Michigan Hunger Study 2024

Technical Report

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Study Leadership and Collaboration:

This work was conducted by Michigan State University (Kerver, Principal Investigator) in collaboration with the Food Bank Council of Michigan. The study team would like to acknowledge the substantial collegial interactions and insights that made this work possible.

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Additional Contributions:

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PREFACE TO THE TECHNICAL REPORT

The Michigan Hunger Study 2024 (MHS2024) was inspired by the Hunger in America 2014 (HIA 2014) study commissioned by Feeding America.[1] This Technical Report provides details on the sample design and selection, weighting, and estimation processes for the Michigan Hunger Study 2024. Because we attempted to replicate the methods of HIA 2014, our description is very similar and, in some cases, identical to that described in the HIA 2014 Technical Volume.[2] While efforts have been made to accurately apply and reflect these approaches, this report is an independent analysis and is not endorsed by or affiliated with Feeding America. Any interpretations, conclusions, or recommendations presented herein are solely those of the authors and do not necessarily represent the views or positions of Feeding America or its partner organizations. Our intent is to fully attribute the work of the HIA 2014 team while noting where we adapted the methods to better fit our specific implementation steps in the MHS2024. Users of this report should exercise their own judgment when referencing or applying the methodologies described.

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[1] Montaquila, Jill, and Nancy Weinfield. *Hunger in America 2014: National Report*. Westat and Feeding America, 2014, https://www.feedingamerica.org/sites/default/files/2020-02/hunger-in-america-2014-full-report.pdf

[2] Westat. *Hunger in America 2014: Technical Volume*. Feeding America, 2014, https://www.feedingamerica.org/sites/default/files/2020-02/HIA2014-Technical-Volume.pdf.

Terms Used in This Technical Report

Capture–Recapture Method:[3] A statistical method for estimating the size of a population that cannot be directly enumerated. The approach uses the degree of overlap across repeated observations or data sources to infer the total number of unique individuals, adjusting for duplication and undercounting. While the method originated in early population estimation research, it is now widely used in epidemiology, demography, and other human population studies.

Clients: Community members using the Food Bank Council of Michigan (FBCM) member network.

Duplicated: The total number of visits, counting individuals each time they access the FBCM member network.

Food Banks: Large-scale warehouses with defined service regions that source food from farmers, retailers, manufacturers, government programs, and donations, sometimes supplemented with purchased food. Some also operate supporting distribution warehouses.

Food Bank Council of Michigan (FBCM): The statewide trade association for seven regional food banks, and part of the Feeding America network. FBCM administers grants, manages large-scale food purchasing with Michigan farmers and suppliers, and advances initiatives to expand access to nutritious food.

FBCM Member Network: The network includes seven food banks and their affiliated local agencies across Michigan, all of which are members of Feeding America and the Food Bank Council of Michigan.

Mobile Pantries: Food distributions operated by regional food banks in partnership with local organizations that bring fresh food into neighborhoods with limited access to traditional pantries, often on a regular schedule.

Partner Agencies: Community-based organizations such as food pantries, soup kitchens, and shelters that acquire food from their regional food bank or warehouse to distribute directly to people facing food insecurity.

Prosperity Region: One of ten groups of neighboring Michigan counties designated by the state to align planning, resources, and data.

Unduplicated: The number of unique individuals served by the FBCM member network.

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[3] Lyles RH, Zhang Y, Ge L, England C, Ward K, Lash TL, Waller LA. Using Capture-Recapture Methodology to Enhance Precision of Representative Sampling-Based Case Count Estimates. J Surv Stat Methodol. 2022 Jan 5;10(5):1292-1318. doi: 10.1093/jssam/smab052. PMID: 36397765; PMCID: PMC9643167.

1. Introduction

The Michigan Hunger Study 2024 (MHS2024) was designed to survey a representative sample of people receiving food assistance through the Food Bank Council of Michigan (FBCM) member network. The target population was all clients and household members that received food from charitable food agencies that partner with the FBCM member network. The overall goal was to provide a description of the individuals and households served in Michigan by the FBCM member network. Specific aims were to:

1. Describe estimates of the numbers of both duplicated and unduplicated clients served by the FBCM member network across the entire state of Michigan, and;
2. Describe characteristics, life situations, and coping strategies of individuals supported by these agencies.

Data collection for the MHS2024 began with the engagement of agencies in the FBCM member network. The Food Bank Council of Michigan provided essential data on member network food banks and agencies operating in Michigan in 2023 for the purpose of designing the study. The sampling unit used to guide the initial selection of agencies was pounds of food distributed by the FBCM member network in the year prior to our field work (i.e., Fiscal Year 2023). This information was used both analytically—to describe the agencies and programs within the FBCM member network—and methodologically, to inform the design and selection of the Client Survey sample. The maximum numbers of agencies that could be included in the Client Survey data collection effort was capped based on available resources. After determining the maximum number of agencies that could be surveyed, the goal was to ensure sufficient sample sizes within each food bank distribution region to support food bank-level estimates. The largest agency sample size that was feasible based on resource considerations was attained.

The Client Survey was conducted in person in 2024 and gathered detailed information on client's household characteristics—including demographics, health status and coverage, living conditions, income and financial challenges, SNAP participation, and food insecurity—as well as their usage patterns and experiences accessing food assistance programs. The pounds of food distributed in 2024 (the same year the client surveys were conducted) by agencies in the FBCM member network

was used for statistical weighting, as well as the agency's participation statuses in the MHS2024 Client Survey. The sampling weights that were used to generate statewide estimates were adjusted for food bank–level nonresponse so that agencies that did not participate are still represented in the statewide estimates.

In considering the sampling unit and unit of analysis for the MHS2024 Client Survey, we used the definition "client" from the Hunger in America 2014 report: "for grocery programs, the client is everyone in the household who may benefit from the groceries received, so it is necessary to account for services received by the respondent and/or anyone else in the respondent's household." Therefore, when counting and sampling clients in grocery programs, each household was considered a single unit. The analysis was performed at the household level, i.e., client count estimates were generated at the household level. If multiple household members visited the program together, they were counted only once as a group. If the household was surveyed, one adult member served as the respondent, provided they could reliably answer questions on behalf of the household.

2. Study Design

To meet the project objectives, a multistage design like that used for the Hunger in America 2014 study was used. To develop a representative sample and to select each client with a known probability of selection, the sampling procedure was nested in stages: 1) agency selection; 2) survey day selection; and 3) client selection. Each stage is described in more detail below.

AGENCY SELECTION

Stage 1: Agency selection involved selecting agencies from the Agency List provided by the Food Bank Council of Michigan using probability proportional to size (i.e., pounds of food distributed in 2023).

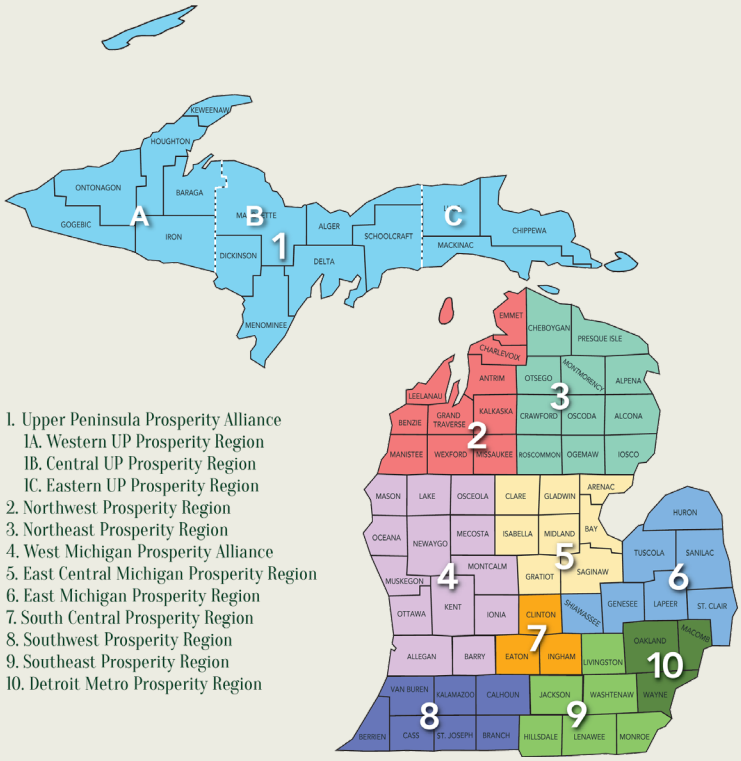
Two kinds of agencies were considered (if an agency refused, a replacement agency was selected):

1. The first set of agencies were intentionally selected, referred to through the report as selected with "certainty". This included agencies with the largest pound weight of food distributed in

each of Michigan's prosperity regions (N=10, see Figure 1), as well as agencies that were reported by their agency directors as serving minority, senior, or other vulnerable populations.

2. The rest of the agencies were randomly selected from each prosperity region in Michigan. Michigan's prosperity regions are designated by the state government for the purposes of categorizing economic and community development.

FIGURE 1: PROSPERITY REGIONS IN MICHIGAN



Agency Sampling Methods

Probability proportional to size (PPS) sampling was used for the selection of agencies. For sampling agencies, the measure of size (MOS, shown in the equation below) was strongly correlated with the total number of clients served by agency. For sampling agencies, we used the annual poundage of food from the food bank in the year before our Client Survey administration (i.e., 2023).

The overall sampling fraction for agencies in each food bank j is shown as the following:

$$f_j = \frac{n_j MOS_i}{\sum_{i \epsilon j} MOS_i}$$

Where n_j is the number of eligible agencies to sample in the food bank j; MOS_i denotes the measure of size (number of clients served) for food distribution site i in region j. Since we do not have the information of number of clients served in each agency, we used the alternative measure of pounds of food distributed at each agency as MOS_i. If the pounds of food distributed was missing, it was imputed using median pounds among agencies in the same food bank.

To make sure there were enough agencies selected by each geographic region and size, selection was stratified by two factors:

a) By the ten prosperity regions in Michigan; and
b) By agency size as approximated by pounds of food distribution in 2023.

The number of agencies sampled was determined by power calculations of clients needed in the section "Target Sample Sizes and Related Assumptions" below, and by the number of agencies sampled with certainty in the project. Additionally, the number of agencies to be sampled within each food bank was determined based on available resources and logistical considerations. The final list of participating agencies is shown in Table 1.

Target Sample Sizes and Related Assumptions (Tables 2-5)

Since clients were selected within agencies in each prosperity region, weights were used to account for differential client selection probabilities due to potential inaccurate measures of size and limits in data collection, nonresponse, and other factors.

Selection of Noncertainties

As noted above, some of the agencies were selected using PPS sampling without certainty. For these non-certainty agencies, a key consideration was the choice of sub-stratification within prosperity regions. Stratification was based on each agency's MOS (measured as the largest pounds distributed in 2023) along with a geographically defined set of agencies.

SURVEY DAY SELECTION

Stage 2: "Survey Day" selection involved assigning a sampled program to a specific data collection time. That is, selecting a day when the program was open and serving clients to plan for data collection activities. This was done to meet the data collection scheduling needs of covering the entire state of Michigan. It also had the effect of capturing a variety of weekday and weekend days at different times of the day and different weeks of the month. Data collection for the Client Survey was conducted between June 5 and September 19, 2024. The specific survey day for each program depended on the day(s)/week(s)/month(s) that the program was open to serve food to clients.

CLIENT SELECTION

Stage 3: Client selection involved sending trained data collectors to the sampled program site on the survey day. Data collectors attempted to survey all clients who were willing and able to complete the survey in the time available at each site. Given operational constraints, varying client sample sizes within agencies was not feasible; therefore, client selection probabilities were adjusted to preserve fixed expected client sample sizes.

The Role of Data Collectors in the Client Survey

The MHS2024 Client Survey was conducted using trained student data collectors from Michigan State University who traveled to the agency site during the survey day/hours to:

- Tally and record the total number of client visits to the agency during the hours the agency was open within the survey day/hours;
- Follow a standardized protocol to offer the survey to all clients;
- Enter data about the surveyed clients (e.g., time of visit, consent and response status, and observations of characteristics for nonresponse adjustments);
- Invite sampled clients to participate and administer survey consent; and
- Assist clients as needed in completing a self-administered survey.

Only one agency with a meal program was included. For that agency, the clients eligible for the survey were adults receiving a meal at the agency site. For all other grocery programs, the clients were surveyed on household level information. According to the data collection procedures, each

family or household sharing the same grocery order was counted as a single unit, and one adult member from the sampled household was asked to complete the Client Survey.

Limits to the Lengths of Data Collectors' Shifts

In most cases, client counting, sampling, and data collection were conducted throughout all hours the program was open on the survey day. However, for agencies with extended service hours, it was operationally challenging for data collectors to cover the full period. To address this, MHS2024 limited survey activities to a maximum of six hours per day.

For agencies operating more than six hours, a single six-hour block was randomly selected from all possible periods during the survey day. This within-day sampling of hours was incorporated into the program visit's selection probability when calculating survey weights.

Multiple Visits to Programs by the Same Client

Because clients could visit programs multiple times, some may have been sampled more than once. To reduce overlap, data collection was limited to a six-hour window, and clients were asked to complete the survey each time they were sampled.

Handling Missed Survey Days

Even with diligent efforts to ensure that data collection occurs as prescribed, there were situations in which it was not possible to administer Client Survey data collection as originally assigned. In such cases, a replacement day was issued,

3. Sample Weighting

To meet study objectives, survey weights were developed to ensure appropriate analysis of Client Survey data in the MHS2024. Methods used for computing survey weights are described below. Base weights were calculated to account for differences in selection probabilities by using the reciprocal of each unit's selection probability. Weights were adjusted for

nonresponse at the agency and client levels. In the MHS2024, there were two stages in which nonresponse occurred:

- Agency nonparticipation in the Client Survey: Agencies meeting the criteria for inclusion were used to construct the sampling frame. However, some sampled agencies were not visited for data collection. In certain cases (e.g., weather, illness), data collectors could not reach the site on the scheduled day. A replacement day—up to two per program—was then assigned, but even with replacements, data collection did not occur at some agencies.
- Client nonresponse to the Client Survey: Some clients sampled for the Client Survey failed to complete the survey. For example, some clients refused to complete the survey, or some did not have time. Even among those who did submit a client survey, in some cases, the survey was deemed to not be complete enough to be considered a response.

To reduce bias in the MHS2024 survey estimates due to nonresponse, the base weights were adjusted for nonresponse at the agency and client levels. Below, we describe the approach used for making these adjustments.

Agency base weights. Changes were made after the original selection to the set of agencies assigned to be visited in MHS2024. Because of the departures from probability sampling used to identify agencies to be visited due to the pounds of food distribution change in each agency from 2023 to 2024, it was not possible to assign base weights based directly on agency probabilities of selection (i.e., assign agency base weights as the reciprocals of the agency selection probabilities). Thus, an alternative approach was developed for this purpose. Under this alternative approach:

- The very large agencies that were added to the sample at the request of FBCM member network were classified as certainties; FBCM member network also identified some sampled agencies that serve minorities, older and vulnerable populations, they would have requested to add to the sample. All these agencies were treated as certainties and assigned a program base weight of 1.
- For the remaining programs, if the food bank's sample was supplemented (other than the addition of the very large programs), the sample is viewed as having been selected in two phases—the original sample (phase 1) and the supplemental portion of the sample (phase 2).

- If the program was selected in the phase 1 sample, it retained its original probability of selection, $P(1)$.
- If the program was not selected in the phase 1 sample but was added through subsequent random supplementation, its phase 2 probability of selection (2), was approximated as $[1 - P(1)]\frac{m_2}{M_2}$ where m_2 is the total number of noncertainty agencies added to the sample for the given food bank through random supplementation, and M_2 is the number of noncertainty agencies in the given food bank that were available for supplemental selection. The agency's base weight was then computed as $1/[P(1) + P(2)]$.

Adjusting for client nonresponse. The next adjustment compensated for eligible clients who failed to complete a client survey. Failure to complete a client survey could have been due to client refusal – or nonresponse for other reasons (e.g., the client did not have enough time for the survey), or the result of a client who submitted a survey that was later deemed to not be complete enough for analysis purposes. Adjustments were made such that the response rate was the reciprocal of the weighted response rate within the cell. The mean client response rate ranged from 26.4% to 100% for the 53 agencies surveyed. Although lower response rates result in some large factors, we decided not to collapse cells further or trim the factors themselves, since the next step in the weighting process was to trim the weights.

Trimming outlier client weights. Following the adjustments described above, excessive client weights were identified and trimmed. For each agency, a trimming threshold was computed as $\sqrt{10\frac{\sum w_i^2}{n}}$, where n is the number of completed client surveys for the given agency in the food bank, and w_i is the client weight (after all the adjustments described above had been applied) for client i. For an agency within a given food bank, if any client weights exceeded this value (the trimming threshold), those weights were trimmed back to that value, and the excess (the total amount trimmed off the weights) was redistributed proportionately to all respondents in the agency in the food bank. Overall, 5 percent of the client weights were trimmed.

4. Estimating Client Counts

The Michigan Hunger Study 2024 had the analytic objective to construct monthly and annualized estimates of the numbers of clients receiving food from the FBCM member network, however, because it was not feasible to randomly select survey administration times throughout the year and because many agencies use the same software program to estimate their own client counts (i.e., Link-2-Feed), that information was obtained from the FBCM member network and used to get more accurate estimates of the client counts. In summary, the estimating methods for the client counts in MHS2024 are different from Hunger in America 2014, which was based on client and agency survey results. The duplicate and unduplicated client count estimates here were obtained for two time periods: 1) 06/2024-09/2024 (Agency Survey Period) and 2) 01//2024-12/2024 (Annual for 2024).

Methodology for Computing Duplicate Client Counts Estimates (Table 6)

As mentioned in the introduction, duplicated client counts were estimated in three steps: 1) by calculating the number of duplicate clients in the agencies that provided Link-2-Feed results by prosperity regions; 2) by calculating the median of the ratio $\gamma_1 = \frac{Pounds\ of\ Food\ Distributed}{Number\ of\ duplicate\ Clients}$ by two time periods a) 06/2024-09/2024 and b) 01//2024-12/2024) by each prosperity region; 3) by using the median ratio γ_1 which was extrapolated to the agencies in each prosperity region without Link-2-Feed information under the assumption that in each prosperity region, the ratio of the pounds of food was distributed over the number of clients. This is a strong assumption; however, information was obtained from 218 agencies with Link-2-Feed information (18.9 % of all pounds of food distributed in FBCM member network in 2024).

Standard Error Estimation for Duplicate Client Counts

Bootstrapping methods were used to obtain standard error of the median ratio γ_1 for agencies at the State level. A sample of agencies were randomly selected with replacement for 1,000 times to obtain a distribution of estimated $\hat{\gamma}_1$ and $\hat{\gamma}_1$ which was used to calculate the duplicated client counts based on the formula:$Number\ of\ duplicate\ Clients = \frac{Pounds\ of\ Food\ Distributed}{\hat{\gamma}_1}$ for

1,000 bootstrapped samples. Based on the bootstrapped distribution, the standard error of duplicate client counts was obtained.

Methodology for Computing Unduplicated Client Counts Estimates

Capture-Recapture method to estimate unduplicated Client Counts for each agency

For agencies with Link-2-Feed information, the unduplicated Client Counts were estimated using the Capture-Recapture method[4] and implemented using R package, "Recapture".[5] Based on each agency's Link-to-Feed data, data sets were re-constructed to capture-recapture statistics, which showed the number of clients captured i times (f_i), the number of clients captured for the first time on occasion i (u_i), the number of clients captured for the last time on occasion i (v_i), the number of units captured on occasion i (v_i) and the number of clients captured on occasion i (n_i).

The simplest log-linear model assumes a single capture probability p common to all clients, at every capture occasion, and did not change after the first capture. For a client with a capture history ω is $\Pr(\omega) = N(1-p)^{t-\sum w_j} p^{\sum w_j}$. The expected mean frequency can be expressed in a loglinear model as $\exp\left(\log(N(1-p)^t) + \sum w_j \log\left(p/1-p\right)\right)$. The log-linear model estimated the abundance (total population size) for clients as $\widehat{N} = n + \exp(\hat{\gamma})$ where $\gamma = \log(N(1-p)^t)$ in previous equation and n is the total number of unique clients captured in one month.

The study was originally designed to collect capture-recapture information repeatedly in the agencies that had the highest pounds of food distributed in 2024 in each prosperity region. But due to the limitation of the data collectors and number of participating agencies, this information was not collected during the survey period. Instead, Link-2-Feed information was collected from a subset of the agencies. Where agencies had the complete information of client visits for the two time periods: 1) 06/2024-09/2024 (Agency Survey Period) and 2) 01//2024-

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[4] Tilling K, Sterne JA. Capture-recapture models including covariate effects. Am J Epidemiol. 1999 Feb 15;149(4):392-400. doi: 10.1093/oxfordjournals.aje.a009825. PMID: 10025483.

[5] Rivest LP, Baillargeon S. Applications and extensions of Chao's moment estimator for the size of a closed population. Biometrics. 2007 Dec;63(4):999-1006. doi: 10.1111/j.1541-0420.2007.00779.x. Epub 2007 Apr 9. PMID: 17425635.

12/2024 (Annual for 2024), the unduplicated clients counts were obtained from the Link-2-Feed data directly by counting the unique client numbers. However, for agencies without complete Link-2-Feed information for the two time periods, the capture-recapture method was used to estimate the total unique client number. Among all agencies, only 5% of agencies did not have the complete Link-2-Feed information.

Extrapolation to other agencies without Link-2-Feed information (Table 7)

For agencies without Link-2-Feed information, an extrapolation method was used to estimate the unique client number. First in each prosperity region, the ratio of duplicate client counts over unduplicated client counts for each agency (ρ_1) with Link-2-Feed information was obtained. The median ratio ρ_1 in each prosperity region was extrapolated to agencies without Link-2-Feed information to calculate the unduplicated client counts based on the duplicate client counts estimate calculated previously. Again, here the assumption was made that in each prosperity region, the frequencies of clients visiting each agency were similar so that the median ratio (ρ_1) was used in all agencies in the same prosperity region.

Standard Error Estimation for unduplicated client counts

Bootstrapping methods were used to obtain the standard error of the median ratio ρ_1 for agencies at the State level. A sample of agencies was selected with replacement for 1,000 times to obtain a distribution of estimated $\hat{\rho}_1$ and $\hat{\rho}_1$ was used to calculate the unduplicated client distribution, and the standard error of unduplicated client counts was obtained.

5 Study Limitations

As mentioned previously, client surveys were conducted by a team of data collectors surveying 53 agencies in the Food Bank Council of Michigan member network during June-September in 2024 and most of the agencies were open only once a week. Therefore, it was not possible to assign a random survey date to each agency. To estimate the duplicate and unduplicated client counts, the ratio of pounds of food distributed over duplicate client counts was assumed to be similar

within each prosperity region and the ratio of duplicate client counts over unduplicated client counts was assumed to be similar within prosperity regions. These may be strong assumptions and could potentially be improved if more information was available for agencies without Link-2-Feed data.

Table 1. Final 53 agencies surveyed for the Michigan Hunger Study 2024

Agency Name	Date of Visit	Food Bank	Prosperity Region	Number of Surveys
Calvary Road Community Church/GCSDA (First Baptist Church)	6/28/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	8	44
Capuchin Soup Kitchen - Services Center Pantry**	8/8/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	47
Care and Share Food Pantry	8/8/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	2	6
Caseville UMC*	7/20/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	6	67
Clare County Harrison*	8/3/2024	GREATER LANSING FOOD BANK	5	116
Community Action House**	8/12/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	4	54
Community Family Life Center	7/13/2024	FOOD GATHERERS	9	17
Comstock Community Center*	6/13/2024	SOUTH MICHIGAN FOOD BANK (SMFB)	8	3
Corner Health Center*	9/17/2024	FOOD GATHERERS	9	3
CRM Meal Assistance Program of Lenawee	6/22/2024	SOUTH MICHIGAN FOOD BANK (SMFB)	9	17
Detroit Friendship House/Harvest House	7/16/2024 & 8/22/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	24
Eagles Helping Hands at Thurston High School	7/17/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	65
Escanaba SDA Food Pantry**	6/7/2024 & 6/10/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	1	87
Every Nation Church	8/6/2025	FOOD BANK OF EASTERN MICHIGAN (FBEM)	6	30
Family Network	8/21/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	4	15
FFD/Union City	6/27/2024	SOUTH MICHIGAN FOOD BANK (SMFB)	8	28
Fishes & Loaves	7/29/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	19
God's Storehouse	7/23/2024	FORGOTTEN HARVEST	10	42
Greater Faith Mission*	9/17/2024	FOOD GATHERERS	9	58
Greater Flint Outreach-Central	6/5/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	6	63
Harvest Time Christian Fellowship	7/30/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	36
Hispanic Center of West Michigan Mobile Pantry*	6/25/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	4	60
Islamic Center of Detroit*	8/24/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	33
KBIC Mobile Pantry*	7/31/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	1	197
Kensington Church*	8/1/2024	FORGOTTEN HARVEST	10	78
LMTS Community Outreach**	7/24/2024	GREATER LANSING FOOD BANK	7	69
Maiden House Ministry	7/26/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	71
Manna Food Project Pantry**	8/8/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	2	23

New Mt Calvary Baptist	8/15/2024	GREATER LANSING FOOD BANK	7	70
New Providence Baptist Church	8/20/2024	FORGOTTEN HARVEST	10	42
Oak Park High School	8/16/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	43
Old Town Soup Kitchen**	7/27/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	5	107
Open Door Outreach Center	7/18/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	5
Otsego County Community FP**	8/17/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	3	69
Pinconning Area Food Pantry	8/9/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	5	65
Renaissance Vineyard*	7/15/2024	FORGOTTEN HARVEST	10	18
Roscommon Food Pantry	6/19/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	3	29
Royal Oak Towers*	9/19/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	35
Safe Harbor Comm. Ctr.	8/5/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	5	26
Sequoia Place*	7/24/2024	FOOD GATHERERS	9	14
Shared Harvest**	7/11/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	9	18
St Mark Baptist Church	7/10/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	6	52
St. Isidore Catholic Church	8/14/2024	FORGOTTEN HARVEST	10	28
St. Patrick's Senior Center*	7/30/2024	FORGOTTEN HARVEST	10	27
Trinity Assembly of God**	8/2/2024	FOOD BANK OF EASTERN MICHIGAN (FBEM)	6	112
Trinity Lutheran Church of Muskegon	8/10/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	4	66
Triumph Church	7/19/2024	FORGOTTEN HARVEST	10	42
Twelve Baskets	8/2/2024	SOUTH MICHIGAN FOOD BANK (SMFB)	8	78
Unify Detroit/Second New Hope	8/13/2024	FORGOTTEN HARVEST	10	23
Urban Neighborhood Initiative*	7/12/2024	GLEANERS COMMUNITY FOOD BANK (GCFB)	10	64
Veterans for USA*	7/25/2024	GREATER LANSING FOOD BANK	5	5
West Michigan Veterans Assistance Program Pantry*	6/24/2024	FEEDING AMERICA WEST MICHIGAN (FAWM)	4	25
Woodside Bible Church	7/22/2024	FORGOTTEN HARVEST	10	47

*Agencies were selected with certainty.

** Agencies with the largest pounds distributed in each prosperity region.

***Only "St. Patrick's Senior Center" is a meal program, and all other agencies are grocery programs.

Table 2. Expected coefficient of variations of estimates of proportions of 0.5 under different levels of the design effect (DEFF)

Sample Size	DEFF=1	DEFF=2	DEFF=3
Sample size=10,000	1.0	1.4	2.0
Sample size=5,000	1.4	2.0	2.5
Sample size=1,000	3.2	4.5	6.3

The design effect (DEFF) is calculated as $1 + \delta (n-1)$ where δ is the interclass correlation for the statistic and n is the average size of the cluster.

Table 3. Binary outcomes: effective and nominal sample sizes needed for testing differences in proportions between 50% assuming 0.8 power and type I error=0.05

Sample Size Needed	4%	6%	10%
Effective completed surveys	2,448	1,086	388
Nominal completed surveys (design effect=2)	4,896	2,172	776
Nominal completed surveys (design effect=2.5)	6,120	2,715	970

Table 4. Continuous outcomes: effective and nominal sample sizes needed for testing effect sizes between 2 groups assuming 0.8 power and type I error=0.05, where effect size = (mean of group 1 - mean of group 2)/standard deviation

Sample Size Needed	0.05	0.5	1
Effective completed surveys	6280	64	17
Nominal completed surveys (design effect=2)	12,560	128	34
Nominal completed surveys (design effect=2.5)	15,700	160	43

Table 5. Nominal and targeted released client survey sample sizes and associated assumptions

Sample Size Number	Adjustment Factors	Percent
Nominal complete surveys 3,000	Client eligibility rate	70
Released sample size for surveys 27,778	Client completion rate	10

Released sample size=nominal surveys/0.07 based on above parameters

Table 6. Pounds of Food distributed per client visit for 218 agencies with Link-2- Feed information by Prosperity region

Prosperity Region	Mean	Max	Min	Median	Std	# of Agencies with Link-2 Feed information
1	60.79	60.79	60.79	60.79		1
2	93.61	148.86	38.36	93.61	78.14	2
3	58.87	118.86	11.77	45.99	54.69	3
4	305.28	608.49	20.03	140.76	240.46	4
5	113.00	113.00	113.00	113.00		1
6	120.79	296.31	30.37	78.46	98.00	7
8	81.67	357.18	0.00	41.27	96.22	23
9	71.10	1107.72	2.83	41.41	146.07	62
10	300.61	1230.67	0.37	30.76	129.33	115

* For agencies in Prosperity region 7, the overall median pounds per client ratio for all 218 agencies were used (38.42 pounds per client)

Table 7. Ratio of duplicate client counts over unduplicated client for 218 agencies with Link-2-Feed information by Prosperity region

Prosperity Region	Mean	Max	Min	Median	Standard Deviation	# of Agencies with Link-2-Feed Information
1	2.35	2.35	2.35	2.35		1
2	2.30	2.82	1.79	2.30	0.73	2
3	2.96	3.45	2.57	2.86	0.45	3
4	3.60	5.12	2.14	2.57	1.36	4
5	1.97	1.97	1.97	1.97		1
6	2.26	3.29	1.79	2.14	0.51	7
8	1.70	3.00	1.02	1.66	0.45	23
9	3.14	8.39	1.00	2.84	1.47	62
10	2.87	7.94	1.00	2.08	3.13	115

* For agencies in Prosperity region 7, the overall median duplicated clients per unduplicated client ratio for all 218 agencies were used (2.21 per unduplicated client)