KNOWLEDGE, ATTITUDES AND PRACTICES TO REDUCE EXPOSURE AMONG RESIDENTS LIVING NEAR DANANG DIOXIN HOT SPOT - 2.5 YEARS AFTER A PREVENTIVE INTERVENTION

Tuyet-Hanh TT[1,2*], Vu-Anh L[1], Dunne M[2], Tenkate T[3], Toms L[2], Harden F[2]

[1] Hanoi School of Public Health and Vietnam Public Health Association, 138 Giang Vo Street, Hanoi, Vietnam;
[2] The Queensland University of Technology; [3] Ryerson University, Ontario, Canada

Abstract

Da Nang Airbase in Viet Nam served as a bulk storage and supply facility for Agent Orange and other herbicides during Operation Ranch Hand 1961-1971[1]. Studies have shown that environmental and biological samples taken around the airbase site have elevated levels of dioxin [1-3]. Residents living in the vicinity of the airbase are at risk of exposure to dioxin in soil, water and mud and particularly through the consumption of local contaminated food. In 2009, a pre-intervention cross sectional survey was undertaken. This survey examined the knowledge, attitudes and practices (KAP) of householders living near Da Nang Airbase, relevent to reducing dioxin exposure through contaminated food. The results showed that despite living near a severe dioxin hot spot, the residents had very limited knowledge of both exposure risk and measures to reduce exposure to dioxin[4]. In response, the Vietnam Public Health Association (VPHA) and Da Nang Public Health Association implemented a risk reduction program at four residential wards in the vicinities of the Da Nang Airbase in 2010. A post intervention KAP survey was under taken in 2011, and the results showed that knowledge of the existence of dioxin in food, dioxin exposure pathways, potential high risk foods, and preventive measures was significantly enhanced. This new study monitored KAP 2.5 years after the intervention through a 2013 survey of food handlers from 400 households that were randomly selected from the four intervention wards. The results show that most of the positive outcomes remained stable or had increased; some KAP indicators decreased compared to those in the post-intervention survey, but were still significantly higher than the pre-intervention levels. In 2014, these findings will be incorporated with qualitative assessments and the results of laboratory analysis of dioxin concentrations in foods in Da Nang and Bien Hoa dioxin hot spots to comprehensively assess the sustained effects of the intervention.

Key words: Da Nang Airbase, KAP, dioxin, dioxin exposure through foods

Introduction

Dioxin was a by-product present in Agent Orange (AO) and other herbicides used by the American military in the Vietnam War. There are currently 28 identified potential dioxin hot spots in Vietnam and Da Nang Airbase, a bulk storage and supply facility for AO during Operation Ranch Hand is one of the two most severe hot spots in the country. Elevated levels of dioxin, especially 2,3,7,8-Tetrachlorodibenzo-p-dioxin, have been reported in soil, sediment, some types of local foods, and human blood in these areas [1, 2]. People who live at An Khe, Hoa Khe, Thanh Khe Tay and Chinh Gian wards, surrounding the airbase were at risk of exposure to dioxin in the environment, particularly through the consumption of dioxin contaminated foods [5]. In 2009, a pre-intervention survey on the KAP of householders living near the airbase was undertaken. The results showed that the knowledge and practices of the local residents on dioxin and preventive measures were very limited [4]. Only 15.9% of respondents knew that dioxin could be present in foods. Knowledge of dioxin, potentially high risk foods and measures to prevent dioxin exposure was also very limited. Among the minority (39.8%) who said they practiced some prevention, some were using practices unlikely to be protective. Therefore, potentially high risk foods were consumed frequently on a weekly basis [5].

In response, an intervention program, comprised of education, communication, and policy advocacy components was implemented by VPHA and its provincial branch in 2010 to reduce the risk of dioxin exposure through the food chain for people living in the four wards near Da Nang Airbase [5, 6]. A post-intervention survey in 2011

revealed that the knowledge of respondents on dioxin and dioxin exposure prevention was significantly improved. Generally, more people were aware of where dioxin could be present in the environment. Knowledge of the existence of dioxin in food more than doubled compared to pre-intervention levels (16.1% to 37.1%, $\chi2 = 35.2$, P<0.001) [5]. The percent of respondents who believed that dioxin could enter the human body through food increased from 78.9% to 90.7% (P <0.001). Correct knowledge of high risk foods such as fatty meat, freshwater fishes, shrimps, crabs, snails, viscera, as well as knowledge about preventive measures increased significantly [5]. The intervention was associated with an increase from 39.8% to 60.3% in the number of households who undertook exposure preventive measures to reduce exposure [5]. The present study was undertaken to assess the continued effectiveness of the intervention. This paper reports a follow-up KAP survey conducted two and a half years after the intervention to assess long term effectiveness.

Material and methods

This survey using a questionnaire on dioxin exposure was implemented in March-May 2013, about 2.5 years after the intervention. The results were compared with those of the pre-post intervention KAP surveys impelemented in 2009 and 2011. A sample of 400 households was randomly selected from the list of all local households living at the four intervention wards surrounding Da Nang Airbase (each ward has over 4,000 households), using systematic random sampling scheme. 400 food handlers from selected households, aged 18-65 were invited to participate in the survey. Data was entered using Epi-data 3.2 and analyzed using SPSS 18.0 software.

Results and disscussion

The knowledge of respondents on dioxin and dioxin exposure prevention were significantly improved after the intervention and remained positive at 2.5 year follow-up. Generally, more people were aware of where dioxin could be present in the environment, except for the knowledge on the presence of dioxin in water when it attached to suspended particles (Figure 1). This reduced to 67.8% in 2013 and was significantly lower than those in pre-intervention (80.3%) and post-intervention surveys (76%) ($\chi2 = 15.9$, P < 0.001). In contrast, the knowledge of dioxin existence in soil was significantly higher, 71.4% in 2013 compared with 54.9% in 2009 and similar to the rate in 2011 of 69.4% ($\chi2 = 22.2$, P <0.001). The knowledge on the existence of dioxin in food post intervention increased more than two-fold compared to the pre-intervention (16.1% to 37.1%, $\chi2 = 35.2$, P < 0.001), and increased to 50% in 2013 (P<0.001). Knowledge of dioxin attached to particles in air was decreased but was not significantly different to that observed in the pre-intervention (15.3%) and post intervention (16.8%) ($\chi2 = 1.6$, p = 0.5). The proportion of subjects who did not know where dioxin exists in the environment (11.6%) was similar to that of post intervention survey (12.7%) and was a significant improvement compared to that in the pre-intervention survey (27.7%, $\chi2 = 45.2$, p < 0.001).

Knowledge of routes of exposure to dioxin was also significantly improved after the intervention and remained positive 2.5 years later (Figure 2). The proportion of participants aware of the main route of dioxin exposure through food consumption in 2013 was 84.1%, somewhat lower than that in post intervention survey (90.6%), but still higher than the rate in the pre-intervention survey (79%; $\chi2 = 17.6$, p < 0.001). Knowledge of the routes of exposure through respiration and dermal absorption did not change significantly from 2011, while knowledge of exposure through consuming breast milk increased significantly from 1.1% in 2011 to 8.6% in 2013 (p < 0.001), but these rates remained remarkably low (Figure 2). The proportion of respondents aware of dioxin pollution in and around Da Nang Airbase in 2013 was 70.9%, not significantly different from the level in 2011 (69.2%), but significantly higher than that of the pre-intervention survey in 2009 (44.7%; $\chi2 = 98,1$, p < 0.001).
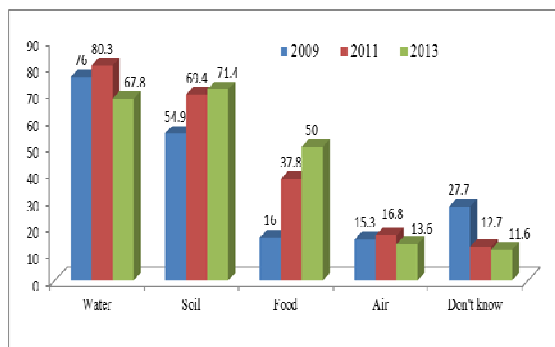
Figure 1. Knowledge of local residents surrounding Da Nang Airbase on the presence of dioxin in the environment and food, 2009, 2011, 2013
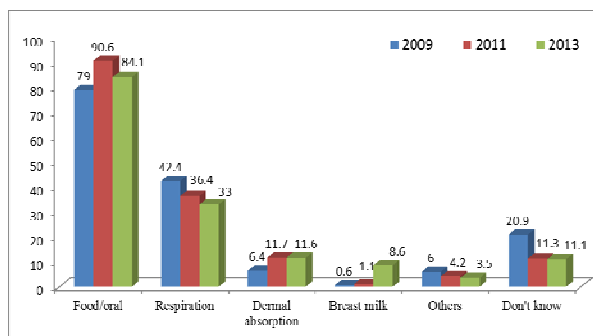

Figure 2. Knowledge of respondents on the routes of dioxin exposure, Da Nang 2009, 2011, 2013

The proportion of respondents aware of potentially high risk foods remained positive with some increases compared to the pre and post intervention surveys (Figure 3). The most high risk foods in dioxin hot spots are fresh water fish, shrimps, crabs (especially the bottom mud feeders). In 2013, 65.6% of respondents were aware of these potentially high risk foods, which was significantly higher than those in the pre and post intervention surveys ($\chi 2 = 117.8$, p < 0.001). Vegetables are usually low risk foods, except for carrot, pumpkin and lotus which have the ability to uptake and thus be contaminated with dioxin [1, 7]. In addition, in dioxin hot spots, leafy vegetables can carry a high risk if people do not wash them carefully to remove all dust and dirt attached to the leaves. The proportions of respondents who thought vegetables were potentially high risk foods if grown in polluted areas were not significantly different among the three surveys: 79.6% (2009); 76.8% (2011); and 79.2% (2013) ($\chi 2 = 3.7$, p = 0.16). The knowledge of respondents regarding other high risk foods such as animal fat, viscera, eggs and breast milk did not change significantly compared to the pre and post intervention surveys, and still remained low (Figure 3). Risk communication activities in the future should focus more on raising awareness of local residents on these potentially high risk foods.
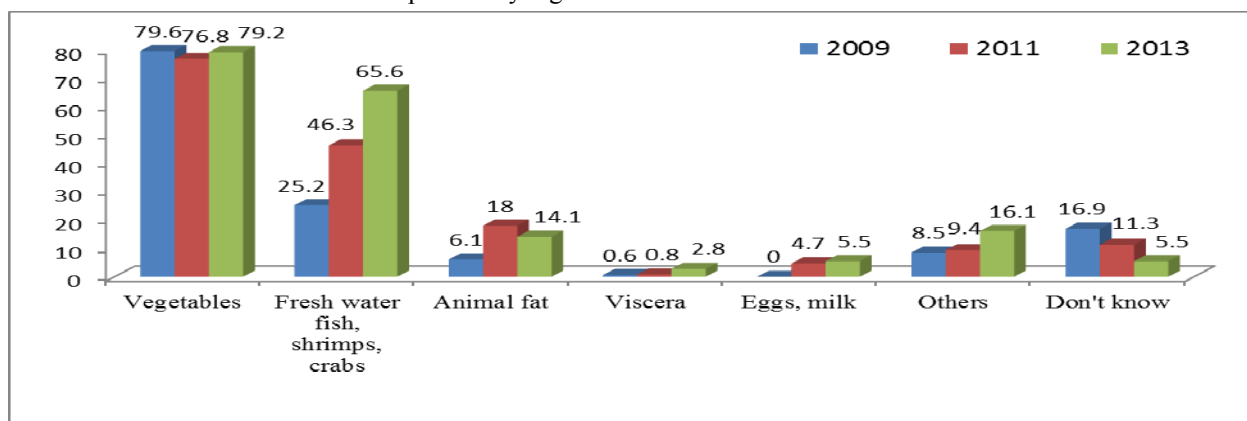

Figure 3. Knowledge on potentially high risk foods, Da Nang 2009, 2011, 2013

In addition, the respondents' knowledge on practical ways to reduce the risk of dioxin exposure was positive compared to the pre and post intervention surveys. In 2013, 46.7% of respondents were aware that they should not eat fresh water fish and aquatic products harvested from ponds and lakes inside and surrounding the airbase. This was significantly higher than those in the pre-intervention survey (2.6%) and post intervention survey (20.8%) ($\chi 2 = 198.3$, p < 0.001). The proportion of respondents reporting that they should wash vegetables carefully in 2013 (60.6%) was significantly lower than the pre-intervention (74.7%) and post intervention surveys (68.5) ($\chi 2 = 17$, p < 0.001). However, knowledge of other preventive measures, such as taking steps to reduce consumption of animal fat, eggs, and breast milk in the first few weeks after birth, was low in all three

surveys with the proportions of respondents ranging from 0% to 16.8%. These results were similar to those observed in the pre and post intervention surveys in Bien Hoa dioxin hot spot in 2007 and 2009 [8, 9].

There were no significant differences in **attitudes** toward preventing dioxin exposure across surveys; most respondents were positive in all three surveys. In 2013, 86% of respondents were confident that they could reduce the risk of dioxin exposure in the contaminated areas, which was similar to that of the post intervention survey in 2011 (86.6%), but significantly higher than before the intervention (77.3%; $\chi2 = 19.3$, p = 0.01). Before the intervention, 96.9% of respondents were willing to quit some of their favorite foods if they knew that these foods were at high risk of being contaminated with dioxin and was equivalent to the pre-intervention result (95.8%). The rate in 2013 was significantly lower than those in 2009 and 2011, however, still remained at 89.5% ($\chi2 = 48$; p <0.001). The number of respondents, 87%, who were willing to buy uncontaminated foods with higher prices, was statistical significantly lower compared to those in the pre-intervention survey (92.1%) and post-intervention survey (95.1%; $\chi2 = 35.2$; p < 0.001).

Regarding **practices** to reduce the risk of dioxin exposure, the survey in 2013 showed that the proportion of households that self cultivated foods in Da Nang in the past 2.5 years remained low, with only 18 households (4.5%). This was not significantly lower than the result of pre and post-intervention surveys (6.9% and 4.9%, respectively; $\chi2= 2.6$, p= 0.3). There was a significant increase to 69.5% households that already undertook exposure preventive measures, compared to that of the pre-intervention survey (39.6%) and post- intervention survey (60.4%; $\chi2 = 95.6$; p < 0.001). The proportion of respondents practicing appropriate preventive measures was also significantly improved compared with pre- and post-intervention surveys. Specifically, in 2013, 73% of respondents reported that they have consumed less fresh water fish, shrimp and crab, which was significantly higher than those in 2011 (38.4%) and 2009 (15.7%; $\chi2 = 146.6$; p < 0.001). Other practices including: avoid foods of unclear origin (58.6%); consume less carrot, pumpkin and lotus growth at the local areas (44.9%); consume less free range chickens and ducks (35.4%); and filter water before use (49.1%) significantly increased compared to those in the pre- and post-intervention surveys. The proportion of respondents consumed less fat and viscera in 2013 was also significantly higher than those in pre- and post-intervention surveys; however, it still remained low (10.2%) (Figure 4).
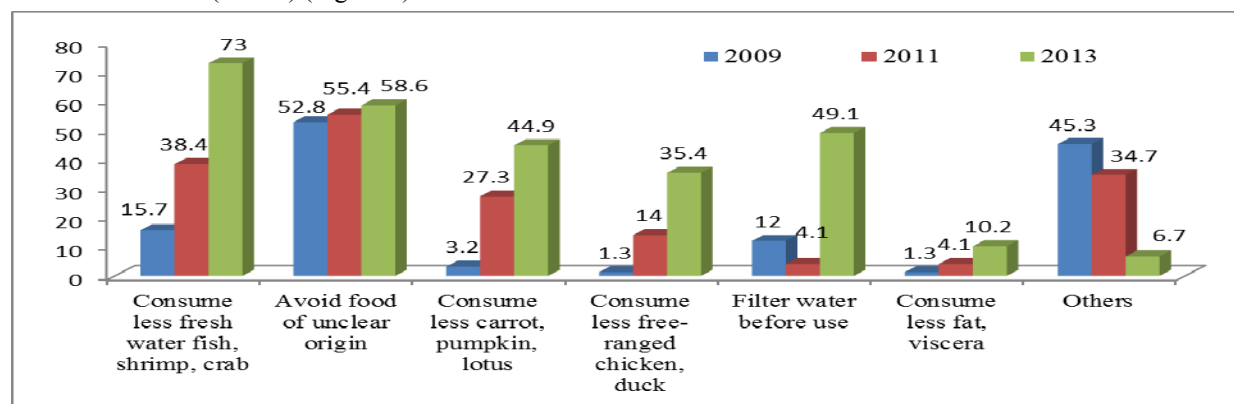

Figure 4. Practices to reduce the risk of dioxin exposure through foods, Da Nang 2009, 2011, 2013

The results also showed that similar to the results of the post-intervention survey, in 2013, potentially high risk foods such as freshwater fishes, chicken eggs, duck eggs, and pumpkin had quite low rates of daily consumption (<= 2.5%) and were significantly lower than those of the pre-intervention survey. The weekly consumption frequencies of some potentially high risk foods in 2013 were slightly higher than those in the post-intervention survey, but still decreased significantly compared to those in the pre-intervention survey (Figure 5). From 2009 to 2011 and to 2013, the following reduction in consumption was observed: pumpkin on a weekly basis from 63.7% to 34.5% and 37.5% (p < 0.001); freshwater fish from 51.4% to 17.4% and 32% ($\chi2 = 105.4$; p < 0.001); wild goose, duck meat from 15.3% to 5.6% and 2.7% ($\chi2 = 46.4$; p < 0.001); and viscera from 6.3% to 2.9% and 2.5% ($\chi2 = 8.8$; p = 0.01) (Figure 5). Other foods such as beef, buffalo meat, pork, and seafood had high weekly consumption frequencies; however, these were low risk foods as the activities of raising cattle and pigs were not observed in Da Nang in 2013.
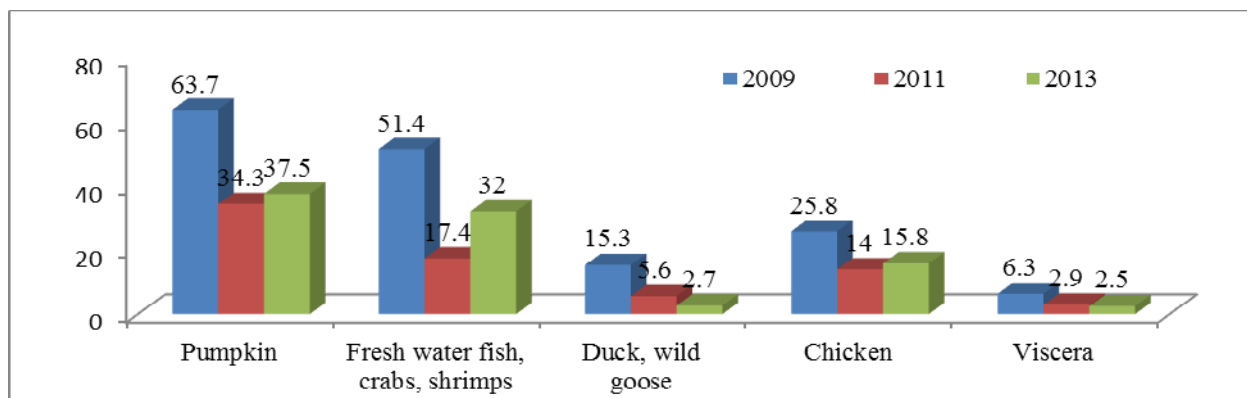
Figure 5. Weekly consumption frequencies of potentially high risk foods, Da Nang 2009, 2011, 2013

Conclusion

The findings indicate that the Public Health intervention program implemented in Da Nang dioxin hot spot to improve knowledge, attitudes and practices among local people has sustained and positive effect 2.5 years after the intervention. In 2013, residents remained aware of health risks associated with dioxin exposure and many applied recommended methods to prevent dioxin exposure through food. In 2014, these findings will be integrated with a more comprehensive analysis that includes qualitative interview assessment and the results of laboratory analysis of dioxin concentrations in foods in Da Nang and Bien Hoa dioxin hot spots to determine the sustainability of the intervention program. This may provide useful evidence to expand the prevention model to other dioxin hot spots in the country.

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