



A Qualitative Analysis of Health Care Providers' Perceptions on Vitamin D Supplementation Program

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ABSTRACT

Previous studies have shown that the health burden associated with vitamin D deficiency is increasing globally. Vitamin D supplementation appears to be a feasible strategy for improving vitamin D status within populations. Little information is available on the perception and barriers to the widespread application of vitamin D supplements in Iran. Therefore, this study was conducted to explore the perception of health care providers regarding the implementation of vitamin D supplementation program in the Iranian cities of Mashhad, Qom and Zahedan.

This qualitative conventional content analysis study was conducted at 3 medical universities in Iran: Mashhad (MUMS), Qom (QUMS) and Zahedan (ZAUMS) University of Medical Sciences. These universities, are within regions with differing prevalence of vitamin D deficiency, and were selected based on the results of National Integrated Micronutrient Survey 2012 (NIMS-II study). Individual semi-structured in-depth interviews were performed with 103 participants (consisting of health professionals and health providers) to understand the perceptions of health professionals and health care providers'. The data were collected from December 2018 to July 2019. Guba and Lincoln's criteria were used to ensure the trustworthiness of the data. Data were analyzed using conventional content analysis based on the approach of Graneheim and Lundman's.

There were three categories of barriers to distribution and use of individual supplements, and the funding to implement the program; there were ten subcategories. Supplement distribution were affected by three subcategories of inadequate distribution of the supplement, irregular distribution of the supplement, and insufficient space to store the supplements. Individual barriers to the use of supplement comprised five subcategories: forgetting to take them, lack of knowledge about their benefits, accessing a health care center providing them, negative advertising for supplement use, and not taking them because of cost. Funding to implement the program contained the two subcategories of financial limitation in urban and rural area and financial limitation for all target groups.

The findings showed that health care providers reported a variety of barriers to supplement use. Applying a multiple strategy requires: training, conducting advertising campaigns, financial support, sufficient and regular distribution of the supplement and perhaps the use of alternative methods of supplement delivery, such as food fortification can be helpful.

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Introduction

There is substantial evidence for the important impact of vitamin D deficiency on public health; publications in this area have increased four-fold between 1995 to 2015 (Quraishi et al, 2016). Vitamin D has been classically recognized as an important nutrient in the prevention and treatment of rickets and osteomalacia (Carpenter et al, 2017; Uday and Hoegler, 2017). However, new studies have demonstrated its possible roles in several other chronic conditions such as diabetes (Wu et al, 2017), cancer (Keum et al, 2019), autoimmune diseases (Altieri et al, 2017; Lin et al, 2016), and cardiovascular outcomes (Pliz et al, 2016). It has been estimated that 80% of the vitamin D requirements are derived from dermal synthesis due to UV-B exposure and 20% from dietary sources; several factors may effect vitamin D status: season/latitude, dietary habits, ethnicity, style of clothing, reduce optimal intake of this nutrient (Holick 2017; Macdonald et al, 2011). Several approaches have been suggested to improve vitamin D status, such as changing dietary habits toward vitamin D rich foods, increasing more outdoor activities and UV-B exposure, losing weight (to mobilize vitamin D and its metabolite from adipose tissues), supplementation, and fortification (Pilz et al, 2018). Although life style changes are potentially first steps in improvement of vitamin D status, they usually have a limited effect in the population; for example according to a recent meta-analysis, increasing fish consumption, a natural rich food in vitamin D, can increase serum 25(OH)D levels by 4.4 nmol/L (Lehmann et al, 2015). However greater degrees of exposure to UV-B may increase the risk of skin cancer. Hence, supplementation and fortification have emerged as feasible strategies for improving vitamin D status within populations. Reports from *National Health and Nutrition Examination Survey (NHANES)* have indicated that supplement use in populations can significantly increase 25(OH)D across all age groups, race, gender and ethnics (Whiting and Calvo, 2005; Moore et al, 2005; Nesby-O'Dell et al, 2002). Nevertheless, the benefits of supplements were reported to be greater in individuals whose vitamin D intakes were above the median intake of population and individuals whose intake is less from foods had a lower beneficial gain from supplementation (Whiting and Calvo, 2005). One significant advantage of

supplements is that there is no need to change dietary patterns. Supplements deliver a precise dosage of nutrients and minimize the risk of toxicity. On the other hand, supplementation may have several disadvantages; supplementation is more expensive than fortification in the context of public health and requires the adherence of individuals, which may be affected by its high cost and the knowledge and beliefs about their benefits (Vieth 2012). There are also several challenges to adopting vitamin D supplementation into public health policies, such as the variations in the requirement for adequate vitamin D intake due to multivitamins and prescribed or over-the-counter supplements. Furthermore, to determine the magnitude of vitamin D fortification, it is necessary to have information regarding the amount of vitamin D intake and barriers to using vitamin D supplements in populations. Therefore, this study was conducted to explore the perception of health care providers regarding to the vitamin D supplementary program implementation in Mashhad, Qom and Zahedan, Iran.

Study Design

This qualitative conventional content analysis study was conducted at the Universities of Medical Sciences at Mashhad (MUMS), Qom (QUMS), and Zahedan (ZAUMS) in Iran. The study population consisted of health professionals, health headquarters staff, public health practitioners, and health care managers. These universities are within regions with varying prevalence of vitamin D deficiency and were selected based on the results of the National Integrated Micronutrient Survey 2012 (NIMS-II study).

Study Population

The participants received both verbal and written information about the study. The age groups in our study include the elderly (over 60 years old), middle-aged (60-30 years old), youth (18-29 years old), pregnant mothers and students (6-17 years old) except for children with the age range of 2 to 5 years old. The study data were collected from December 2018 to July 2019. Purposive maximum variation such as Job Type in the health system and work responsibilities was used to select the participants. Individual semi-structured interviews were performed with 103 participants to understand health professionals

and health care providers' perceptions and to investigate the cultural and behavioural factors influencing the intake of vitamin D supplements in Mashhad, Qom, and Zahedan. The interviews were performed in the health centers, and the interviews were carried out in places that were convenient for the participants. The interview was conducted face-to-face or by telephone. The mean interview duration was 20 minutes (10-42 minutes).

Data Collection

For data gathering, a questions interview guideline was used to conduct in-depth semi-structured interviews. The interview questionnaires are available in Supplement 1. The interview began with general questions, such as "Have you encountered the use of vitamin D supplements as a health worker?" and moved to more specific, detailed questions as the interview advanced, such as "What kind of problems did you experience when attempting to supply vitamin D supplements? and "What are the barriers to taking and distributing vitamin D supplements?" Probe question, such as "Can you tell me more, please?" were asked to discover further data. Data collection was carried out until data saturation was achieved.

The Guba and Lincoln's criteria (Graneheim and Lundman, 2004), including credibility, confirmability, transferability, and dependability were used to assurance the trustworthiness of the data.

Data Analysis

Data were analyzed using the inductive, qualitative content analysis, which allows researchers to examine individual experiences (Graneheim and Lundman, 2004). After listening to the recorded interviews, the researcher transcribed and read them repeatedly to better understand their data. In the next step, meaning units (words, sentences, or paragraphs) that were related to each other through their content and context were identified (Graneheim and Lundman, 2004). The meaning units were condensed and given a descriptive code and were then organized into subcategories and categories. The categories were sets of different codes that shared the same content.

Results

A total of 103 participants were recruited, including Authorities of the Comprehensive

Health centers, Healthcare Managers, Public Health Practitioners, Heads of Healthcare Centre, Heads of Network Development Group, Heads of Family Health Unit, Heads of Nutrition Unit, Deputy Heads of Healthcare, Executive Officers, Technical Officers, Heads of Network Development Unit, City Network Development Officer, Heads of Population/Family and schools Health, Heads of the Department of Nutrition Improvement, Heads of School, and Schools' Supplementary Implementation Officers.

Generally, the three categories of the supplement distribution, the individual barriers to use of supplement, and the funding to implement the program, and 10 subcategories emerged.

The Supplement Distribution

Supplement distribution comprised three subcategories of inadequate distribution of the supplement, irregular distribution of the supplement, and insufficient space to store the supplements. The likelihood of inadequate, or irregular distribution of the supplement based on age groups was a factor mentioned by the participants. "Distributing of supplements in different age groups has not been optimum for some time and has not been available for the whole year. It has been irregularly available in the Health Centers in a rural area). In this situation, people who are referred to Health Center were asked to get the supplement privately from the drugstore", (Contributor 39 in ZAUMS' Health Center). Another contributor emphasized that the supplement distribution was less than for the target population: "We gave the supplement to all centers but was not sufficient because the purchases were not sufficient to cover the target group", (Contributor 28 in the comprehensive Health Center). Prioritizing the distribution of supplements to the poorest areas and suburbs was also one of the factors contributing to the heterogeneous distribution of vitamin D supplement in the city: "The supplement is distributed to elderly and middle-aged subjects with the priority of suburban and rural area, but there is insufficient supplement available", (Contributor 47, Head of comprehensive Health Center).

In Zahedan, there was insufficient space to store the supplements, but stockroom capacity was reported as a problem to implement the program only in this city. The Head of the Family Health Unit in ZAUMS mentioned that "The supplement requests are set and delivered monthly because

of the lack of sufficient space in Health Centers and unsuitable conditions". Another contributor on hot weather and unsuitable storage conditions stated that "The health centers and schools have no suitable storage facilities for the supplements. Zahedan with hot and dry weather is warm all year round. Therefore, temperature <25° C as an important factor for storing vitamin D supplements, cannot be observed", (Head of Network Development Group).

A technical officer in health deputy stated that "There are currently insufficient vitamin D supplements available. A reason for this is that we faced an abrupt reduction in supplement distribution in the market; the drug distribution companies were not supplying many of the supplements, and so on. Because the prices have increased a lot, these increases have undoubtedly affected the program". Another contributor in a Health Center of the Qom said that "Despite sufficient funding, there were insufficient supplements available in the market. Then we had to start the vitamin D and iron supplementary program in February 2018. Based on the guideline, we should distribute nine vitamin D pearls (50.000 IU) to every student in high schools based on the guideline, only three supplements could be purchased and distributed to each student".

Solutions

To improve storage conditions, the necessary equipment for this and effective distribution were other important issues of contributors: "To supply cooling equipment during the hot seasons due to extremely high temperatures, for proper storage of all supplements are recommended in health posts, houses and health care centers of the city" (Contributor14, Head of Nutrition Unit, ZAUMS). "Supplement availability in the drug distribution companies is important because we had credit for a period of time, but there were no supplements available from the suppliers"(Contributor 52, Head of Nutrition Unit, ZAUMS). A public health practitioner in QUMS stated that "We should increase distributed supplements directly to people, especially to those who do not need other services and are merely referring to supplementation. This approach can help us to manage our time. For example, if we give them 6 supplements instead of 3, they will refer to the health care centers in a longer time than before".

Individual Barriers to Use of Supplement

Individual barriers to use of supplement comprised five subcategories; forgetting to take them, lack of knowledge about their benefits, accessing a health care center, negative advertising for supplement use, and not taking because they are being provided free of charge. Most participants mentioned that going to the health care center is one of the important issues of using vitamin D supplements by people. Other barriers to the use of supplements were the lack of knowledge about the benefits and negative advertising for supplement use such as Family members, especially parents and teachers, not allowing the use of the supplements or being concerned about their potential negative health impacts.

A health care manager in Mashhad stated that "Resistance was greater in middle-aged subjects and they did not know what supplements were. Then, we taught them that the vitamin D supplement can be useful for osteoporosis and preventing heart disease, and they were then asking for the measurement serum vitamin D levels themselves and asking for vitamin D".

Another contributor mentioned that "Some elderly and middle-aged subjects cannot attend Health Centers, because they have mobility problems", (A public health practitioner, ZAUMS).

A Head of a High School said that "It has been rumored by the public that the vitamin D supplement may affect the fertility of students in the future".

Solutions

Training of the public was one of the main suggestions that contributors mentioned about taking vitamin D supplement.

"When some mothers are referred to Health Centers after delivery, we find that they have not consumed any vitamin D supplements at all. They mention that the doctor did not say anything about its consumption. Education and people's awareness should be raised. But generally, vitamin D supplement is much better consumed than iron because it is consumed once a month" (health care manager, MUMS). "Distributing brochures and educational posters on the vitamin D importance and its properties to people can be useful. Because some people sometimes forget in the follow-up what the supplement is. The brochure was already there, but in limited size", (public health practitioner in

QUMS). "Training about the importance of vitamin D intake and its deficiency through educational mass media should be increased because people do not even know how to get sunlight to make vitamin D in the body and to prevent vitamin D deficiency by taking Vitamin D pearls" (contributors 40, health care practitioner, ZAUMS). Practical training and counseling by health care providers to increase the willingness and awareness was the other participant suggestions, so that one of the participant stated this: "Education and counseling by health care professionals about vitamin D intake is important to people because if somebody is aware of the benefits, he/she can be persuaded to use vitamin D supplement and can be obtained from the drugstore", (Contributor 44 county of family health unit).

Funding to Implement the Program

Funding to implement the program contained the two subcategories of financial limitation in urban and rural area and financial limitation for all target groups. Funding was one of the most important issues raised by participants in 3 different provinces. Contributor 2, a health deputy in ZAUMS stated that "The urban per capita funding for health is much lower than the rural per capita, but the urban population is greater. So, there is a financial limitation in the city, and on the other hand given the current situation, there is also a financial limitation in a rural area. Moreover, much of the credit is also spent on providing the experts, and insurance deductions make it worse".

A contributor at MUMS' health deputy mentioned, "We have financial limitations to provide the required number of supplement for all target groups and prioritize our resources for vulnerable age groups. That is, we put the priority first on the pregnant women, then on students. Among the students, girls are the top priority".

Contributor 1, a Health Deputy in QUMS mentioned that "Supplements have been purchased for all age groups according to the guideline, but we could not completely provide all required supplements due to economic issues and increased prices". Another contributor is a health care center in Qom said, "Vitamin D supplements have been distributed as a guideline, but due to inadequacy, priority has been given to rural areas and city surrounds. So that, poor people hurt less, thus the supplement

not distributed in some areas because there were no enough supplements".

Solutions

Timely funding allocation to purchase the vitamins was one of the most essential suggestions the participants mentioned: "Timely funding should be sent to the cities to purchase and distribute the supplements to students during educational year to prevent happening any problems" (Contributor 38, Head of school, ZAUMS).

Moreover, ordering the vitamins from drug distribution companies several months before starting the program was another subject that was mentioned: "Requests should be sent to pharmaceutical companies a few months in advance in order to prepare supplement in time" (Head of family health, contributor 44, ZAUMS). "It is recommended that sufficient funding be provided for the preparation and distribution of supplements, together with supplying sufficient supplements in the market", (Head of Network Development Unit, QUMS).

Direct funding by the health ministry to make the program more effective was another issue raised by the contributors: "In the supplement distribution between units, the purchase and distribution depend on the city because the credit is allocated to every city. If the supplementary is effective, it is advisable that the supplementary budget be spent directly by the health ministry and if it is not effective, it should not be done" (Contributor 46, Public health manager, ZAUMS)

Others

Other problems encountered in implementing the vitamin D supplementary program were: insufficient supervision, lack of sufficient experts, hot weather, and transportation issues to get to health care center.

Solutions

Applying alternative methods for vitamin D supplements, such as sun exposure, proper diet, and food fortification was another suggestion that may be effective in preventing the vitamin deficiency and saving costs.

"The financial and economic cost of the supplements is important generally supplementation has early effectiveness and is one of the four recommended strategies of the World Health Organization. But food fortification, such as fortified bread with

vitamins D or other micronutrients including iron and folic acid has a very good effect, at a very low cost, with a high availability, and covers almost the whole of the country, therefore the costs are reduced nationally. For example, in 2001 and 2012, the Nutrition Improvement Office Ministry of Health reported that iron deficiency anemia was reduced by 50%, meaning we were successful about micronutrients. We suggest that the food should be fortified if possible. On the other hand, training people about vitamin D has a great effect and we are required to inform people about the supplementary benefits and vitamin deficiency side effects", (Head of the Department of Nutrition Improvement, QUMS). "In my view, the priority is a fortification, and people can select the type of goods themselves. I think having a financial contribution is better than not being paid too much", (Head of the Department of Nutrition Improvement, MUMS).

Discussion

Vitamin D deficiency has been identified as a health problem worldwide for all age groups, especially in Middle East countries (Ovesen *et al*, 2003). The high prevalence of vitamin D deficiency is an important concern of health officials in Iran (Pouraram H, *et al*, 2018). Since vitamin D deficiency would affect the health consequences and impairment of the function of many organs of the human body (Palacios and Gonzalez, 2014), the implementation of appropriate and targeted interventions can play a significant role to improve the public health in the country. In Iran, the vitamin D supplementary program has been applied by the Office of Nutrition Department Society in the whole of the country among different age groups since 2014. Therefore, it appears necessary to evaluate the status of the vitamin D supplementation program in Iran to identify the weaknesses and implementation problems of the program. Moreover, it seems that exploring the vitamin D supplementary program can also be used to identify the executive barriers and problems.

Qualitative analysis showed that there are several problems in implementing the program in Iran, such as distributing the supplement and the existence of barriers to using the supplement by people and funding. The barriers to use supplements were: 1- Forgetting to take them, especially among middle-aged or elderly, 2- Lack

of knowledge about the benefits, 3- Access to the health care center, 4- Negative advertising for supplement use (Family members especially parents and teachers not allowing use of the supplements, being terrified of negative health effects), 5- Not taking supplements because of being free of charge, 6- Side effects, such as: nausea and headache, 7- Implementation of the project at schools with a delay of 3 months.

In MUMS and QUMS, supplying vitamin D supplementation was the most important problem, whereas in ZAUMS, distributing the supplement has been reported as the most critical issue as the barriers to the person's use of supplements. Among several problems, inadequate/irregular distribution of the vitamin D supplements and not providing them by drug distribution companies should be considered by health headquarters in QUMS and ZAUMS. The health professionals' solutions include a need to intervene a multiple strategy that contains training, campaign, financing, sufficient and regular distribution of the supplement and to apply the alternative methods such as food fortification.

In the current study, side effects such as nausea or headache were reported by 5.8% of health providers as a barrier to supplements. Most public health practitioners and health care managers have reported that people were willing to receive the vitamin D supplement because it lacks scent and bad taste.

In recent years, the supplementary price has increased by over 50%, but the budget dedicated to the supply of the supplement has not changed. Providing the vitamin D supplement as centralized (by health ministry/food-drug administration/provincial headquarters) and its sufficient and regular distribution was one of the solutions to the problems of providing supplements. Because in this case, the cost of purchasing decreased with the allocation of vitamins budget from the source to buy vitamins and the purchase of drugs at one time. The wandering of the authorities in the provision of supplements from different companies or the allocation of supplements budget to other essential requirements, such as the purchase of antibiotics, would be avoided.

Another strategy is taken to deal with the lack of funds was prioritizing the Health Center based on the richest and poorest areas. In the case of lack of supplement, distribution priority was in

poorest areas and in cities surrounding and in the richest areas; individuals were trained to purchase and consume vitamin D supplements. Moreover, some of the more vulnerable age groups, such as pregnant women and female

students, were prioritized. Figure 1 has summarized some suggestions for improving the implementation of the Vitamin D supplementary program.

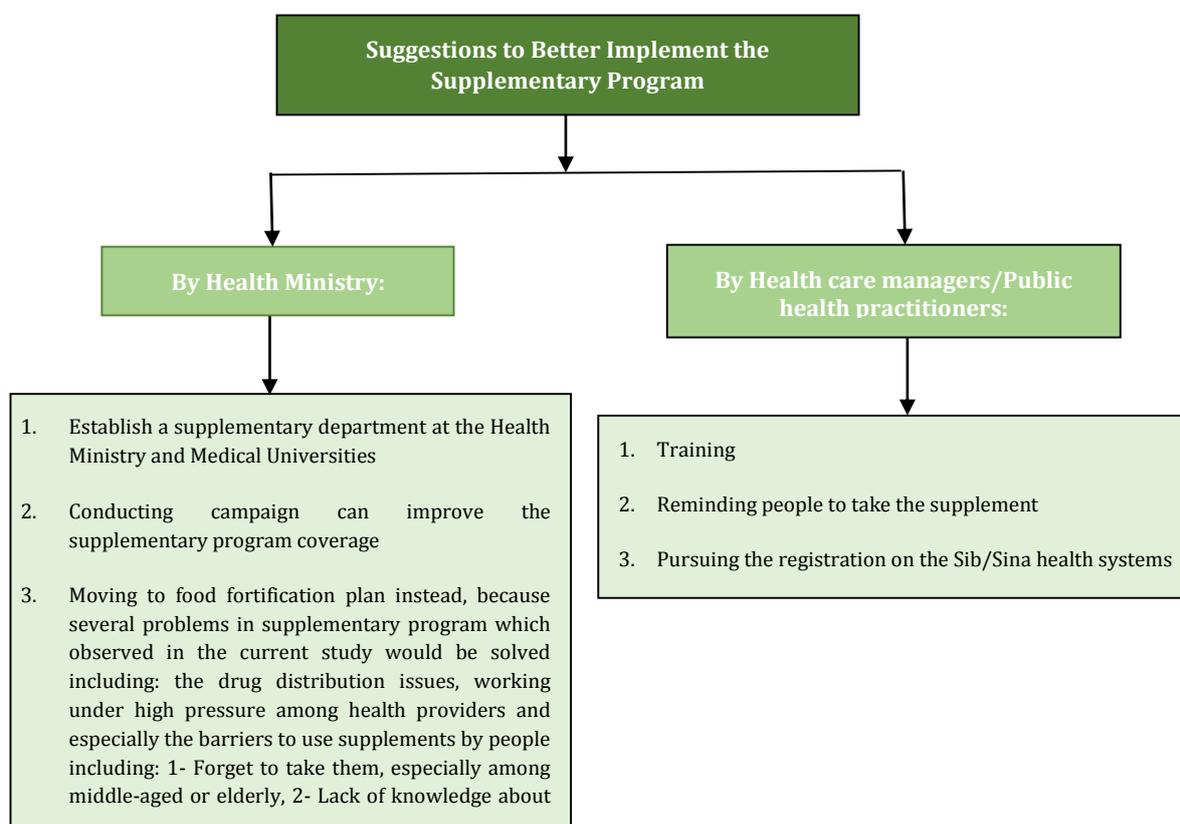


Figure 1. Suggestions for improving the implementation of the Vitamin D supplementary program

Conclusion

This study indicates that there are several problems in implementing the vitamin D supplement program, including issues related to distribution of the supplement, the barriers to take supplement by people, and funding. The findings can suggest applying national interventions through multiple strategies containing training, conducting campaigns, financing, sufficient and regular distribution of the supplement, and applying alternative methods such as food fortification.

Ethical Consideration

This study was approved by the Research Deputy of MUMS based on the MUMS's ethical guidelines and in accordance with the Declaration of Helsinki

(ID: 970940; IR.MUMS.MEDICAL.REC.1397.387). Informed written consent was obtained from all participants. All participants' names have been removed from all of the manuscript.

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Conflicts of Interest

The authors confirm no competing interests.

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