Integrated Program Enhancements
Increased Utilization of Farmers’
Market Nutrition Program¹

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ABSTRACT Three New York State agencies undertook a state-wide initiative in 2001 to enhance the effectiveness of the Special Supplemental Program for Women, Infants, and Children (WIC) Farmers’ Market Nutrition Program (FMNP) for both families and farmers. The program enhancements included four components intended to influence market and consumer behavior: hiring a state-wide Cornell Cooperative Extension staff member to initiate and coordinate FMNP promotion efforts; increased collaboration among state-level agencies; local-level community capacity-building; and dissemination of newly developed nutrition education resources. Because components were overlapping and potentially synergistic, the total effect was considered. To test the hypothesis that the enhancements increased Program utilization as measured by redemption rates, a time-series, quasi-experimental design was employed in which observed 2001 redemption was tested for departure from earlier trends. Linear regression showed FMNP coupon redemption rates from 1996 through 2000 decreased 2.36% annually (P = 0.002). This trend was interrupted in 2001 when actual redemption exceeded predicted redemption by >2.2% (P < 0.055). Alternate explanations for this shift were deemed improbable. These findings show that FMNP goals were advanced through a coordinated, collaborative initiative with activities at state and local levels, resulting in increased utilization of FMNP benefits by WIC participants and increased income to local farmers. J. Nutr. 133: 1841–1844, 2003.

KEY WORDS: • Special Supplemental Program for Women, Infants, and Children • Farmers’ Market Nutrition Program • collaboration • initiative

The Special Supplemental Program for Women, Infants, and Children (WIC)³ Farmers’ Market Nutrition Program (FMNP) was established in 1992. Its aims were 1) to improve the health of nutritionally at-risk women, infants and children through access to fresh produce and nutrition education, and 2) to support small farmers and the economic vitality of communities by expanding the awareness and use of farmers’ markets. In 35 states, families participating in WIC annually receive coupons for fresh fruits and vegetables from authorized farmers, and nutrition education about the FMNP and use of fresh produce. In 2000, >1.9 million participants in the United States received a set of coupons worth $10–28, which when redeemed, supported 12,897 farmers with >$17.5 million in sales (1). The Program operates through a small amount of Federal funds, $15 million in 2000 and $20 million in 2001, with state matching funds.

WIC FMNP results in a net economic gain when its costs and benefits are compared (2). Farmers gain 7–9% more than the coupon redemption value through additional purchases. Net gain in economic welfare is 20–30% of the coupon redemption value through increased fruit and vegetable consumption, valuation of produce secondary to provision of nutrition education and purchasing power. The Program is more effective when coupons are combined with nutrition education. In another study, recipients reported increased fruit and vegetable consumption with the Program (1). Increased consumption was also found in a recent experimental study in which the increase was greater when nutrition education was also provided (3). An earlier study did not find a significant change in consumption (4).

Challenges that can affect redemption of the WIC FMNP coupons include accessibility of markets (e.g., transportation, location and hours), perceived quality of produce, personal circumstances of low income families with small children, unfamiliarity with and lack of information about the farmers’ market environment and foods, viability of markets and weather (1,4). Three components believed to be integral to FMNP success are educating WIC participants to use the FMNP, accessibility of markets by WIC participants and market quality (5).

Although the rate of FMNP coupon redemption is not a comprehensive indicator of effectiveness (5), it provides information about the percentage of benefits realized by WIC families. New York State (NYS) has participated in the FMNP since its inception and is the largest state FMNP. As the Program grew from 1996 to 2000 in NYS, however, declining redemption was observed. Some FMNP administrators suggested that redemption has decreased because, as the Program has grown, coupons were distributed in areas with less established markets and to individuals less motivated to redeem...
coupons. The NYS redemption rate in 2000 was 60%, slightly higher than the national rate of 57% (1).

To improve FMNP effectiveness, increase the number of families who benefit and maximize benefit among both WIC participants who receive coupons and farmers, three NYS agencies undertook a state-wide initiative to enhance the WIC FMNP in 2001. Collaborative approaches are relevant to and increasingly used for nutrition interventions (6). Initiatives among state-level agencies have had positive effects on a shared public health goal in other situations; for example, three NYS agencies together greatly reduced tuberculosis incidence within the NYS Department of Correctional Services after years of rising numbers of cases (7). The success of similar statewide efforts on behavioral outcomes, however, is less certain.

The agencies that undertook the 2001 FMNP initiative were the NYS Department of Agriculture and Markets (DAM), the NYS Department of Health (DOH) and the Division of Nutritional Sciences/Cornell Cooperative Extension (CCE) at Cornell University. The initiative developed from a memorandum of understanding established in 1996 to "provide for the development, funding, operation, and administration" of the FMNP.

Four interrelated components were intended to influence both consumer and market behavior to increase redemption in 2001: 1) hiring of a statewide CCE staff member to initiate and coordinate FMNP promotion efforts; 2) increased collaboration of state-level agencies; 3) community capacity-building at local level; and 4) dissemination of newly developed nutrition education resources. Each component was in full operation during the 2001 FMNP season.

**Hiring of part-time statewide CCE staff member to focus solely on support of the FMNP.** This person initiated and coordinated FMNP efforts within CCE and among collaborating State agencies, and played an important role in other components. This hiring allowed for the development of new FMNP nutrition education resources, improved interagency collaboration, fully supported community capacity building (through oversight and assistance to local CCE associations) and administration of the dissemination of resources to CCE.

**Interagency collaboration at the state level.** NYS DAM, NYS DOH and CCE collaborated via meetings, telephone and e-mail. Collaboration occurred through shared information (e.g., Program and evaluation data), shared or divided responsibilities in specific activities (e.g., planning and implementing FMNP training for local WIC staff before the 2001 FMNP season) and assistance with one another’s goals (e.g., CCE using administrative flexibility to distribute nutrition education resources for DOH quickly, and DOH facilitating CCE’s evaluation efforts through offering legitimacy to a survey and access to WIC staff). This collaboration increased the capacity of NYS to administer and promote the Program. For example, as a result of training, attendees reported an increase in knowledge about the FMNP and in motivation to use the resources described below.

**Community capacity-building at local level.** Expansion of community capacity-building began in the 2000 FMNP season and grew significantly in 2001. Coordinated through CCE, 38 local extension associations committed to organizing capacity-building efforts in their communities, including hosting of pre- and post-FMNP season meetings among stakeholders, identification of community goals and means for accomplishing them and identification of parties responsible for taking certain actions towards accomplishing those goals. To promote these local efforts, a statewide CCE in-service for local associations was held 5 mo before the 2001 FMNP season, and associations were supported in developing community-level collaborations. Evaluation showed that all 38 associations participated and that efforts resulted in increased delivery of FMNP nutrition education at farmers’ markets and WIC agencies as well as changes in market operation times and locations to suit community needs. Community capacity-building was thought to increase redemption by improving market accessibility and decreasing barriers to the purchase and preparation of fresh produce.

**Dissemination of nutrition education resources.** Several new FMNP nutrition education resources that had been developed in the previous 2 y for this initiative were made available and promoted for the 2001 FMNP season to both WIC and CCE in communities. The resources, called Get Fresh! (8), include a set of videos, recipe cards, ideas for using the videos and recipe cards, and an activity booklet for children (CCE only). Get Fresh! was promoted through a concerted dissemination effort including a CCE in-service and WIC training events. Videos were mailed to all local WIC agencies and to the 38 participating local CCE associations. The resources were incorporated into local educational activities at WIC sites, CCE FMNP activities and farmers’ markets. Among the local WIC agencies (89 agencies) as well as 38 local CCE associations, 90% utilized the resources in 2001. Nutrition education using these resources was intended to increase redemption through decreasing barriers to purchasing and preparing fresh produce.

The effects of the components were overlapping and potentially synergistic, and it was important to consider their joint effect. The purpose of this study was to test the hypothesis that the enhancements increased Program utilization as measured by redemption rates.

**METHODOLOGY**

The study was designed as a time-series quasi-experiment (9) in which a trend in time was examined to determine whether an outcome after an intervention was different from what would have been expected had the intervention not occurred. The outcome was Program utilization as measured by coupon redemption rates. NYS redemption rates from 1996 through 2000 were plotted and assessed for trend by linear regression. After finding no evidence of sequential trend dependency by examining residuals for autoregression, the observed redemption rate for 2001 was tested for departure from the linear trend by a one-tailed t test. The null hypothesis was that the observed redemption rate in 2001 was the same or lower than that predicted from the earlier trend and the alternative hypothesis was that the redemption rate was higher than that predicted. The t test was constructed as:  
\[ t = \frac{(\text{observed} - \text{predicted})}{\text{STD (predicted)}} \]  
This approach is equivalent to using the extrapolation method for forecasting the redemption rate for 2001 based on the earlier trend, and then comparing the forecasted and observed values for the year 2001 (11).

Annual NYS FMNP coupon issuance and redemption records were collected and maintained by the NYS DAM from 1996 through 2001. The redemption rate was calculated by the number of $2 coupons redeemed, as reported by the central bank that processes FMNP coupons and makes payments to farmers, divided by the number of coupons issued to WIC participants, as reported by local WIC agencies. From 1996 through 2000, a labor-intensive follow-up administrative procedure was conducted to account for all coupons that were distributed to WIC agencies to verify that the coupons were actually issued to participants. In 2001 however, this could not be done. Consequently, the actual number of coupons distributed to WIC agencies and then issued to participants is not known precisely. Therefore, for 2001, to be conservative when calculating the t test, we estimated the lowest possible 2001 redemption by calculating the redemption rate using as the denominator the total of all coupons that could have been issued, with or without verification of issuance.
The highest possible redemption rate was found by using as the denominator the total of only those coupons verified as issued. The actual redemption rate lies between the lowest and highest possible rates. Increased income to farmers was calculated by multiplying the increased redemption (i.e., observed minus predicted redemption) by the value of a coupon, $2.

RESULTS

The annual WIC FMNP coupon redemption rates in NYS from 1996 to 2001 were 68.8, 67.8, 64.03, 61.84, 60.00 and 59.67%, respectively. The redemption rate of 59.67% given for 2001 is the smallest that it could have been (i.e., assuming all coupons that could have been issued were actually issued); the highest that the 2001 rate could have been was 63.58%.

Linear regression on the NYS redemption rates from 1996 to 2000 showed that, on average, FMNP coupon redemption rates decreased by 2.36% each year ($P = 0.002, n = 5$). The proportion of variance explained (i.e., $R^2$) was 0.975 and the SD of the residuals was 0.688. The predicted redemption rate for 2001 was 57.43% (SE = 0.997). The minimum value of the 2001 observed redemption rate of 59.67% was different from this predicted rate with $P = 0.055$ ($n = 5$).

The predicted number of coupons to be redeemed in 2001 was subtracted from the observed range of coupons redeemed to show that the increased number of coupons redeemed due to the initiative was between 61,466 and 158,377. Multiplying this number by the monetary value of a coupon, $2$, we found that WIC families purchased an additional $122,931–316,754 worth of fruits and vegetables in 2001.

DISCUSSION

This study examined the effect on redemption rates of state wide FMNP program enhancements. The 2001 redemption rate was greater than would have been expected if the earlier trend had continued. The true difference between the 2001 redemption rate predicted by the trend and the observed redemption rate was even larger than that used for calculation of the $t$ test because the 2001 observed redemption rate that we used understated the true 2001 redemption. This was because of the inclusion of some coupons in the denominator that were not actually issued to WIC participants and therefore had no chance to be redeemed. Therefore, the true $P$-value for the hypothesis test was $< 0.055$.

The time-series, quasi-experimental design that was used has several strengths. In having measurements over time, the design accounts for Program maturation, the naturally occurring shifts in the Program as it develops over time (9). Thus a deviation in trend should not be due to maturation. Similarly, regression, or the “negatively accelerated function of elapsed time” (9), should not explain a shift at a time point that is not expressed throughout the time series. Additionally, because FMNP redemption data are regularly collected for FMNP administration, a shift due to repeated measurement is not a plausible explanation. Because all NYS WIC agencies are included in the measurement of redemption, there is no possibility of selection bias (9).

With this time-series, quasi-experimental design, “the problem of internal validity boils down to the question of plausible competing hypotheses that offer likely alternate explanations of the shift in the time series other than the effect of the initiative (9). The two largest threats to inference are “history” and “instrumentation.” The threat of history is addressed by exploring alternate hypotheses that could explain the shift in redemption rate over time. To accept that it is plausible (12) that the initiative is the cause of the shift in redemption, the possibility that concurrent events caused the shift must be ruled out.

Weather is an implausible explanation. Weather fluctuates yearly, but the redemption rate has steadily decreased. Weather for the 2001 season was not ideal for farming due to clustered periods of rain and dryness, and therefore weather was not a likely contributor to the increased 2001 redemption over that expected. Greater number of FMNP sites in 2001 is not a likely cause for the increase because the number of sites had been increasing since 1996. On the contrary, the loss of six market sites in New York City after the September 11th disaster may have decreased redemption. Similarly, the higher value of coupon booklets (from $20 in 2000 to $24 in 2001) likely did not account for the shift; when coupon booklet value decreased in 1997 from $20 to $18, and then increased in 1998 from $18 to $20, no shifts in trend were observed.

Another possible competing explanation for the change in redemption trend is the existence of a larger national trend, e.g., the economic downswing of 2001 may have increased utilization of assistance. To examine this, we compared the trend in NYS with that of the other 34 states within the Program. Annual redemption rates of all other state Programs combined (excluding NYS coupons) were obtained from the Vermont Office of Economic Opportunity, on behalf of the National Association of Farmers’ Market Nutrition Programs (NAFMNP) from national Program data verified by the USDA. As in NYS, these redemption rates showed a strong declining linear trend from 1996 through 2000 ($P = 0.046, n = 5$). Unlike in NYS, however, the observed rate for 2001 (54.69%) fell slightly below the predicted rate (54.94%) extrapolated from the previous years (Fig. 1). That is, the linear trend of decreasing redemption in other states continued into
2001, suggesting that it is implausible that national economic or other forces were responsible for the change in redemption trend in NYS in 2001.

Instrumentation is a second possible threat to inference and refers to differences in methodology used to measure changes. Instrumentation error is unlikely because the same methods were used to obtain the redemption and issuance data from 1996 to 2001, with the exception of the previously described uncertainty in the issuance of some coupons that were distributed. Even with the conservative assumption that coupons of unknown issuance were actually issued, there is evidence that the 2001 redemption rate was higher than that predicted from the earlier trend. No other changes related to the Program, its administration or participants explain the shift in redemption in 2001.

Redemption rates are important because redemption must occur for WIC participants to receive produce and for local farmers to receive income and access to consumers. The rates describe the percentage of benefits that are gained by the participants, but should be used with caution as a measure of Program effectiveness (5). NAFMNP (1) warns that “modest benefit level, coupled with barriers to Program participation... affects the rate of coupon redemption” and thus redemption should not be the only indicator of Program effectiveness.

The 2000 national redemption rate of 57% was considered acceptable by Federal and state officials (1), but low rates are viewed as problematic by some. For example, in 2001 an Ohio Department of Health spokesperson cited the State’s 60% redemption as a reason for the department’s decision to cut the WIC FMNP (13,14).

Implications of the observed shift in redemption are great. In 2001 in NYS, 154,350 WIC families redeemed coupons worth a total of $3,274,674 of fresh fruits and vegetables. As a result of the program enhancements, WIC families redeemed more coupons and thus purchased $122,931–316,754 worth of additional fresh fruits and vegetables that they would not have purchased if the previously observed redemption rate trend had continued into 2001. This put additional income into the hands of NYS farmers using direct marketing, thus adding vitality to local economies. Redemption was increased through means other than targeting or reducing coupon distribution to areas or individuals with past low redemption (5), indicating that fresh produce from farmers’ markets was made more desirable and/or more accessible to low income families. Other measures of program effectiveness that may have changed, but were not measured by this study, include continued patronage of farmers’ markets by WIC participants beyond use of FMNP coupons, and increased total and/or variety of produce consumed by WIC participants.

Estimating the incremental cost (15) of the program enhancements is useful to understand the net benefit in NYS in 2001 and help other states plan for similar enhancements. The estimated incremental cost was $46,000, mainly for the statewide CCE staff member and duplication of resources. This cost was for extra programming activities for the WIC FMNP in 2001 beyond the usual ones, and estimates what it might cost to replicate the enhancements elsewhere. This cost was less than the direct economic benefit to WIC families and farmers, which is only part of the benefit of the WIC FMNP (2).

These results show that FMNP goals can be advanced through coordinated and collaborative enhancements at state and local levels to influence both consumer and market behavior, resulting in increased utilization of FMNP benefits by WIC participants and increased income to local farmers. This approach is likely applicable to other statewide efforts to promote the FMNP. Each of the four components (i.e., interagency collaboration, hiring of coordinating staff person to focus on the program, supporting capacity building at local level and making available high quality resources) could be replicated in other states and could be applied to other large-scale collaborative health and nutrition initiatives. We will report in subsequent papers on the specific strategies used for state-level collaborative, community capacity-building and dissemination of resources. In funding the development of Get Fresh!, the USDA intended that it would be used in other states to promote the FMNP and for other applications in food and nutrition education. The print resources and information about obtaining the video series are nationally available (8).

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LITERATURE CITED