Impact of behaviour change communication interventions on sales of fortified sunflower oil in Tanzania: A spatial-temporal analysis and association study

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Abstract

The Masava project was implemented in Manyara and Shinyanga regions in Tanzania to improve vitamin A intake by making available vitamin A-fortified sunflower oil with a subsidy through a mobile phone-based e-Voucher system. This study was conducted to assess the impact of the behaviour change communication (BCC) campaign of the project on volume of sales of vitamin A-fortified sunflower oil. The e-Voucher system provides real-time data on the number of e-Vouchers redeemed. The number, type, and locations of BCC events were obtained from the implementation agency. Multivariate linear regression was used to examine the associations between (a) the number and type of BCC events conducted in a ward and the volume of subsequent fortified oil redeemed in the ward and (b) distance of clinic shows, a component of the BCC campaign, from participating retailers and the volume of fortified oil redeemed in the store. After 1 year of the campaign, the volume of fortified oil redeemed monthly increased by more than 5 times in Manyara and by more than three times in Shinyanga. Among the different types of BCC events conducted, only clinic shows and cooking shows were significantly associated with the volume of redemptions ($p < .05$). Compared with retailers where at least one clinic show was conducted within 0.5 km from its location, the volume of redemptions was significantly lower at retailers where no clinic show conducted within 3.0 km from its location ($p < .05$). These findings suggest that future health promotion interventions in rural Africa should involve health clinics.

KEYWORDS

behaviour change communication (BCC), fortified foods, social marketing, Tanzania, vitamin A deficiency

1 | INTRODUCTION

Vitamin A deficiency (VAD) is a public health problem in many countries, particularly in Africa and South-East Asia (World Health Organization, 2018). According to the World Health Organization (WHO), it is the leading preventable cause of blindness in children (World Health Organization, 2018). VAD is also associated with an

increased risk of morbidity and mortality due to diarrhoea, measles, malaria, and other infectious diseases in children under 5 years, and all-cause maternal mortality in pregnant women (Rice, West, & Black, 2004). Among other strategies that could be adopted to improve vitamin A intake, fortification with vitamin A has been recognized by WHO as a highly cost-effective strategy due to the low unit cost of fortification and the significant reduction in infant and

child mortality (Allen, de Benoist, Dary, & Hurrell, 2006; Horton, 2006). Food fortification works well in contexts where supplies and/or access to foods rich in the respective micronutrient are limited (Allen et al., 2006). Food fortification has been a practice in industrialized countries to control micronutrient deficiencies since the 1920s and is gaining increased acceptance in developing countries in recent years (Allen et al., 2006). Foods that are commonly fortified with vitamin A in both industrialized and developing countries include cooking oil, flour, sugar, milk, and milk powder.

In 2010, 33% of children under 5 years and 37% of reproductive-aged women in Tanzania were vitamin A-deficient (National Bureau of Statistics, Tanzania, and ICF Macro, 2011). According to the 2010 Tanzania Demographic and Health Survey, 80% of households in Tanzania use oil for cooking (National Bureau of Statistics, Tanzania, and ICF Macro, 2011). This makes cooking oil an attractive food vehicle for fortification. Among the different types of oil that are used for cooking, red palm oil and sunflower oil constitute 37% and 31%, respectively, of all oil consumed in the country. In an effort to combat VAD, fortification of cooking oil with vitamin A was made mandatory in Tanzania in 2012. However, the legislation is only met by large-scale producers that primarily focus on urban markets. To address VAD in rural Tanzania, the Masava project was implemented in 2014 to enable small- and medium-sized sunflower oil producers to fortify unrefined sunflower oil with vitamin A and distribute in the regions of Manyara and Shinyanga where the prevalence of VAD is some of the highest in the country (National Bureau of Statistics, Tanzania, and ICF Macro, 2011). Sunflower oil was preferred over red palm oil as a vehicle for fortification because it is locally produced and milled and is the preferred choice of many households in the region. Under the Masava project, vitamin A-fortified sunflower oil is produced by the two small- and medium-sized enterprises and was distributed through a network of 554 retailers ("Masava retailers"). To create an initial demand for the fortified sunflower oil, the oil was made available at a subsidized price (mainly to offset the increased packaging cost compared with other locally-processed oils) from November 2015 to May 2017 through a mobile phone-based e-Voucher system. A behaviour change communication (BCC) campaign was also implemented by the Tanzania Communications and Development Center, using a social marketing approach, to increase awareness of the health benefits of vitamin A and the availability of the fortified oil at a subsidized price.

This study was conducted to assess the effectiveness of the BCC campaign of the Masava project in promoting consumption of vitamin A-fortified sunflower oil in rural Tanzania by studying the temporal and spatial impact of the campaign. The study examined the association between the number and type of BCC events conducted and the volume of fortified sunflower oil redeemed through e-Vouchers, and the association between distance of clinic shows, as a component of the BCC campaign, from Masava retailers and the subsequent volume of the fortified oil redeemed in the store.

Key messages

- Clinic shows and cooking shows, but not bicycle races or football matches which were conducted to target men, were significantly associated with the volume of fortified sunflower oil redeemed.
- Compared with retailers where there was at least one clinic show conducted within 0.5 km from its location, the volume of fortified sunflower oil redeemed was significantly lower at retailers where there was no clinic show conducted within 3 km from its location.
- Future BCC campaigns that aim to promote healthy behaviours particularly pertaining to women and child health should involve health clinics in their implementation strategy as important channels of information dissemination.

2 | METHODS

2.1 | Setting

The study was conducted in Manyara and Shinyanga regions in Tanzania, two regions where vitamin A deficiency is high. The BCC events and subsidy through e-Vouchers were implemented in three districts in each region (Figure 1; Wu, Corbett, Horton, Saleh, & Moshia, 2019). There was also one control district in each region. In the control districts, no BCC event was implemented, but e-Vouchers were made available.

2.2 | The intervention

The intervention was a social marketing campaign that promoted consumption of vitamin A-fortified sunflower oil. The primary focus of the intervention was a reduction in price of vitamin A-fortified sunflower oil through a mobile phone-based e-Voucher system. Without e-Vouchers, the fortified oil would be more expensive than other oil in the market due to the higher cost of packaging and labelling that is required for the fortified oil. Using e-Vouchers, the fortified oil could be purchased for about Tsh2,900, which is comparable to the price of about Tsh3,000 of other oil in the market.

As part of the intervention, BCC events were implemented from February 2016 to March 2017. The events included road shows, cultural shows, clinic shows, cooking shows, bicycle races, and football matches. The events highlighted messages of the health benefits of vitamin A, availability of vitamin A-fortified sunflower oil at a discounted price, and how to identify fortified oil from the fortification logo. The target population of the intervention was households with lactating women and children under 5 years. A detailed description of the intervention has been previously described (Wu et al., 2019).

FIGURE 1 Map of Tanzania showing locations of study regions and districts

2.3 | Outcomes

The primary outcome for the study is the volume of sales of the fortified sunflower oil, in litres. The volume of sales is measured by the number of e-Vouchers redeemed for each of 1-, 5-, 10-, and 20-L package size of the fortified oil.

2.4 | Data collection

Data on the number of e-Vouchers redeemed in each month for each package size of the fortified oil was downloaded from the online e-Voucher database. The e-Voucher system provides real-time data on the number of e-Vouchers redeemed for 1-, 5-, 10-, or 20-L package size of the fortified oil by each Masava retailer.

The number of each type of BCC event conducted was obtained from the quarterly reports of the Tanzania Communications and Development Center. The quarterly reports provide a record of the number and ward names of each type of BCC events conducted in each project quarter, defined as a timeframe of 3 months beginning in February 2016. Using the names of the health facility or ward in which clinic shows were conducted, the online Tanzania Health Facility Registry (HFR portal) database was searched to obtain the global positioning system (GPS) coordinates of the clinic show locations (all wards where clinic shows were conducted were served by only one public health facility according to the HFR portal; Ministry of Health, Community Development, Gender, Elderly and Children, 2017). For events for which the location provided did not include the name of the ward, the ward was identified from the HFR portal or otherwise based on spatial overlap between their approximate location, identified in Google Maps using the recorded location name, and the area administered by the wards (Brinkhoff, 2014; Ministry of Health, Community Development, Gender, Elderly and Children, 2017). The location of BCC events other than clinic shows could only be identified at the ward level, not the GPS coordinates level.

The number of active Masava retailers in each quarter was determined from the record of the first and last day of activity of each Masava retailer provided by the Masava field workers. The GPS coordinates of the Masava retailers were recorded using Garmin eTrex Handheld® GPS device.

2.5 | Data analysis

To determine the association between the number and type of BCC event conducted in each quarter in a ward and the subsequent volume of sales of fortified sunflower oil in the ward, multivariate linear regression was used. Subsequent volume of sales of fortified sunflower oil was defined as the volume of fortified sunflower oil redeemed through e-Vouchers in the ward from the day of the first event of the quarter to 30 days after the day of the last event of the quarter. To allow for potential confounding, the regression model was then fitted to examine whether the association was affected either by adjusting for the number of Masava retailers in the ward that were active within 30 days of the last event of the quarter because the number of Masava retailers varied during the span of the project or by seasonal variation in the oil supply because the supply of sunflower seeds vary during the year. The 3-month time frame or quarter was used to adjust for the seasonal variation in oil supply.

Locations of the Masava retailers and clinic shows were mapped and visualized in ArcGIS 10.5.1. The geographical data were georectified to the Universal Transverse Mercator zone 37S projection, 1984 datum. Euclidean or straight-line distance, in meters, from each Masava retailer to the nearest clinic where clinic shows were held were calculated using the "point distance" tool in ArcGIS and exported into Microsoft Excel 2016 spreadsheets for further analysis. Due to unavailability of precise GPS coordinates of events other than clinic shows, only the distance between Masava retailers and clinic shows was used. The distance between household and clinics were then divided into 0–0.5 km, 0.5–1.0 km, 1.01–2.0 km, 2.01–3.0 km, and >3.0 km. Small increments were used as individuals in rural areas are less likely to travel far to purchase cooking oil, because poor households often purchase oil on a daily basis. Then multivariate linear regression was used to determine the association between the distance of Masava retailers to the nearest clinic show location and the volume of fortified sunflower oil redeemed from the day of the event to 30 days after the event. The multivariate linear regression model was then adjusted for the number of Masava retailers in the ward and seasonal variation in the oil supply using quarter to allow for possible confounding. In the regression analyses, $p < .05$ was considered statistically significant. All statistical analyses were carried out in R version 3.3.1.

3 | RESULTS

3.1 | Time series analysis of the volume of fortified sunflower oil redeemed

Figure 2 shows the time series of volume of fortified oil sunflower oil redeemed along with a three-month moving average in Manyara and Shinyanga. In Manyara, before the implementation of the BCC campaign from November 2015 to January 2016, a 3-month moving average of 789 L per month of the fortified sunflower oil was redeemed (Figure 2). After about 2 months of the campaign from March to May 2016, the volume of monthly redemptions increased by more than three times to an average of 2,532 L. After 1 year of campaign, in February–April 2017, the average redemption increased to more than 5 times that from before the campaign to 4,235 L. The increase in the number of redemptions was also observed in Shinyanga, although the trend was more prominent in Manyara compared with Shinyanga. Before the implementation of the campaign from November 2015 to January 2016, an average of 318 L per month was redeemed in Shinyanga. This increased by 55% to 492 L after about 2 months of campaign (March–May 2016) and by more than three times to 1,042 L after 1 year of the campaign (February–April 2017). One of the factors that are responsible for the low volume of redemptions in Shinyanga compared with Manyara is that in Shinyanga, palm oil is the preferred oil, whereas in Manyara where sunflower is grown, sunflower oil is preferred.

3.2 | Number and type of BCC events conducted and volume of redemptions

Out of the total of 324 BCC events that were conducted, 110 were cooking shows (34%), 109 were cultural shows (34%), 77 were clinic shows (24%), 22 were bicycle races (6%), and 6 were football matches (2%). Table 1 shows the results of the association between the number and type of BCC events conducted and the volume of fortified

sunflower oil redeemed within 30 days after the event. The analysis was restricted to the 299 events (92%) for which the ward where the event was conducted could be identified. In the unadjusted model, the number of road shows, cultural shows, clinic shows, and cooking shows conducted in a quarter were found to be significantly associated with the volume of fortified sunflower oil redeemed in the quarter. After adjusting for the number of active Masava retailers and seasonal variation in oil supply, only the number of cultural shows, clinic shows, and cooking shows conducted were found to be significantly associated with the volume of fortified oil redeemed. More of the oil was redeemed where more clinic shows and cooking shows but fewer cultural shows were conducted, although both cooking shows and cultural shows were conducted in the market area in the open air (adjusted β -coefficient_{clinic show} [95% CI] = 95.82 [21.14, 170.50], $p = .012$; adjusted β -coefficient_{cooking show} = 200.90 [56.90, 344.90], $p = .007$; adjusted β -coefficient_{cultural show} = -168.64 [-309.15, -28.13], $p = .020$). None of the events designed and implemented to target men, namely, bicycle race and football match, were found to be significantly associated with the volume of redemptions (adjusted β -coefficient_{bicycle race} = -17.28 [-124.41, 89.85], $p = .752$; adjusted β -coefficient_{football match} = 24.32 [-180.77, 229.41], $p = .816$). The number of active Masava retailers in the ward was also significantly associated with the volume of redemptions. This association persisted after adjusting for the number of each type of BCC event conducted and the seasonal variation in oil supply (adjusted β -coefficient_{retailers} = 9.52 [3.82, 15.22], $p = .001$).

3.3 | Distance of Masava retailers from nearest clinic show location and volume of redemptions

Out of the total of 554 Masava retailers that were recruited to carry the fortified sunflower oil from the Masava small- and medium-sized enterprises, GPS coordinates could not be obtained for 96 retailers (17%). Out of 324 events that were conducted, 77 were clinic shows. GPS coordinates could not be obtained for seven clinic shows.

FIGURE 2 Time series of volume of fortified sunflower oil redeemed per month and three-month centred moving average of volume redeemed in Manyara and Shinyanga

TABLE 1 Association between number of each type of BCC events conducted and volume of fortified sunflower oil redeemed

Variables	Unadjusted		Adjusted	
	β -Coefficient (95% CI)	P	β -Coefficient (95% CI)	P
Type of social marketing events	70.96 (13.58, 128.34)	0.016	34.77 (-35.15, 104.60)	.331
Road show				
Cultural show	-179.26 (-319.48, -39.04)	0.013	-168.64 (-309.15, -28.13)	.020
Clinic show	110.86 (38.33, 183.34)	0.003	95.82 (21.14, 170.50)	.012
Cooking show	227.59 (83.70, 371.47)	0.002	200.90 (56.90, 344.90)	.007
Bicycle race	6.31 (-101.91, 114.52)	0.909	-17.28 (-124.41, 89.85)	.752
Football match	-2.23 (-201.37, 196.92)	0.983	24.32 (-180.77, 229.41)	.816
Number of active Masava retailers in ward	10.24 (5.20, 15.30)	9.64×10^{-5}	9.52 (3.82, 15.22)	.001
Quarter				
Q1 (November 2015 to January 2016; reference)	1.00	—	1.00	—
Q2 (February–April 2016)	77.93 (-53.13, 208.99)	0.245	75.60 (-60.53, 211.74)	.278
Q3 (May–July 2016)	82.06 (-43.31, 207.42)	0.201	117.96 (-18.06, 253.98)	.091
Q4 (August–October 2016)	26.42 (-99.62, 152.47)	0.682	68.82 (-78.31, 215.94)	.360
Q5 (November–December 2016)	20.54 (-98.82, 139.90)	0.738	41.51 (-88.21, 171.24)	.531
Q6 (January–March 2017)	17.96 (-00.33, 136.24)	0.766	31.84 (-114.69, 178.37)	.671

Adjusted R-squared in adjusted model = 0.1092, *F*-statistic = 3.115, *p* < .001.

TABLE 2 Association between distance of Masava retailers from nearest clinic show location and volume of fortified oil redeemed

Variables	Unadjusted		Adjusted	
	β -Coefficient (95% CI)	P	β -Coefficient (95% CI)	P
Distance of Masava retailer nearest clinic show location				
<0.5 km (reference)	1.00	—	1.00	—
0.5–1.0 km	-55.55 (-120.50, 9.40)	0.094	-54.37 (-119.78, 11.05)	.103
1.0–2.0 km	-41.30 (-111.24, 9.40)	0.247	-43.44 (-113.50, 26.63)	.224
2.0–3.0 km	-68.43 (-199.86, 63.01)	0.307	-70.09 (-201.90, 61.72)	.297
>3.0 km	-56.46 (-98.25, -14.68)	0.008*	-53.38 (-9.63, -11.13)	.013
Number of active Masava retailers in ward	-0.05	0.927	0.02 (-1.07, 1.11)	.966
Quarter				
Q1 (November 2015 to January 2016; reference)	1.00	—	1.00	—
Q2 (February–April 2016)	10.29 (-18.20, 1.03)	0.48	7.42 (-21.19, 36.02)	.611
Q3 (May–July 2016)	12.64 (-15.76, 38.25)	0.38	11.89 (-16.54, 40.33)	.412
Q4 (August–October 2016)	23.06 (-6.30, 1.03)	0.12	20.72 (-8.75, 50.19)	.618
Q5 (November–December 2016)	2.31 (-27.75, 38.25)	0.88	1.19 (-28.93, 31.31)	.938
Q6 (January–March 2017)	19.61 (-6.48, 1.03)	0.14	15.86 (-10.70, 42.42)	.241

Adjusted R-squared in adjusted model = 0.0002, *F*-statistic = 1.041, *p* = 0.406.

Table 2 shows the results of the association between distance of Masava retailers from the nearest clinic show location and volume of fortified sunflower oil redeemed within 30 days after the event. The analysis was limited only to the 458 Masava retailers (83%) and 70 clinic shows (91%) for which the GPS coordinates could be obtained. After controlling for the number of active Masava retailers and seasonal variation in oil supply, compared with retailers that had at

least one clinic show conducted less than 0.5 km away, the volume of fortified sunflower oil redeemed was significantly lower at retailers that did not have a clinic show conducted within 3.0 km (adjusted β -coefficient_{>3.0 km vs < 0.5 km} = -53.38 [-9.63, -11.13], *p* = .013). However, contrary to the previous finding that the number of active Masava retailers was significantly associated with the volume of redemptions, here we found that the number of active

Masava retailers was not significantly associated with the volume of redemptions in the ward (adjusted β -coefficient_{retailers} = 0.02 [-1.07, 1.11], p = 0.966).

4 | DISCUSSION

This study employs time series analysis and a combination of geospatial and statistical tools to examine the impact of a BCC campaign on sales of vitamin A-fortified sunflower oil in Manyara and Shinyanga regions in Tanzania. Using time series analysis, we found that in Manyara, the volume of fortified sunflower oil redeemed through e-Vouchers increased by more than 5 times from an average of 789 L before the BCC campaign to 4,235 L after about 1 year of the campaign. Similarly, in Shinyanga, the volume of redemptions increased by more than 3 times from 318 L before the campaign to 1,042 L after about 1 year of the campaign. Among the different types of BCC events that were conducted to promote consumption of the fortified sunflower oil, we found that only clinic shows and cooking shows were significantly positively associated with the volume of oil redeemed in the same ward. None of the events designed and implemented to target men, namely, bicycle races and football matches, were significantly associated with the volume of fortified oil redeemed. This finding was validated through a separate survey conducted by the organization overseeing the BCC activities, which found that clinic shows were the most common source of information about vitamin A and vitamin A-fortified oil, and some individuals heard about the oil through bicycle races, no one reported hearing about the oil through football matches. Regarding the effect of proximity of BCC events on volume of redemptions at a Masava retailer, we found that compared with retailers that had a clinic show conducted within 0.5 km from its location, the volume of redemptions was significantly lower at those retailers where no clinic show was conducted within 3.0 km from its location. Thus, proximity of BCC events to retailers appears to influence purchase, but this result was only established in relation to health clinics. Based on these findings, it may be concluded that the BCC campaign was effective in promoting consumption of vitamin A-fortified sunflower oil in rural Tanzania.

A common trend observed in the time series analysis of the volume of fortified oil redeemed in Manyara and Shinyanga is that redemptions increased from July 2016 when the retailers were permitted to sell oil in 20-L containers from which individual "scoops" of oil could be sold to poor consumers. The higher sales in June–August 2016 and the lower sales in December 2016–February 2017 are related to the sunflower harvest and hence, greater availability and lower price of oil postharvest. Also, December–January was a holiday season in Tanzania. Fewer BCC events held during this period might explain the low volume of redemptions.

Our finding that none of the events that targeted men (bicycle races or football matches) were significantly positively associated with the volume of fortified oil redeemed is consistent with a number of studies in low- and middle-income countries, which showed that compared with men, women spend a higher share of their income on their children's health (Duflo, 2003; Qian, 2008; Thomas, 1992), although the

evidence is scarce (Dupas, 2011). In this project, events that particularly target men were implemented as formative research conducted to inform the intervention design and implementation showed that men influenced household decision-making, especially as it pertains to household purchase. Thus, our findings disagree with the formative research findings. The clinic shows were conducted by a nurse or a community-based officer in health clinics to improve understanding of the benefit and impact of the fortified sunflower oil among lactating mothers and children who attend the clinic; the cooking shows were conducted by the community-based officers in the market area in the open air, and the audience were invited to sample local foods cooked in fortified oil. It is likely that a health clinic is regarded as a trusted source of information and is associated with good health, and the cooking shows demonstrated that no additional skills are required to cooking with fortified oil compared with unfortified oil ("self-efficacy") and that food does not taste different when cooked in fortified oil. Our finding also agrees with the finding from a systematic review of the effectiveness of gender-integrated behaviour change interventions in promoting behaviours related to reproductive, maternal, and child health in low- and middle-income countries conducted by Kraft, Wilkins, Morales, Widyono, and Middlestadt (2014) that interventions are most effective when they can, among others, give women access to resources such as education, and empower women to take actions (Kraft et al., 2014). Therefore, based on these findings, with limited resources, future social marketing and BCC interventions aimed at promoting healthy household behaviours or improving maternal and child health in rural Africa should involve health clinics as important channels for information dissemination and tailor the intervention to target women rather men through cooking shows.

According to the systematic review of Kraft et al. (2014), there are both null and positive evidences of the effectiveness of interventions designed to increase men's support for women and child health. Studies on the effect of involving men in BCC interventions have mostly been limited to the field of reproductive health. Few studies have examined the effect on supporting consumption of fortified foods. Our study contributes to the literature by examining the association between the number of BCC interventions that are conducted to target men (bicycle races and football matches) and the subsequent volume of fortified oil sales. In our study neither bicycle races nor football matches had an impact on reaching men, but this does not preclude the possibility that different events might have succeeded. Our study is also novel in the fact that to the best of our knowledge, no studies have used spatial techniques such as geographic information system technology to assess the impact of BCC interventions. Spatial techniques have been used in public health since the mid-19th century when Dr. Robert Baker mapped the cholera incidence in England and used it to identify areas of higher incidence (Musa et al., 2013). With the development of geographic information system, spatial methods have been used in studying a wide range of epidemiological phenomena including but not limited to health inequity, disease surveillance, intervention monitoring, health services planning, and access, proximity, clustering, and spatial correlation (Musa et al., 2013). Our study contributes to the

literature of using spatial techniques to assess the impact of BCC or social marketing interventions.

It must be noted that the intervention in this project likely only worked for a time, because of the subsidy provided through e-Vouchers and through external support for social marketing, which drove the increased demand for the fortified oil. To date, there are no small-scale oil fortification programs, which are viable in the open market. Food fortification programs are only sustainable through one of the three ways: (a) when it is mandated and enforced, (b) if it is done voluntarily by an industry and it is willing to either cover the extra fortification costs or pass on the full costs to the consumer, or (c) the fortified foods are delivered through an ongoing public subsidy program (Allen et al., 2006; Garrett, Luthringer, Yetley, & Neufeld, 2019). Our study shows that small-scale food fortification is feasible when there is a subsidy and that demand can be driven through strong communications.

One of the limitations in our study is that we only examined the effect of proximity of only one of the types of BCC interventions, namely, clinic shows, due to unavailability of the GPS coordinates of other types of BCC events. By focusing only on clinic shows, which constitute only 24% of the BCC events, the results could be obscured by other events that are occurring locally, particularly the cooking shows, which are not included. Also, geographic coordinates could not be obtained for 9% of the clinic shows. Also, the volume of sales of the fortified oil observed and used in this study was during the period when the fortified oil was available with a subsidy through e-Vouchers. Therefore, it does not represent the sales after the span of the Masava project when there is no subsidy and when the fortified sunflower oil becomes more expensive than unfortified oil.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

DCNW performed the statistical analyses, interpreted the results, and wrote the first draft of the manuscript; SH and TCM designed to the study concept and design; NS coordinated the study; NY provided the BCC campaign data; SH, NS, and TCM revised the accuracy of the information presented. All authors have read and approved the final version of the manuscript.

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