore the potential and constraints of the target population. Through this process, they identified two effective strategies: asking the CHVs to educate the women, and using a flip chart and a dental model for training of both the CHVs and women in the intervention group. In Iran, CHVs are trained for various health issues through lectures and modeling on a set of CHV's training books, including oral health. This training is implemented in all urban areas of Iran without considering the needs and facilities of different groups in the society; whereas, the use of the ADDIE model in the present study led to an intervention based on the needs and available facilities of the target community, which might have contributed to the positive outcomes observed in the intervention group. Lack of previous research on oral health suggests that this study may serve as a starting point for further exploration of effective ways to use the ADDIE model to improve oral health outcomes in slum settings.

The strengths of this study were as follows: First, the results of the study were measured

both clinically (PI) and through a self-report questionnaire. The second strength is the participation of beneficiaries in designing and preparing the intervention based on the facilities, needs, and culture of the target community using the ADDIE model.

One limitation of this study was using a self-report questionnaire for OHL and oral health behavior, which may increase the possibility of response bias. Another limitation was related to the questionable effectiveness of interventions for behavioral change; it is often assumed that the acquired behaviors generally disappear in the long run after the intervention. Therefore, the authors suggest future studies with longer follow-ups to evaluate the effect of training on behavior.

## CONCLUSION

The present results indicated that it is possible to rely on the effectiveness of oral health training and the potential of CHVs to train families. In addition, it can be assumed that if the training contents are transferred properly and according to the target groups' situation and facilities, they can change the community's attitude and viewpoint towards oral health.

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## CONFLICT OF INTEREST STATEMENT

None declared.

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