Food Insecurity Issues: An Analysis Based on California WIC Data

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Rural California WIC participants tend to show a slightly lower propensity to redeem WIC-issued food instruments than urban California WIC participants do. In addition to possible food availability problems associated with rural locations, the presence or absence of cultural factors, especially foreign language backgrounds, may also help to explain this difference. Limited English-speaking WIC participants seem somewhat more likely to redeem their food vouchers than primarily English-speaking WIC participants do. This condition seems to be as prevalent in rural California areas as it is for the urban-dominated California WIC population as a whole. Nevertheless, WIC food instrument redemption rate analysis, together with geographic information systems, might be helpful in pinpointing areas around the country where physical food availability problems might exist.

Background

Food insecurity has been defined as lack of "assured access at all times to enough food for an active, healthy life" (Andrews, 1999). Food insecurity may be exacerbated in rural areas vis-à-vis urban areas because of transportation issues and less well-stocked grocery stores with more expensive items (Kaufman, 1997).

To help study possible regional variation in food accessibility, food instrument (voucher) redemption records are available from the Women, Infants, and Children (WIC) Supplemental Nutrition Program, whose purpose it is to provide food supplements and nutritional education for low-income women and their small children (Food Research and Action Center). Qualified individuals can redeem WIC-issued instruments for specified food items from authorized grocers or vendors. Rates of redemption can vary. Previous research has shown a significant difference in California WIC food instrument redemption rates between members of various ethnic and linguistic groups. Notably, limited English-speaking households were generally found to have higher food instrument redemption rates than primarily English-speaking households (Matthews, 2000). See Figures 1a and 1b. Such food instrument redemption rate difference measurement could also be applied to rural vis-à-vis urban settings.

Objectives

In this paper, WIC food instrument issuance and redemption patterns and local vendor locations are examined as surrogates for food availability measurements in various California locations. Fully redeemed WIC food instrument packages could provide some indication that an adequately nutritious combination of food is making it into WIC participants' homes, wherever they may be located. It might also be assumed that persons not enrolled in the WIC program would have access to a nutritionally reasonable combination of foods from many of these same vendors that serve the WIC participants. Since the WIC program is available in all states, the methodology developed herein may have useful applications outside of California.

Methodology

All food instrument issuance and redemption data in this study come from the California WIC program's Integrated Statewide Information System (ISIS), which collects extensive data on WIC participation (Matthews, 2000). California zip codes in which at least 100 food instruments were issued in May 2000 are this study's basic geographic comparison unit for regional redemption rate differences.

One measurement used for a zip code's "ruralness" or lack thereof is the density or number of WIC food instruments issued to residents of that zip code. A high number of food instrument issuance would suggest that a zip code would have to be urban in nature. A low number of such issuance might be an indicator of sparse rural population but might also indicate a location in a relatively affluent urban neighborhood where a small percentage of the population receives WIC assistance. Zip codes with less than 10,000 food

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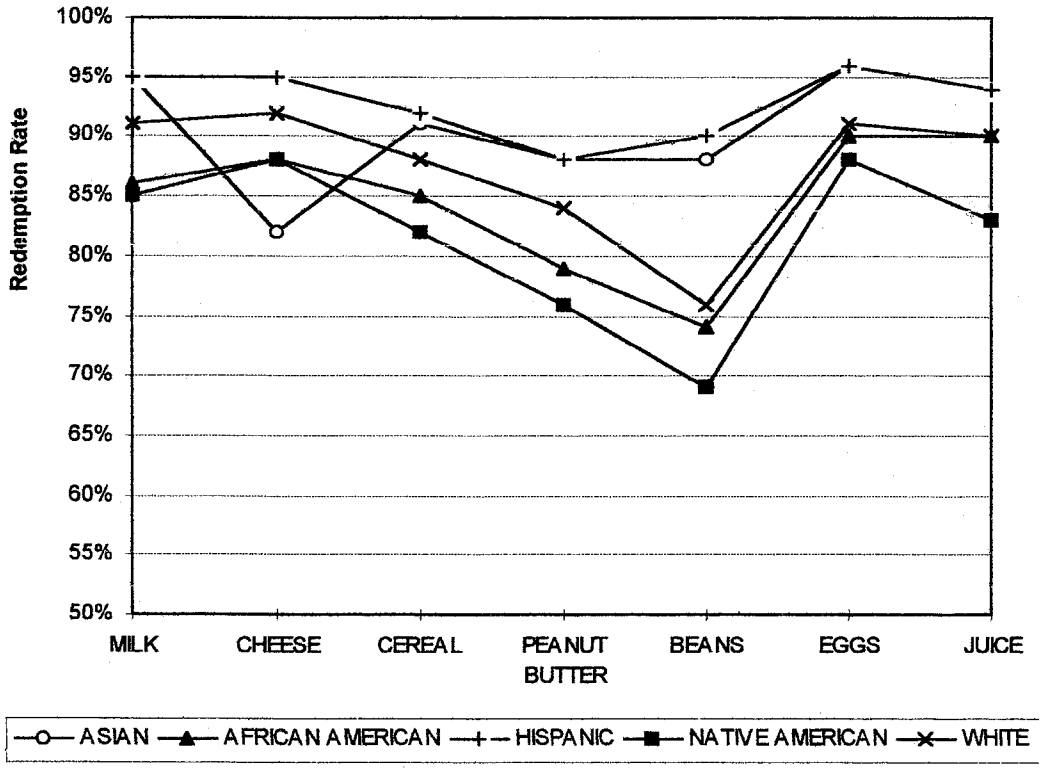

Figure 1a. California WIC Food Instrument Redemption Rates by Ethnicity, February 1999.

Source: ISIS data (see text).

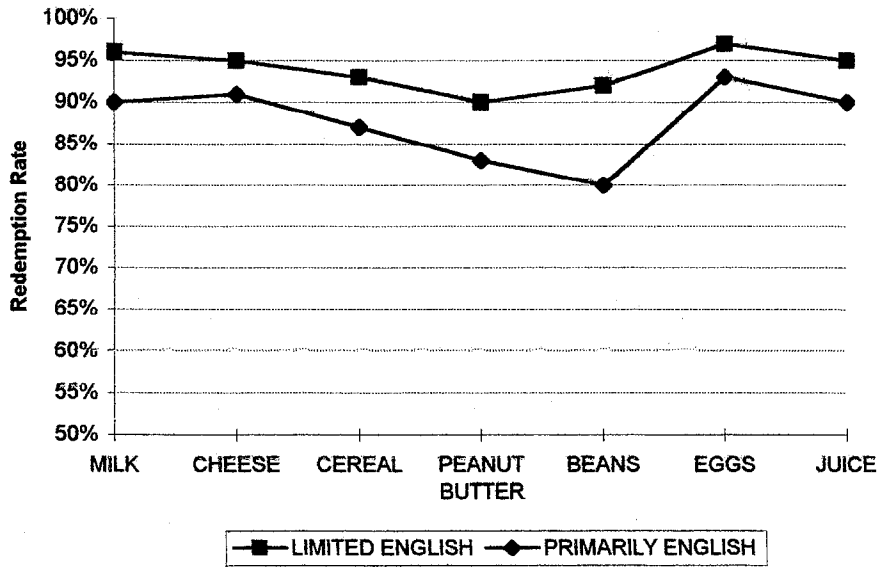

Figure 1b. California WIC Food Instrument Redemption Rates for Primarily English Speakers and Limited English Speakers, February 1999.

Source: ISIS data (see text).

instrument issuances were not used in this study unless they were found to be a substantial distance from major population centers. In this manner, the number of food instruments issued in May 2000 was used as an indicator of food instrument density, or ruralness, of a zip code.

The relationship between the food instrument density and the food instrument redemption rate is shown in Figure 2. Overall, redemption variation between California zip codes is not great, with 14 percent of the zip codes showing redemption rates above 90 percent and 12 percent showing redemption rates below 80 percent. However, there could be enough redemption variation to test its relationship with other characteristics, including location factors, of zip codes and their populations. The less rural (higher food instrument density) zip codes have overall redemption rates around 90 percent. As zip codes become more rural (with lower food instrument density), redemption rates drop, but the average redemption rate seems to remain above 80 percent. The more rural zip code redemption rates seem more uneven than those of the more urban zip codes, resulting in a heteroskedastic variation pattern.

When fitting the food instrument density and redemption rate relationship to a linear regression, a transformed logarithmic function was used as illustrated in Table 1. Such a transformed function is commonly used for a better fit to the data when heteroskedasticity is present. Other relevant measurements in addition to food instrument density are used in this regression in an attempt to obtain as full an explanation of regional redemption rate variation as possible.

Observations

The results of the regression analysis, using a Generalized Linear Model (SAS Institute Inc., 1989), are shown in Table 2. A coefficient of determination (R Square) of .44 was found for this regression analysis, which is substantial for a cross-sectional analysis such as this. Forty-four percent of the variation in zip code redemption rates can be explained by the variables entered into this model.

A significant parameter was found for food instrument density (FIDEN) indicating that food instrument redemption rates tend to show some sensitivity to this measurement. This parameter is positive, showing a slightly lower WIC participant propensity to redeem food instruments in rural, lower food instrument density, zip codes. However, other parameters were found to significantly affect food instrument redemption. The parameter for the percent of limited English-speakers (FPCT) was also significant. Based on previous research showing limited English-speakers' greater propensity to redeem WIC food instruments vis-à-vis primarily English-speakers, this is no surprise. The percentage of food instruments redeemed by persons from household supported by agricultural employees (AGPCT) was not significant. Higher numbers of agricultural WIC participants could suggest a more rural zip code with lower redemption rates. But agricultural WIC participants in California tend to be Hispanic and would include many limited-English speakers, who tend to have higher redemption rates. The number of authorized WIC vendors in a given zip code (VENDORS) parameter is significant and has a negative sign. This is a surprise, since one would think that fewer vendors would mean a lower redemption rate, especially in a rural area. When run alone, without the effects of other parameters, there is a significant parameter for VENDORS that does have a positive sign and an R SQUARE of .07. The INCOME parameter has a negative sign, which would be expected. Higher incomes, suggesting less dependence on WIC, would be consistent with lower redemption rates. This parameter is significant only at the 90 percent level, however. The RURAL variable was used to help determine the density index. It has a value of 1 if the zip code is, by observation of maps, determined to be substantially distant from major urban centers. Otherwise, its value is zero. The higher value of 1 in this variable does correlate, not quite at the 95 percent confidence level, with lower redemption rates, resulting in a negative parameter value.

These parameters can interact with each other. For example, we know that the density index and the percent of limited English-speakers both have a positive correlation with redemption rates. Examination of maps, generated by a geographic information system (ESRI), shown in Figures 3 through 6 can help to determine which influence might be dominant.

For example, Figures 3, 4, and 5 show generally higher redemption rates in the zip codes that are known to be more urbanized, such as the Los Angeles Basin shown in Figure 3. Figure 4 shows the sparsely populated area east of the crest of the

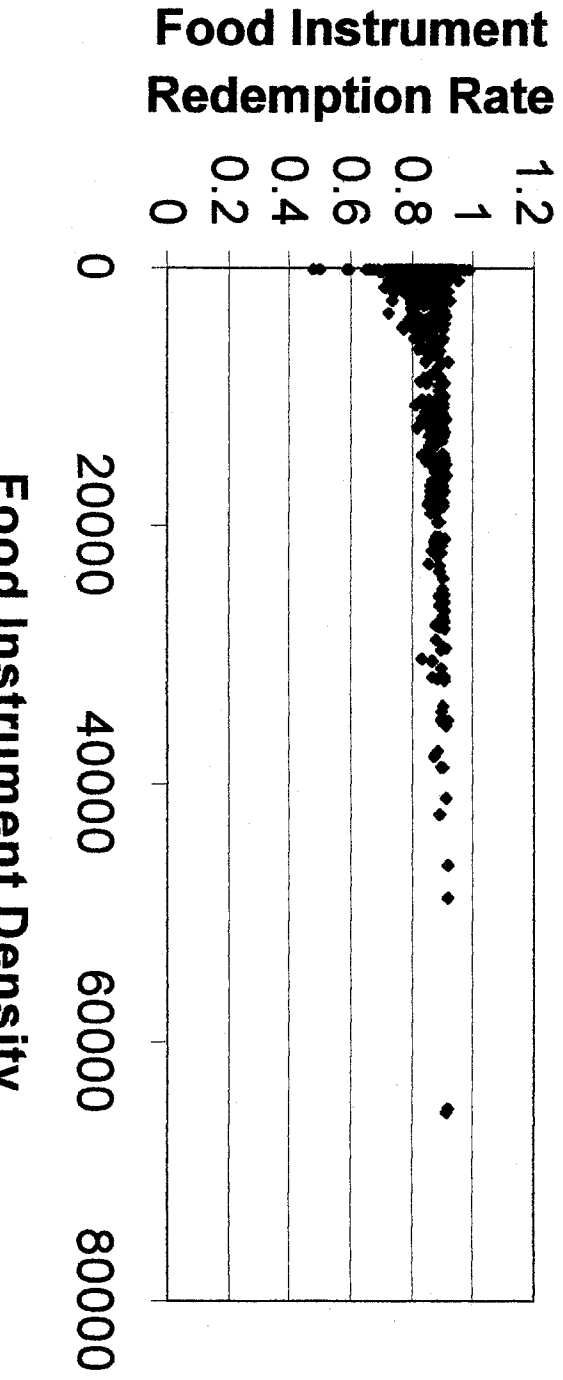

Figure 2. Zip Codes by Food Instrument Density and Redemption Rates.

Source: ISIS data (see text).

Table 1. Factors Influencing California WIC Food Instrument Redemption: A Regression Model, May 2000 data.

Model:

RRATE = A + LOG(B1(FIDEN)) + LOG(B2(FPCT))
+ LOG(B3(AGPCT)) + LOG(B4(VENDORS))
+ LOG(B5(INCOME)) + B6(RURAL) + e

Where:

RRATE = WIC food instrument redemption rate for a given zipcode.

A = Intercept

B1 - B6 = Parameters for each independent variable.

FIDEN = Food instrument density in a given zipcode.

FPCT = percent of Calif. WIC food instruments issued to limited English speaking participants in a given zipcode.

AGPCT = percent of Calif. WIC food instruments issued to persons in households supported by agricultural employment in a given zip code.

VENDORS = number of WIC authorized vendors in a given zipcode.

INCOME = mean WIC participant household income in a given zipcode.

RURAL = 1 if zipcode is primarily rural in character, 0 if not.

e = disturbance term; unexplained variation.

Table 2. Factors Influencing California WIC Food Instrument Redemption by Zip Code, Regression Model Results, May 2000 Data.

R Square (Coefficient of Determination) = .44

N = 414 California Zipcodes

Estimation of Parameters:

Parameter	Estimate	Standard Error	t-Value	Probability of Error
Intercept	**1.006607215**	**0.0787964**	**12.77**	**<.0001**
FIDEN	**0.025122078**	**0.0109916**	**2.29**	**0.0228**
FPCT	**0.026181408**	**0.00229736**	**11.4**	**<.0001**
AGPCT	0.001325598	0.00104837	1.26	0.2068
VENDORS*	**-0.005808826**	**0.00288487**	**-2.01**	**0.0447**
INCOME	-0.019725137	0.01079414	-1.83	0.0684
RURAL	-0.011978990	0.00626916	-1.91	0.0567

*when run alone (RRATE=A+LOG(B1(VENDORS))+e) R Square is .08, estimate of X1 is 0.0148079024, standard error is .00228385, t value is 6.48, probability of error is <.0001

Bold face estimates were found to be significant at the 95 percent confidence level.

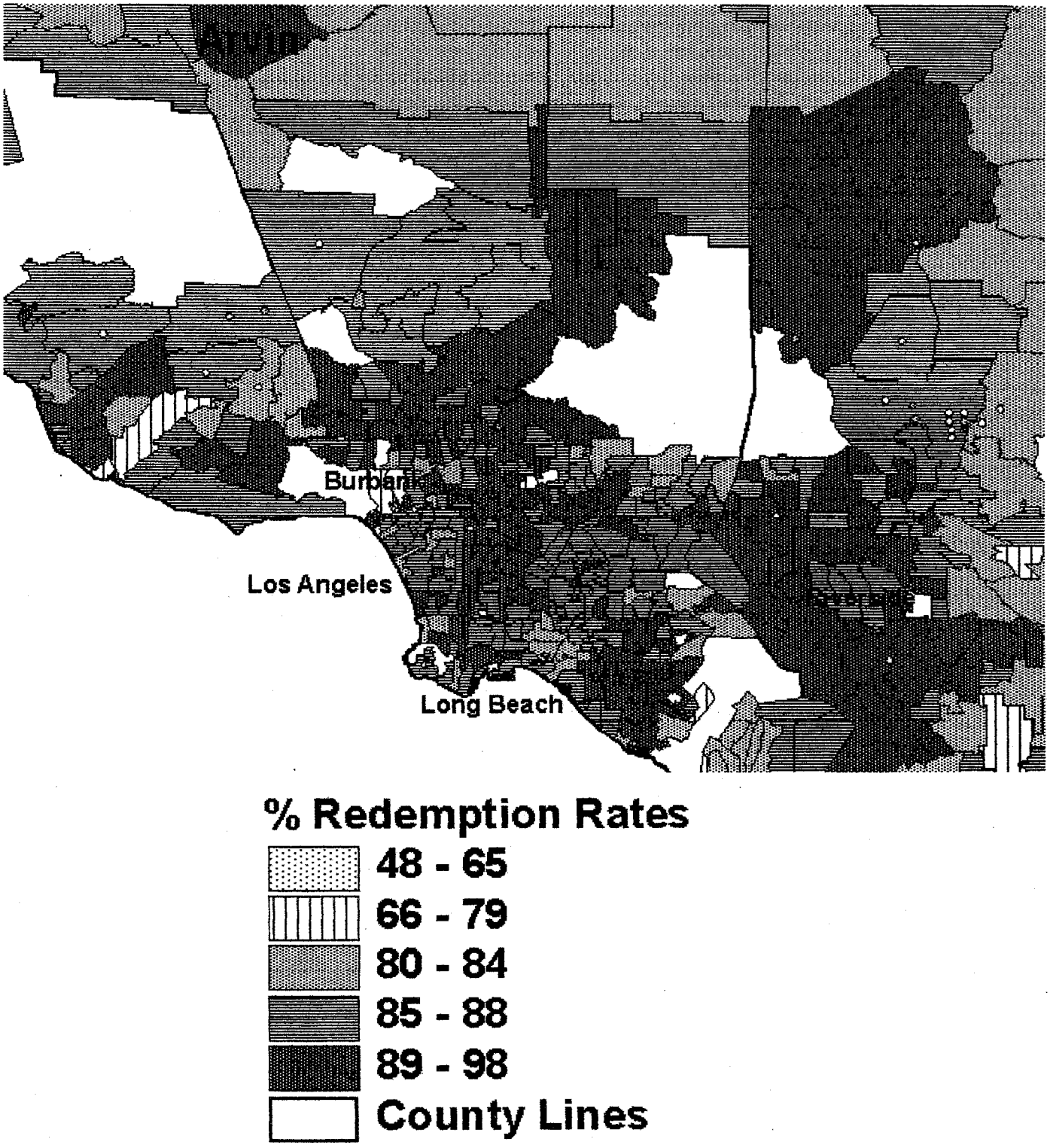

Figure 3. Los Angeles Area WIC Food Instrument Redemption Rates, May 2000.

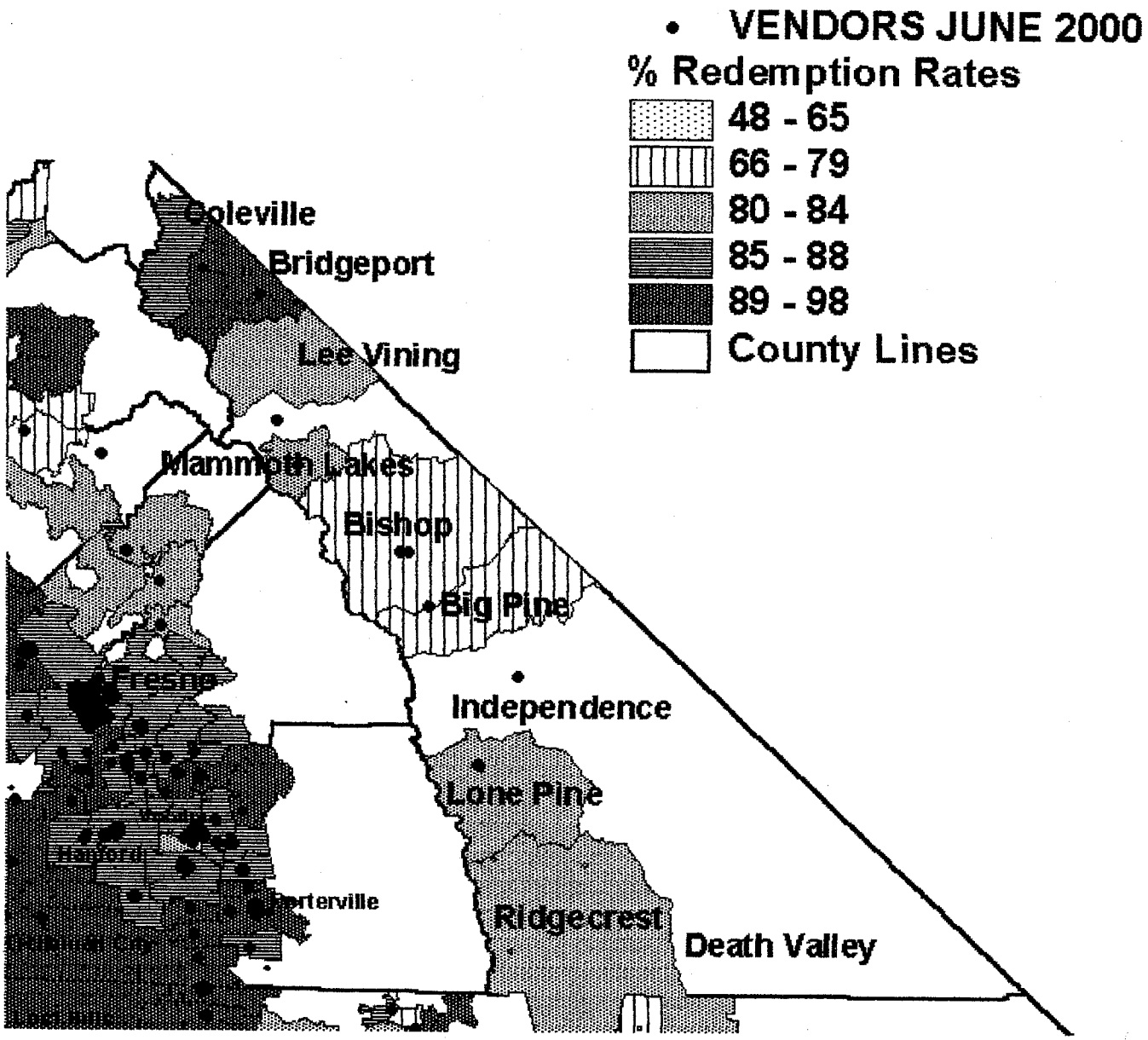

Figure 4. Eastern California WIC Food Instrument Redemption Rates, May 2000.

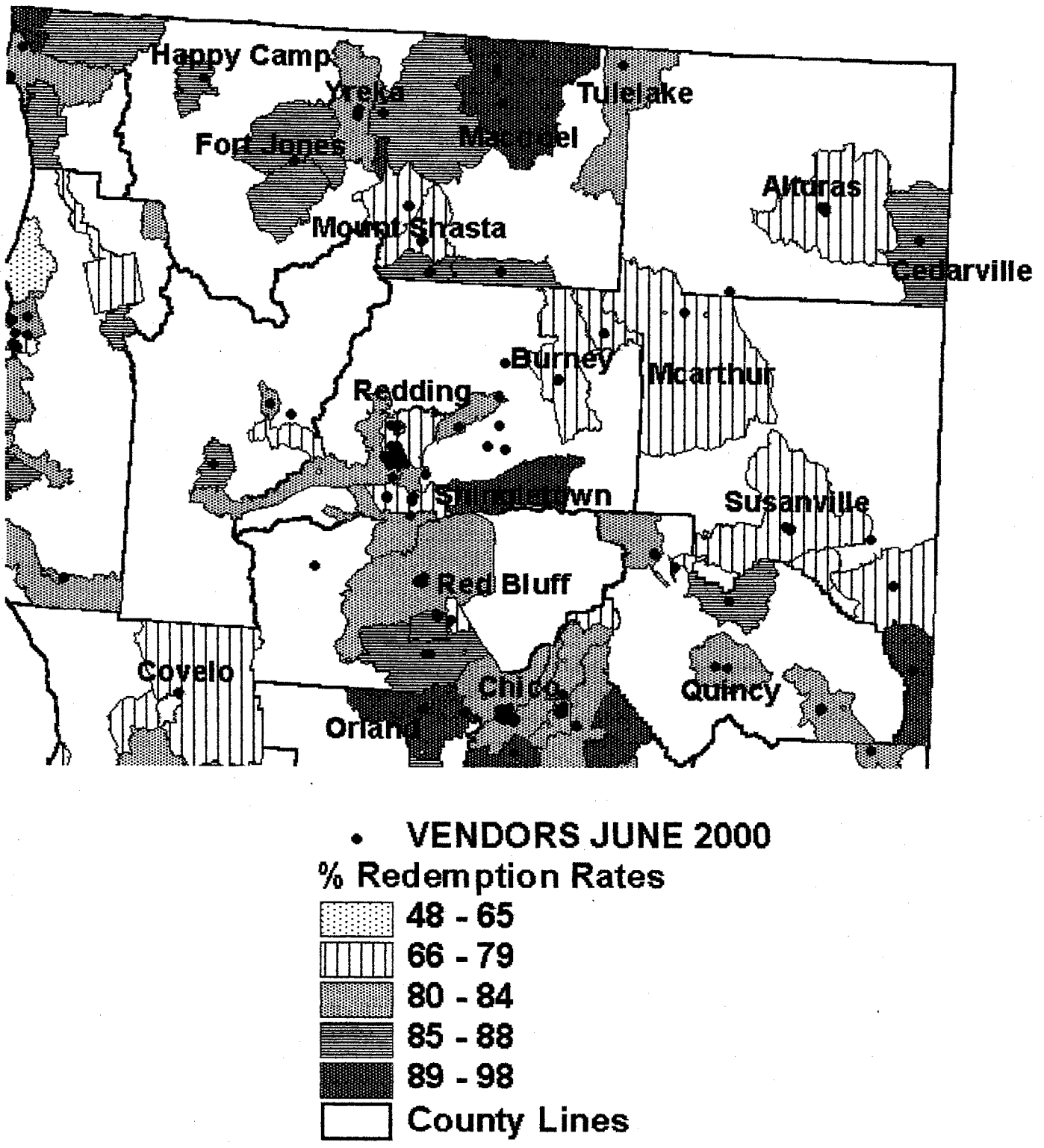

Figure 5. Northeastern California WIC Food Instrument Redemption Rates, May 2000.

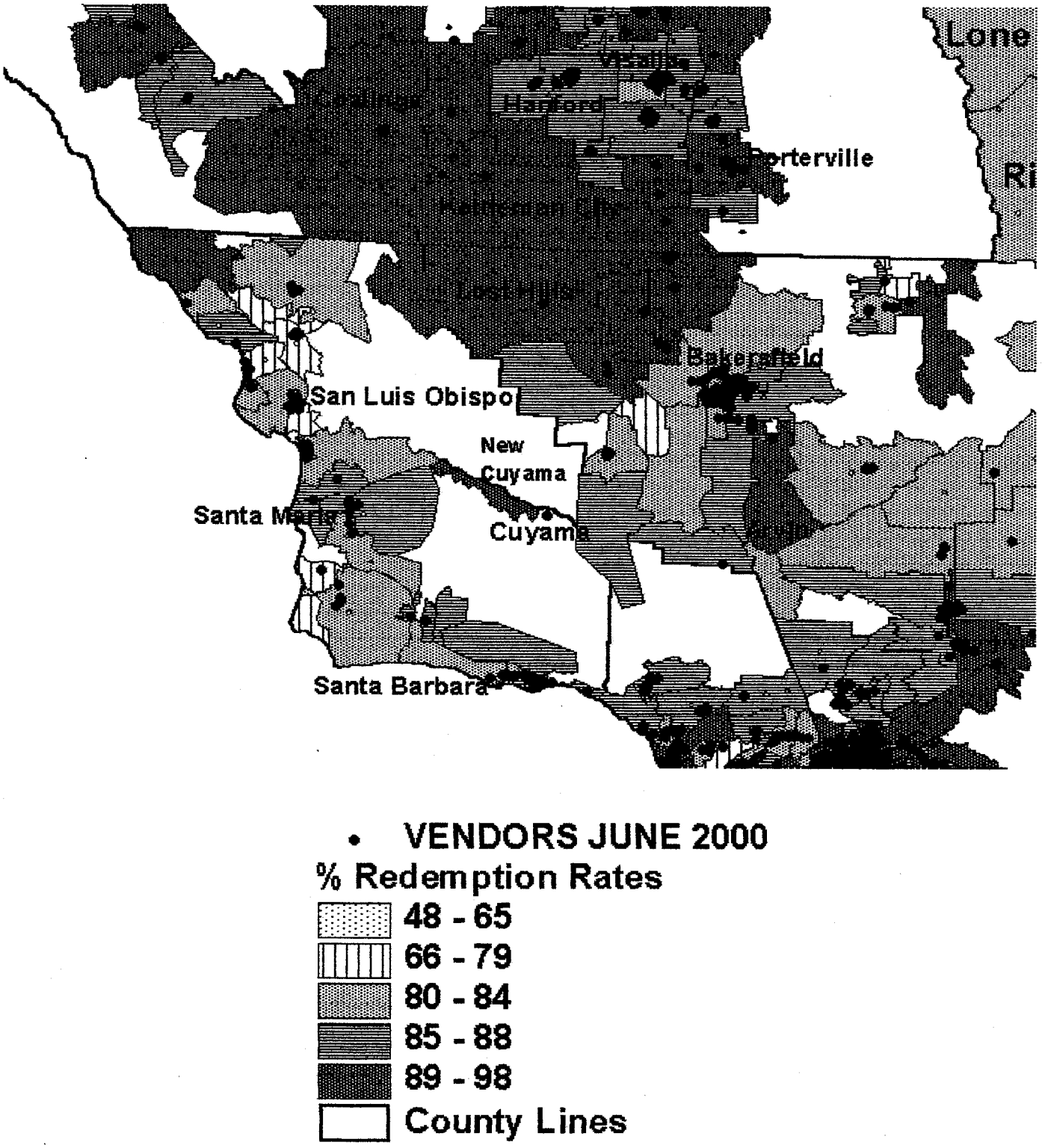

Figure 6. West San Joaquin Valley WIC Food Instrument Redemption Rates, May 2000.

Sierra Nevada Mountains (Bridgeport, Bishop, Ridgecrest, and surrounding territory) to be showing generally lower redemption rates than those more populated areas to the West of the mountains, around Fresno. Also, WIC vendor locations are shown in Figure 4. Because they are authorized WIC vendors, we may be reasonably sure that they offer a full line of nutritious foods at these locations. Figure 5 shows redemption rates in northeastern California locations. This area would be characterized as rural, possibly excepting areas around Redding and Chico. Figure 6 shows the western San Joaquin Valley, where very high redemption rates are shown in rural zip codes (around Lost Hills and Kettleman City) even with relatively few local WIC vendors. The fertile San Joaquin Valley supports more agriculture than can be found in the harsher climates east of the Sierra Nevada Mountains. The larger rural San Joaquin Valley Hispanic farm worker population can explain the high redemption rates there. Figures 4 and 5 show certain rural pocket areas east of the Sierra with high redemption rates. ISIS has reported these zip codes were found to have a high percentage of limited-English speaking WIC participants.

Map analysis suggests that the previously detected trend toward greater WIC food instrument redemption by limited English-speaking participants is present in rural areas just as it is in California's urban-dominated WIC population as a whole. To examine this possibility closer, Table 3 shows the results of the same regression analysis reported on in Table 2, except that only those zip codes where the RURAL variable is 1 (not 0) are included. As would be expected in this case, the food instrument density (FIDEN) parameter became insignificant, since all zip codes dealt with here are of low food instrument density. But the foreign language percent is still very significant, showing that the statewide limited English-speakers' greater propensity to redeem food instruments is not deviated from in rural areas. It is interesting that Table 3 shows a significant positive correlation between the percentage of agricultural employee-supported families (AGPCT) and propensity to redeem food instruments. The Hispanic influence is probably affecting this. The parameter for number of vendors (VENDORS) has not shown much change and, of course, the RURAL parameter is non-existent because its variable is always 1.

Conclusions

A slight but measurable positive correlation was found between WIC food instrument issuance density by zip code and respective redemption rates in California. While this condition may indicate some lesser degree of food availability in rural vis-a-vis urban areas, there is evidence that cultural influences on redemption rates are also present.

Map analysis has shown that very high redemption rates have occurred in rural California areas that are dominated by foreign language speaking WIC participants, indicating physically accessible food outlets. The results of this study confirm previous studies concluding that the limited English-speaking WIC participants tend to redeem a greater percentage of their food instruments than primarily English-speaking WIC participants do. This redemption rate dichotomy appears to be present in rural as well as urban areas. The presence of absence of limited English-speaking rural WIC participants seems to contribute to the more uneven food instrument redemption patterns in rural vis-à-vis urban zip codes.

Given this linguistic effect on food instrument redemption, it is not possible to conclude definitively that California has a significant rural food availability problem. However, the regression model's sensitivity to food instrument density and the illustrative ability of map analysis based on WIC data suggest that these analytical techniques could be useful components of food security analysis at locations throughout the United States.

References

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