MARKET DECISIONS RESEARCH

2024 Massachusetts Employer Survey Methods Report

Prepared for :

The Center for Health Information and Analysis

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PROLOGUE

This report outlines the survey methods for the 2024 Massachusetts Employer Survey (MES), detailing the survey design and implementation process. The survey instrument and sampling protocols were largely based on the 2021 survey, with updates including web scraping to identify the person within the firm best able to answer the survey questions and an increased online focus supported by phone recruitment. Survey administration in 2020 and 2021 faced significant challenges due to the COVID-19 pandemic, as companies adapted to remote work and online communication. MDR applied the lessons learned from the 2020 administration to refine data collection methods and improve communication with employers.

Previous administrations relied on survey booklets, mailings, and phone calls to encourage participation. While this approach had been effective for many years, changes in the workplace, such as fewer employees being regularly present in office, required a shift in strategy. MDR adopted an online-focused approach, supported by phone recruitment. Web scraping was used to gather the most accurate and up-to-date contact information. Email invitations and reminders were sent throughout the data collection process, with multiple contacts secured for each company. If no response was received from a contact after a set number of attempts, emails were cycled to other contacts.

Paper versions of the survey and instructions were still available for those who preferred a hard copy. A dedicated website was also developed, offering instructions, an FAQ section, a copy of the survey, and MDR contact information for any technical issues or general inquiries.

BACKGROUND OF THE MASSACHUSETTS EMPLOYER SURVEY

The Massachusetts Employer Survey (MES) is a critical tool for the Center for Health Information Analysis (CHIA) as it provides information that is critical to its mission of monitoring Massachusetts health care and health insurance systems. The survey provides reliable information and meaningful analysis for those seeking to improve health care quality, affordability, access, and outcomes.

The MES was first fielded in 2001 and has been re-administered multiple times since then. The most recent administration took place in 2024. With more than 15 years of data available, the MES provides a unique lens on changes in Massachusetts health insurance markets in both pre- and post-reform periods, including the implementation of the Affordable Care Act (ACA). Throughout this period, the MES has been the primary and most relied upon source of information on employer health insurance in the state. National employer surveys, such as the Medical Expenditure Panel Survey and the KFF Employer Health Benefits Survey historically have not had sample sizes large enough to make reliable estimates for Massachusetts, nor do they address state-specific issues.

THE SURVEY

The 2024 questionnaire was based on previous CHIA survey instruments administered in 2001, 2003, 2005, 2007, 2009, 2010, 2011, 2014, 2016, 2018 and 2021 but was modified to gather more detailed information about health plans and health reimbursement arrangements. Questions related to the COVID-19 pandemic and how this altered the employment landscape were added in 2021 and removed in the 2024 survey. Working in collaboration with CHIA, an initial survey draft was developed and then finalized for the 2024 MES. The core topics of the 2001 to 2021 MES were retained with the following changes implemented prior to 2024 data collection:

- Added clarifying language, used on the EEO-1 form, to define employment types.
- Updated definition of employee to include those who are both physically present at MA locations, as well as those working remotely who are on the payroll at MA locations.
- Removed EMP02 'Do all of your firm's employees work in Massachusetts? Please include any Massachusetts based employees working remotely.'
- Modified language throughout from 'in Massachusetts' to 'Massachusetts-based.'
- Added definition of Massachusetts-based employee.
- Removed EMP03B, 'Approximately what percentage of your full and/or part-time employees in Massachusetts are working remotely?'
- Removed questions related to the COVID-19 pandemic including those that asked about the following.
    - Employment characteristics prior to the pandemic
    - Layoffs or furloughs related to the pandemic
    - Changes in sick leave in response to the pandemic
    - Whether employees left their positions voluntarily
    - Whether there are newly offered or no longer offered benefits as of March 2020
    - Changes to company contributions since March 2020
    - The implementation of any wellness programs to include waived cost for COVID-19 treatment, mental health or substance use treatment, or telehealth.
- Removed questions related to unions, including EMP04, 'Are any of your Massachusetts-based employees unionized?' and EMP05, 'number of full and part-time unionized employees.'
- Added language throughout directing the person completing the survey to human resources or payroll to pull data being asked in the survey if they worked for a large company. For small companies, it was suggested that an executive complete the survey and provide their best estimates.
- Added questions regarding the racial and ethnic composition of the company and whether this information is tracked using the EEO-1 form or through employee self-report.

- Updated salary bands.
- Updated list of benefits offered through an individual coverage HRA.
- Updated the definitions of Individual Coverage Health Reimbursement Arrangements (ICHRA) and Small Business Health Reimbursement Arrangements (QSEHRA)
- Removed BEN07, 'How many hours per week must a part-time employee in Massachusetts work to be eligible for health insurance coverage at your firm?'
- Updated high deductible plan deductible amount to 2024 threshold.
- Removed HCP13, 'Do any of your firm's health plans include a tiered provider network?'
- Removed HCP14, 'Do any of your firm's health plans include a limited provider network?'
- Removed HCP15, 'Do any of your health plans use payment contracts with provider groups that encourage the development of accountable care organizations (ACOs)?'
- Removed HCP17, 'Which of your health plans provide this wellness program?'
- Removed HCP18, 'Does your firm offer an employee wellness program that is not part of a health plan?'
- Added questions related to telemedicine, including whether plans cover services provided through telemedicine and how they are covered.

SAMPLING

Target Population

The target population for the 2024 Massachusetts Employer Survey (MES) consisted of all firms that have three or more employees physically working in Massachusetts or those working remotely with payroll through a Massachusetts location. This included firms headquartered in Massachusetts as well as firms headquartered outside of Massachusetts.

Sampling Methodology Overview

Sampling for the 2024 MES relied on a hybrid sampling methodology combining a probability sample of firms employing three or more workers in Massachusetts with a non-probability sample drawn from a list of firms that responded to the 2021 MES.

Sample Stratification

Stratification was based on the following.

- The number of employees working in Massachusetts (employee size class)
- The type of firm (NAICS sector—North American Industry Classification System)

Sampling was based on six employee size classes and nine NAICS sector groups (either NAICS sectors or combinations of two or more sectors), resulting in 54 sampling strata. The employee size classes and NAICS groups are presented in the following tables.

Table 1 Employee Size Classes

Size Class	Number of Massachusetts Employees
1	3-9
2	10-24
3	25-49
4	50-199
5	200-999
6	1,000 or more

Table 2 NAICS Sector Groups

NAICS Sector Group	NAICS Sector	Type of Firm
1	21	Mining, Quarrying, and Oil and Gas Extraction
1	22	Utilities
1	31-33	Manufacturing
1	48-49	Transportation and Warehousing
2	52	Finance and Insurance
2	53	Real Estate and Rental and Leasing
10	42	Wholesale Trade
3	44-45	Retail Trade
4	23	Construction
5	51	Information
5	54	Professional, Scientific, and Technical Services
5	55	Management of Companies and Enterprises
5	61	Educational Services
7	62	Health Care and Social Assistance

NAICS Sector Group	NAICS Sector	Type of Firm
8	56	Administrative and Support and Waste Management and Remediation Services
8	81	Other Services (except Public Administration)
9	11	Agriculture, Forestry, Fishing and Hunting
9	71	Arts, Entertainment, and Recreation
9	72	Accommodation and Food Services
97	99	Industries not classified

Source of the Sample

Two data sources were used to provide the sample for the 2024 MES.

- A probability sample provided by Marketing Systems Group (MSG) drawn from the April 2024 Dun and Bradstreet (D&B) database of firms
- A non-probability panel sample provided by MA CHIA including firms responding to the 2021 Massachusetts Employer Survey

Probability Sample

Using the D&B database, MSG pulled a custom dataset based on total aggregate employees within the state of Massachusetts. MSG pulled all marketable records that have a physical address within the state of MA. We excluded records with a primary SIC code of 43: USPS, and 91-97: Government entities.

Each record has a DUNS number, which is a nine-digit, non-indicative identification number assigned by D&B to all business establishments in the D&B information base. Each record also has an Ultimate DUNS, representing the highest-ranking family member to that DUNS number within the United States. Therefore, the base records are the "children" of the Ultimate DUNS, the "parent". It is from these "children" that the aggregate employee size is derived.

We output the unique DUNS ("children") of every business within the state of MA and rolled up the "at location" employee size of all of the "children" that share that same Ultimate DUNS ("parent") within the state. This then becomes the custom aggregate employee size for each Ultimate DUNS. This process only applies to records with a family linkage. Head Quarter non-subsidiary and Single Site non-subsidiary locations have a blank Ultimate DUNS, as their DUNS number is the Ultimate.

Using the custom MA aggregate employee size for each Ultimate DUNS for stratification, MSG places each unique Ultimate DUNS within the employee size categories defined by Market Decisions Research (MDR). The output record is the "parent" location of the Ultimate DUNS

regardless of geography. For example, if the top linkage to a record in MA is the "parent" location in CA, the location in CA is the output.

The NAICS sector code is appended to each parent record allowing the sample to be grouped by firm type.

The final probability sample file included DUNS number, the firm name, address, telephone number, a contact person (if available) along with company characteristics, including total number of employees, employees in Massachusetts, NAICS code, and location of firm headquarters.

The Panel Sample of Prior MES Participants

Firms that responded to the 2021 MES (1,093), regardless of survey completion, were also included in the sample. To avoid duplicate records, the panel sample was deduplicated against the probability sample. In addition, the panel sample was provided to MSG to append updated firm information. If a firm from the panel sample was also drawn as a part of the probability sample, it was considered a part of the probability sample.

Sample Generated

The final sample file for the 2024 MES included 14,286 records from the probability sample and panel of prior MES participants.

The sample was drawn from the same sample used for the short and long survey but excluded sample records in the following instances.

- A firm was no longer in business
- A firm did not have three or more employees in Massachusetts
- The phone number was non-working or disconnected (and another could not be identified)

Table 3 summarizes the population distribution and sample allocation for the 2024 MES. Population figures were provided by MSG.

Table 3 2024 MES Population (Firms) Distribution and Sample Allocation

Number of Massachusetts Employees	Population Size	Panel Sample Size	Non-Panel Sample Size	Total Sample Size
3-9	47,022	210	3,708	3,918
10-24	18,378	177	2,953	3,130
25-49	6,606	198	2,886	3,084

Number of Massachusetts Employees	Population Size	Panel Sample Size	Non-Panel Sample Size	Total Sample Size
50-199	5,360	248	2,430	2,678
200-999	1,547	206	984	1,190
1,000 or more	375	54	232	286
Total	**79,287**	**1,093**	**13,193**	**14,286**

Identifying Contact Person to Provide Information on Health Benefits

One of the challenges in conducting the 2024 MES was identifying the appropriate contact person within the firm who is knowledgeable about the health plan offerings of the firm. As part of the sample generation process, MDR worked with MSG and the firm Dunhill International to obtain contact information for staff members that were most likely to be able to provide the information asked in the MES. The combined sample with both the probability sample and panel sample was sent to both firms for contact lookups. The process to identify contacts follows.

- First, MDR reviewed a list of available job and personnel titles to identify those most likely to be associated with providing health benefits to employees.
- MSG then searched based on these titles and appended any identified contact information to each sample record. This included, when available, a contact name, contact phone number, and/or a contact email.
- MDR then provided the sample file to Dunhill International along with the list of job titles. Dunhill International conducted a search and appended any identified contact information to each sample record. This included, when available, a contact name, contact phone number, and/or a contact email.
- If available, up to six contacts were appended to a sample record.

Web Scraping

MDR worked closely with Morris Davis and Company (MDavis) to develop and run automated custom web scripts to extract contact information from company websites, focusing on individuals knowledgeable about the company's health insurance offerings. Web scraping was employed to efficiently gather contact information for sampled firms. This method was chosen to supplement traditional data sources and ensure a comprehensive outreach to firms of various sizes and sectors. The web scraping process involved the following key steps.

1. MDR provided MDavis an initial file with company name, address, phone number and any contact information identified by MDR's sampling firm, MSG.

2. MDavis identified relevant sources of firm information, including websites and LinkedIn. These sites provided essential details such as names, contact emails, phone numbers, and addresses.
   - The script was designed to look for contact information for people with the following titles within sampled firms with no reliable contact information. Larger firms included these titles:
     - Health Benefits Manager/Director
     - HR Manager/Director
     - Compensation and Benefits Specialist
     - Employee Relations Manager
     - Wellness Program Coordinator
     - Chief Financial Officer (CFO)
     - Chief Human Resources Officer (CHRO)
     - Corporate Communications Manager
     - Insurance and Risk Manager
     - Employee Health and Safety Officer
     - Director of Total Rewards
     - HR Generalist
     - VP of Human Resources
     - Labor Relations Manager
     - Health and Welfare Benefits Analyst
     - Occupational Health Manager
     - Human Capital Management Director
     - Director of Benefits Administration
     - Senior Manager, Employee Benefits
     - Director of HR Operations
     - Compensation Analyst
     - Employee Engagement Specialist
     - Chief Benefits Officer
     - VP of Employee Experience
   - Others identified through initial search of titles

   Smaller firms included the following:

     - Owner
     - President
     - Human Resources Director/Manager
   - Others identified through initial search of titles

3. The extracted data underwent a rigorous cleaning process to remove duplicates, standardize formats, and verify accuracy.

4. The web scraping activities adhered to the terms of service of the websites, and only publicly available data was collected. No personal or proprietary information was harvested.
5. The cleaned and validated contact information was integrated into our survey administration system, enabling MDR to distribute invitations and reminders to firm representatives via email. This approach optimized survey response rates and minimized coverage bias by ensuring a more extensive and accurate firm outreach.

DATA COLLECTION

Summary of Data Collection Modes

The 2024 MES relied on a multi-mode data collection strategy that included the following.

- Survey invitations sent by email
- Recruiting firms to participate by telephone
- Survey invitations sent by mail to a small subset of the sample

The strategy used varied based on the type of information that was available in the sample. Once determined, the strategy was then adapted based on target goals for the number of completed surveys overall and within Massachusetts employee size classes.

Data Collection Process

Data collection for the 2024 MES survey began on April 9, 2024, and was completed on September 6, 2024. Table 4 summarizes the data collection activities for the survey, which included the following:

- 39,247 recruitment and reminder phone calls
- 47,602 email invitations and reminders
- 53 survey invitation letters and booklets to firms who may have provided incorrect information on the online survey

Data collection relied on three modes of communication: telephone calls, mailed survey invitation letters, and email invitations and reminders. The methods were used concurrently throughout data collection to maximize the opportunity to speak with a person at the firm and elicit participation in the survey.

Telephone Outreach. Telephone calls began on April 18, 2024, with the last call attempt made on June 28, 2024. The purpose of the telephone outreach was to verify that the firm was eligible to participate in the survey, identify the correct person within the firm to participate in the survey, and elicit the participation of the appropriate contact. Data collection calls were made by trained interviewers at our partner, MDavis. Telephone numbers (up to eleven per firm) were included in the sample and were identified by MSG. If a telephone number was

determined to be non-working, additional attempts were made to other phone numbers identified for the firm. In cases where a successful call did not reach the appropriate contact to provide the survey information, interviewers attempted to identify the appropriate contact and obtain a direct telephone number to be used in later call attempts. Once the appropriate contact was identified and agreed to participate, the contact's direct phone number and email were recorded, and an email invitation was sent. Email reminders and reminder telephone calls were made to non-responders. On average, 2.8 call attempts were made to respondents included in the sample file.

Email Invitations and Outreach. Email invitations were sent beginning on April 9, 2024, with the last reminder sent July 16, 2024. Email contacts were used throughout data collection to send initial survey invitations, to send email reminders following an initial email invitation, to send an invitation to a contact identified during telephone outreach, and to follow-up with non-responders. Emails were distributed on a rolling basis with new batches sent as the web scraping program found the appropriate email contacts. The email included a link to the online survey and a personalized ID number to access the survey. An initial email invitation was sent to 10,157 firms for which an email was identified during the web scraping process and preparation of the sample. These emails were identified by MSG and Dunhill International. Following this initial email, two reminder emails were sent to non-responders approximately one week apart and then reminders were paused. Once a firm agreed to participate, the email of the respondent was collected, and email reminders were sent weekly. Additional emails were sent to those who opened the survey link, but did not complete the survey and larger firms that had not responded by the end of data collection.

Mail Outreach. Additional mail outreach was done for 57 firms who completed the survey online, but for whom the information provided appeared potentially inconsistent. The mailing consisted of a letter, survey booklet, and instructions. The mailing was sent on August 29, 2024. The letter explained why they were being contacted and the concerns that their firm provided inconsistent information to CHIA. The letter provided the link to the survey along with a unique ID number to access the survey. The letter also indicated respondents would receive an incentive for completing the survey.

Table 4 Data Collection Activities for the 2024 MES Survey

Action	Total Contact Attempts by Month			
	April	May	June	July
Telephone Outreach	39,255	-	-	-
Email Outreach	23,093	44,120	141,535	97,942

Action	Total Contact Attempts by Month			
	April	**May**	**June**	**July**
Survey booklet sent to firms who may have provided inaccurate information	-	-	-	49
Mail survey requests	-	-	1	-
Total	**62,340**	**44,120**	**141,536**	**97,991**

SURVEY RESPONSE

Summary

A total of 1,066 surveys were considered complete cases and retained for final analysis. Surveys were considered complete if they provided responses at least through the health plan characteristics section. On average the survey took 41 minutes to complete.

Table 5 Firms Completing the Survey by NAICS Sector Group and Massachusetts Employer Size Class

CHIA MES 2024 Survey	Massachusetts Employer Size Class						
NAICS Sector Group	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	Total
Manufacturing, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Transportation and Warehousing	24	36	31	43	10	4	**149**
Finance and Insurance, Real Estate and Rental and Leasing	11	12	14	14	9	5	**65**
Retail Trade	18	12	18	15	8	1	**72**
Construction	16	20	17	15	6	1	**75**
Professional, Scientific, Technical Services, Information, Educational, Management of Companies and Enterprises	48	55	44	76	27	5	**255**
Health Care and Social Assistance	23	28	32	43	53	16	**195**
Other Services (except Public Administration), Administrative and Support and Waste Management and Remediation Services	24	30	18	30	15	4	**121**

CHIA MES 2024 Survey	Massachusetts Employer Size Class						
NAICS Sector Group	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	Total
Accommodation and Food Services; Arts, Entertainment and Recreation; Agriculture, Forestry; Fishing and Hunting	12	11	16	14	9	0	**62**
Wholesale Trade	8	21	13	22	8	1	**73**
Total	**184**	**225**	**203**	**272**	**145**	**37**	**1,066**

Response Rate

All 1,066 completes were completed online with a survey completion rate of 55%. The survey completion rate is the percentage of individuals who completed the survey out of the total number of individuals who accessed it.

The survey response rate was 8% (AAPOR Response Rate 3). Table 6 summarizes response rates by sampling strata.

Table 6 Response Rates by Strata MES 2024 Survey

	Massachusetts Employer Size Class						
NAICS Sector Group	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	Total
Manufacturing, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Transportation and Warehousing	11%	12%	6%	9%	6%	10%	9%
Finance and Insurance, Real Estate and Rental and Leasing	4%	6%	7%	7%	7%	13%	6%
Retail Trade	5%	4%	7%	7%	10%	4%	6%
Construction	6%	9%	7%	10%	14%	20%	8%
Professional, Scientific, Technical Services, Information, Educational, Management of Companies and Enterprises	9%	10%	8%	14%	10%	10%	10%
Health Care and Social Assistance	4%	9%	11%	14%	28%	27%	12%
Other Services (except Public Administration), Administrative and Support	4%	8%	6%	13%	14%	17%	8%

NAICS Sector Group	Massachusetts Employer Size Class						Total
	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	
and Waste Management and Remediation Services							
Accommodation and Food Services, Arts, Entertainment, and Recreation, Agriculture, Forestry, Fishing and Hunting	3%	2%	4%	5%	10%	0%	4%
Wholesale Trade	8%	13%	6%	13%	16%	17%	10%
Total	6%	8%	7%	11%	13%	14%	8%

A total of 39,255 screening and recruiting telephone calls were made to firms. Table 7 summarizes case dispositions of these calls.

Table 7 Call Outcome Final Dispositions (Phone Outreach)

Final Phone Disposition	Count
Call completed	1,135
No contact/No answer	4,291
Hang-up	2,370
Answering Machine	1,836
Operator Intercept	1,284
Ineligible	1,059
Wrong number	510
Hard refusal	254
Callback	218
Soft refusal	129
Do Not Call List	122
Busy	97
Language Barrier	42
No Ring	13
Other	926

Final Phone Disposition	Count
Total	**14,286**

Table 8 Final Survey Dispositions (Online Outreach)

Final Phone Disposition	Count
Completed	1,066
Drop-Outs	469
Screened Out (ineligible)	399
Other	63
Total	**1,934**

DATA FILE PREPARATION

Survey Data Collection Protocols for Data Verification and Quality Checks

To ensure the accuracy of the data, MDR conducted data consistency checks on files as part of the data file preparation for analysis. Initial data quality checks were pre-programmed into the survey to minimize the need for post-survey data corrections.

Once data collection was complete, MDR undertook a series of data verification and consistency checks including missing values and outlier analysis. In cases where missing values or outliers were identified, the values were imputed, or cases were excluded. MDR reached out to firms in cases where the data looked internally inconsistent to confirm the accuracy of the information provided.

Data Consistency Checks

MDR conducted analysis using contingency tables to evaluate survey responses to ensure that responses were in an acceptable range and that responses were correct based on survey skip patterns. These checks are listed below.

- Verifying the total number of Massachusetts full-time employees does not exceed the total number of full-time employees for the firm.
- Verifying the total number of Massachusetts part- time employees does not exceed the total number of part-time employees for the firm.
- The sum of counts reported for the three age categories for the age distribution of employees equals the total number of Massachusetts employees.
- The sum of counts reported for the three income categories for the income distribution of employees equals the total number of Massachusetts employees.

- The total number of full-time employees eligible for health insurance does not exceed the total number of full-time Massachusetts employees.
- The total number of part-time employees eligible for health insurance does not exceed the total number of part-time Massachusetts employees (if this is offered as a benefit to part-time employees).
- The total number of full-time employees enrolled in health insurance does not exceed the total number of full-time employees eligible for health insurance.
- The total number of part-time employees enrolled in health insurance does not exceed the total number of part-time employees eligible for health insurance.
- If a plan is identified as a high deductible plan, the respondent was asked whether the plan includes a health reimbursement arrangement or a health savings account.
- If a plan has a health reimbursement arrangement that the respondent provided a value for the employer contribution.
- If a plan has a health savings account that the respondent provided a value for the employer contribution.
- That questions regarding the Health Connector are asked of firms with 50 or fewer Massachusetts employees.
- That firms that do not offer health insurance answer the sequence of questions for those firms that do not offer health insurance and that they do not provide responses for sections asking about health plan characteristics, enrollment, or cost sharing.

Identification of Missing Values

MDR conducted analysis to identify any missing data on key study variables including:

- Demographic distribution of employees (age and income distribution)
- Benefits offered to employees
- Number of employees eligible for health insurance
- Number of employees enrolled in health insurance
- Number of plans offered
- Types of plans offered
- Plan deductible
- Plan out of pocket limits
- Plan premiums
- Health reimbursement account and health savings account features
- Plan features like self-funding
- Plan enrollment numbers by coverage (employee only, employee plus spouse, etc.)
- Plan co-pays and co-insurance
- Health care decision making
- Health Connector information
- Reasons for not offering insurance (among firms not offering traditional group insurance)

The missing values analysis flagged any missing data, which was then imputed.

Data Imputation

Data imputation is a procedure that determines the likely value of a missing case based upon other known characteristics of the respondent. Imputation relies on answers to other questions to derive the most likely value for the missing response. MDR imputed missing cases on several of the variables in this research. In those cases where a variable was imputed, the final dataset contained a copy of the variable with imputed values, a copy of the original variable with missing values retained, and a flag variable which identifies which values were imputed and the method used. Our research staff used three primary methods of data imputation:

Logical Imputation

This step involves an assessment of answers to other questions (within the case) to determine if it is possible to deduce what is likely the correct answer to a question with a missing value. In some cases, this is done by evaluating a question that is very similar in nature and content. In other cases, it involves assessing several related questions to derive the most likely value. For example, one may be able to deduce a missing plan deductible by examining the plan maximum out-of-pocket.

Donor Substitution Imputation—Hot Deck Imputation

Hot deck imputation relies on the fact that firms or health plans with similarities on several variables are likely to be similar on those variables with missing values. The process involves identifying a case (a donor) that is similar to the case on a number of variables besides the variable that is missing. Hot deck imputation is used on variables where there is a relatively limited number of possible values.

K-Nearest Neighbor (kNN) Imputation

A popular approach to missing data imputation is to use a statistical model to predict the missing values. K-Nearest Neighbor (kNN) imputation is a form of hot deck imputation that uses kNN analysis to identify donor cases that are then used to predict missing value estimation. The configuration of kNN imputation often involves selecting the distance measure (e.g. Euclidean) and the number of contributing neighbors for each prediction, the k hyperparameter of the kNN algorithm. A missing case is imputed by finding the samples in the data set "closest" to it and averages these nearby points to fill in the missing value.

Table 9 Variable used as predictors in kNN models

Variable	Label
NAICSGROUP	NAICS Sector for sampling

Variable	Label
NAICSSECTOR	NAICS Sector Code
USEMP	How many employees does your firm employ nationally in the United States?
EMP03_FTMA	How many full-time employees work for your firm in Massachusetts?
EMP03_PTMA	How many part-time employees work for your firm in Massachusetts?
MATOTAL	Total number of Massachusetts employees
EMP06_A1	How many of your firm's Massachusetts employees are in each age group? - Under age 26
EMP06_A2	How many of your firm's Massachusetts employees are in each age group? - 26 - 49
EMP06_A3	How many of your firm's Massachusetts employees are in each age group? - 50 and older
EMP07_A1	How many of your Massachusetts employees earn - Less than $17 per hour ($34,820 per year)
EMP07_A2	How many of your Massachusetts employees earn - Between $17 and $42 per hour ($34,821 to $86,510 per year)
EMP07_A3	How many of your Massachusetts employees earn - $42 or more per hour ($86,511 or more per year)
BEN01C1	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Dental insurance
BEN01C2	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Vision plan
BEN01C3	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Pre-tax flexible spending account for uncovered health expenses (Section 125 FSAs)
BEN01C4	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Disability insurance (short or long term)
BEN01C5	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Life insurance
BEN01C6	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Company-sponsored retirement plan including 401K, Simple IRA, or a pension
BEN01C7	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Wellness programs for employees (either company-provided or provided as a part of health benefits coverage)
BEN01C8	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Reimbursement for child care
BEN01C9	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Student loan repayment programs

Variable	Label
BEN01C10	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - Employee Assistance Programs
BEN01C11	Do you offer the following benefits to any of your full- or part-time Massachusetts-based employees? - None of the above
INDHRAINTRO	Do you offer an ICHRA or QSEHRA to any of your employees?
BEN02	Does your firm offer health insurance to any employees in Massachusetts?
BEN03_1	Do you offer coverage to any of the following, in addition to offering coverage to your Massachusetts employees? - Coverage for the employee
BEN03_2	Do you offer coverage to any of the following, in addition to offering coverage to your Massachusetts employees? - Coverage for the employee plus spouse
BEN03_3	Do you offer coverage to any of the following, in addition to offering coverage to your Massachusetts employees? - Coverage for the employee and dependent children
BEN03_4	Do you offer coverage to any of the following, in addition to offering coverage to your Massachusetts employees? - Coverage for the employee, spouse, and dependent children
BEN04A	If an employee's spouse is offered health insurance from their employer or another source, is the spouse still able to enroll in your firm's plan?
BEN05A	If a spouse is offered health insurance from another source, are they required to contribute more than other spouses, such as higher premiums or higher cost-sharing?
BEN03B_A1	Does your firm offer health insurance coverage to UNMARRIED domestic partners? - Same sex domestic partner
BEN03B_A2	Does your firm offer health insurance coverage to UNMARRIED domestic partners? - Opposite sex domestic partner
BEN04B	If an employee's domestic partner is offered health insurance from their employer or another source, is the domestic partner still able to enroll in your firm's plan?
BEN05B	If a domestic partner is offered health insurance from another source, are they required to contribute more than other domestic partners, such as higher premiums or higher cost-sharing?
BEN06	Are any of your firm's part-time employees in Massachusetts eligible for health benefits?
BEN08_FTELIG	How many of your Massachusetts full-time employees are eligible for health insurance offered by your firm?
BEN08_PTELIG	How many of your Massachusetts part-time employees are eligible for health insurance offered by your firm?
BEN09_FTENROL	How many full-time employees are enrolled in your firm's health plans?
BEN09_PTENROL	How many part-time employees are enrolled in your firm's health plans?

Variable	Label
BEN10	If an employee turns down health insurance offered by your firm, does that employee receive money or other compensation?

Outlier Analysis

It is important to note that imputed outlier cases did not have meaningful impact on the distribution of the imputed variables.

This careful scrutiny ensured the accuracy and reliability of the final dataset, addressing any potential inconsistencies in firm-reported health insurance practices.

Data Weighting

The purpose of weighting is to produce population estimates for the target population with a known level of precision. Weighting factors in the sampling design (probabilities of selection), the results of data collection (patterns of non-response), and alignment of the data with the actual population based on the population's known characteristics (post design weighting adjustments). The data includes several types of populations for which weights were calculated.

1. **The first is the firm.** Data was collected from a sample of firms on a range of topics related to health care coverage.
   - **The second is the employee.** The data is used to estimate various characteristics of Massachusetts employees such as the percentage of employees offered insurance and the percentage of eligible employees who enrolled in one of a firm's offered health plans. This required a weight related to the number of Massachusetts employees
2. **The final is the health plan.** A firm may offer more than one type of health plan to its employees. Analysis is used to understand the characteristics of the health plans offered by Massachusetts employers requiring a weight relative to the number of health plans offered by each firm.

The process of weighting is designed to allow analysis of survey data at each of three different population levels. The weights also build upon one another. The firm-level weight is the basis used in calculating plan-level and employee-level weights.

Data Sources Used in Weighting

Weighting relies on a source that can provide an accurate estimate of the population to which survey results are compared and normalized. It is important to note that there was not one definitive source of data that provided the necessary population counts. Instead, weighting relied on two primary sources.

- The US Census Bureau's County Business Patterns (2021)
- D&B's Database of US firms (2024)

US Census Bureau County Business Patterns

2021 County Business Patterns (CBP) data, the most recent available at the time of survey data post-processing, was provided by the US Census Bureau. CBP data provides information about the number of establishments, firms, and employees by employee size class and NAICS code for the US and for individual states. The publicly available data did not meet the needs of the project since it includes all employees (while the MES focuses on firms with three or more employees). To obtain data in a form appropriate for weighting, MDR made a special data request to provide firm and employee counts broken out by employee size class relevant to the target population and to align with sampling. This analysis was conducted by staff of the US Census Bureau, which provided counts of firms. Establishments, employees by employee size class and NAICS codes were based on 2021 data.

Dun and Bradstreet Database of firms

Dun and Bradstreet (D&B) maintains a commercial list of firms in the United States that includes characteristics including their NAICS code and number of employees. This list of firms was used to develop the sample of Massachusetts firms used during data collection.

Compared to CBP data, the advantage of D&B is its recency because its counts reflect 2024 data. The weakness of the D&B database and why it is not appropriate for population estimates is that it may not include recently created firms and may retain firms that are no longer in business. While not providing an accurate population estimate of the number of firms, it provides a way to assess the distribution of firms.

FIRM-LEVEL WEIGHTS

Design Weights

An initial base weight was calculated for each record included as part of the sample used during data collection. The initial base weight was computed as the total number of firms in the population (contained within the D&B database) divided by the number of firms in the sample file within each sampling strata. All records within a stratum had the same base weight but base weights differed across sampling stratum. At this stage all sample records within the sample file had a positive weight (regardless of the outcome of data collection). A non-response adjustment was then applied to all sample records which was equal to:

- 0 if the sampled firm did not complete the survey
- 0 if the sampled firm was determined to be ineligible (fewer than three employees)
- 0 if the sampled firm was no longer in business

- 0 if the sampled firm was acquired by another firm
- N/r if the sampled firm was eligible and completed the survey with r equal to the response rate within the stratum to which the firm belonged

At this stage, all firms that completed the survey had a positive design weight while firms that did not complete the survey had a weight of zero. Again, design weights were equal within sampling strata.

At this stage, the weighted data only reflected the distribution of firms that completed the survey and did not reflect the actual distribution of firms within Massachusetts by employee size class and NAICS sector Group.

Post Design Weighting Adjustments

A weighting adjustment was then made to normalize the weighted firm-level data to reflect the actual distribution of firms in Massachusetts by employee size class and NAICS sector group.

The population data for the post design weighting adjustments were provided by the US Census Bureau, developed from the 2021 CBP data. This data provided a breakdown of firms by NAICS sector groups by size class based on the total number of US employees at these firms.

The cells used in weighing adjustments are presented in Table 13 and match survey sampling strata.

Table 10 Post-Stratification Weighting Adjustment Cells

NAICS Sector Group	Employee Size Class (Number of Employees in Massachusetts)					
	3 - 9	10 - 24	25 - 49	50 - 199	200 - 999	1000+
Manufacturing, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Transportation and Warehousing	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell
Finance and Insurance, Real Estate and Rental and Leasing	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell
Retail Trade	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell
Wholesale Trade	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell
Construction	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell	Weighting cell

NAICS Sector Group	Employee Size Class (Number of Employees in Massachusetts)					
	3 - 9	10 - 24	25 - 49	50 - 199	200 - 999	1000+
Professional, Scientific, and Technical Services, Information, Educational Services	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*
Health Care and Social Assistance	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*
Other Services (except Public Administration), Administrative and Support and Waste Management and Remediation Services	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*
Accommodation and Food Services, Arts, Entertainment, and Recreation	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*	*Weighting cell*

The tables on the following pages present the estimated population counts of firms by NAICS sector group and the Massachusetts employee size class used in making the weighting adjustments. The tables also show the distribution of firms that completed the survey by Massachusetts employee size class and NAICS sector group.

Table 11 Estimated Number of Massachusetts Firms by NAICS Sector Group and Massachusetts Employer Size Class

NAICS Sector Group	Massachusetts Employer Size Class						
	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	Total
Manufacturing, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Transportation and Warehousing	3,101	1,914	1,073	960	233	62	7,343
Finance and Insurance, Real Estate and Rental and Leasing	3,660	1,298	445	437	137	63	6,040
Retail Trade	4,966	1,792	536	409	96	29	7,829
Construction	1,539	976	443	353	66	10	3,387
Professional, Scientific, Technical Services, Information, Educational, Management of Companies and Enterprises	3,472	1,458	523	320	52	6	5,831
Health Care and Social Assistance	8,134	3,489	1,354	1,249	502	88	14,815

NAICS Sector Group	Massachusetts Employer Size Class						Total
	3 to 9	10 to 24	25 to 49	50 to 199	200 to 999	1000 or more	
Other Services (except Public Administration), Administrative and Support and Waste Management and Remediation Services	7,781	1,897	648	619	217	64	11,225
Accommodation and Food Services, Arts, Entertainment, and Recreation, Agriculture, Forestry, Fishing and Hunting	8,285	2,208	691	453	135	30	11,801
Wholesale Trade	6,085	3,347	892	560	108	24	11,016
Total	47,022	18,378	6,606	5,360	1,547	375	79,288

Table 12 Distribution of Completed Surveys by NAICS Sector Group and Massachusetts Employee Size Class

NAICS Sector Group	Estimated Percent of Massachusetts Firms	% Within CHIA MES 2024
Manufacturing, Mining, Quarrying, and Oil and Gas Extraction, Utilities, Transportation and Warehousing	9%	14%
Finance and Insurance, Real Estate and Rental and Leasing	8%	6%
Retail Trade	10%	7%
Construction	4%	7%
Professional, Scientific, Technical Services, Information, Educational, Management of Companies and Enterprises	7%	24%
Health Care and Social Assistance	19%	18%
Other Services (except Public Administration), Administrative and Support and Waste Management and Remediation Services	14%	11%
Accommodation and Food Services, Arts, Entertainment, and Recreation, Agriculture, Forestry, Fishing and Hunting	15%	6%
Wholesale Trade	14%	7%
Massachusetts Employer Size		
3 to 9	59%	17%
10 to 24	23%	21%
25 to 49	7%	19%

NAICS Sector Group	Estimated Percent of Massachusetts Firms	% Within CHIA MES 2024
50 to 199	7%	26%
200 to 999	1%	14%
1000 or more	<1%	4%

This weighting adjustment was equal to the estimated population of firms divided by the weighted survey count of firms within each NAICS sector group by Massachusetts employee size class group. The design weight was multiplied by this adjustment to arrive at the final firm weight. Where there were instances where a specific weighting cell was empty, a final weighting adjustment was made to normalize the number of firms within a Massachusetts size class with empty weighting cells to the total number of firms within the class.

By using the final firm weight in analysis, the survey data now accurately reflects the estimated population of Massachusetts private sector firms with three or more employees.

EMPLOYEE-LEVEL WEIGHTS

Defining Employee Population Counts

The population estimates used in weighting the data set to the total number of Massachusetts employees were computed using the 2021 CBP. The 2021 data was used to estimate the population count of private sector Massachusetts employees and was calculated for each NAICS sector group by Massachusetts employee size class strata. The weights are based on 3,109,099 employees in Massachusetts working for private firms with three or more employees.

Calculating the Employee-Level Weights

Prior to calculating the employee-level weight, it was necessary to transpose the file. Rather than the data file containing one record for each firm, a new file was created where there was one record for each employee. A set of variables was then used to define the characteristics of each employee (whether they were full- or part-time, eligible for health insurance through the firm, and enrolled in health insurance through the firm). Firm-level variables were appended to each record including the final firm weight in this data set.

The data was weighted by the final firm weight and survey counts of employees obtained within each Massachusetts employee size class by NAICS sector group. The employee-level weighting adjustment was equal to the estimated population of Massachusetts employees divided by the weighted survey count of employees within each NAICS sector group by Massachusetts employee size class group. The final firm weight was multiplied by this adjustment to calculate the final employee-level weight. When a specific weighting cell was

empty, a final weighting adjustment was made to normalize the number of employees within a Massachusetts size class with empty weighting cells to the total number of employees within the class.

By using the final employee-level weight in analysis, the survey data now accurately reflects the estimated population of Massachusetts employees working in firms with three or more employees.

Plan-Level Weights

The plan-level weight is equivalent to the firm-level weight. This weight is appended to each record in the plan-level file based on their number of plans. Firms that do not offer a plan are not included in that file.

DATA SETS

Survey Data Files Structure

The data from the survey was used to develop a set of data files to allow analysis at the firm, plan, and employee level.

Firm level: To analyze the data at the firm level based on the population of all Massachusetts firms with three or more employees. In firm-level files, each firm is a separate data record.

Plan Level: To analyze the data based on all health plans offered by Massachusetts firms. In plan-level files, every plan offered by surveyed firms is a separate record. In this file a firm may be represented in one to five records.

Employee Level: To analyze the data based on the population of all Massachusetts employees in the private sector working for firms with three or more employees. In this file a record was created for each employee. A set of flag variables was created to identify employees and denote their characteristics (coded as 0 or 1). The characteristics are:

- Was employee a full-time employee?
- Was employee a part-time employee?
- Was employee eligible for health insurance coverage?
- Was employee a full-time employee eligible for health insurance coverage?
- Was employee a part-time employee eligible for health insurance coverage?
- Was employee enrolled in health insurance coverage?
- Was employee a full-time employee enrolled in health insurance coverage?
- Was employee a part-time employee enrolled in health insurance coverage?