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# Monitoring the Future Longitudinal Panel Study mortality data 1976–2021 report (Updated March 2026)

Bohyun J. Jang
Yvonne M. Terry-McElrath
Virginia B. Laetz
Megan E. Patrick
Richard A. Miech

50 YEARS
1974–2024

# MONITORING THE FUTURE LONGITUDINAL PANEL STUDY MORTALITY DATA & WEIGHTS FOR COHORTS 1976–2019 (UPDATED MARCH 2026)

*by:*

**Bohyun J. Jang, Ph.D.**

**Yvonne M. Terry McElrath, M.S.A.**

**Virginia D. Laetz, M.S.**

**Megan E. Patrick, Ph.D.**

**Richard A. Miech, Ph.D.**

**University of Michigan**
**Institute for Social Research**

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# SECTION 1 - Overview of the MTF Longitudinal Panel Study Mortality Data and Weights

The Monitoring the Future (MTF) Longitudinal Panel study, which began in 1976, is a primary source of national data on historical, developmental, and cohort-related changes in substance use and other health behaviors and attitudes (Patrick et al., 2025). Since 1976, MTF has enrolled ~2,450 individuals each year at modal age (hereafter referred to simply as "age") 18 from its nationally representative annual sample of 12th graders (Miech et al., 2025) into the MTF Longitudinal Panel Study (Patrick et al., 2025). These panel members are randomly assigned to begin their surveys one or two years after high school and followed up every other year in young adulthood (i.e., ages 19/20 to 29/30), and then every five years thereafter throughout adulthood (currently ages 35, 40, 45, 50, 55, 60, and 65). As of the 2025 data collection, the MTF Longitudinal Panel Study includes about 120,000 individuals up to age 65 who were first surveyed in 12th grade in 1976–2024. A primary goal of the MTF Longitudinal Panel Study is to examine potential consequences of substance use across the life course, including mortality. Therefore, the MTF Longitudinal Panel Study now includes mortality measures (dates of death, as well as place and cause or causes of death where available).

This report describes the mortality data available for the 1976–2019 cohorts of the MTF Longitudinal Panel study. The mortality data have been obtained from either a) information linked to the National Death Index (NDI), or b) information through the MTF tracking process. Section 2 of this report describes the process of linking the MTF Longitudinal Panel participants (cohorts 1976–2019) to the NDI, methods used to identify the correct NDI record for MTF participants and the procedure to code NDI records for use. Section 3 briefly reviews the MTF tracking process (where Accurint and obituary information is obtained), and provides a comparison with national death rates for the same age groups. Section 4 introduces the MTF Longitudinal Panel Eligibility and Sampling Weight (PESW) that should be used with the mortality data. Section 5 and Section 6 provide a summary of the *MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026)* file and its use (including weights) with survey data from the MTF Longitudinal Panel Study.

# SECTION 2 - Protocol of NDI Submission and Coding for Cohorts 1976–2019

## 2-1. NDI pilot submission: Cohorts 1976 and 2006

We first conducted a pilot project to test the feasibility of matching MTF Longitudinal Panel data to the NDI. Importantly, the matching process for MTF data must be able to work successfully without some of the key identity information typically used for the NDI matching process such as respondents' social security numbers (SSN) and exact birth dates, which MTF does not collect.[1]

In 2019–2021, the MTF team completed a pilot NDI submission using cases from the cohorts of 1976 and 2006. Records of 2,244 respondents from the 1976 cohort and 2,439 respondents from the 2006 cohort were submitted to NDI. These numbers were different than the sample sizes in Tables 3-3 and 3-4 because the MTF team had cleaned several ineligible cases over the course of data management. The pilot submission included first, middle, and last name, as well as month and year of birth.

From the pilot submission, we received 3,877 possible NDI record matches for 951 respondents from the 1976 cohort and 430 possible matches for 298 respondents from the 2006 cohort. To sort true matches from false matches of NDI records to MTF Longitudinal Panel respondents, two trained coders reviewed randomly selected sets of 100 respondents that had one or more death certificates matched to their name and date of birth information. This first review process included rigorous tests using valid and reliable data sources (e.g., Accurint,[2] obituaries) to develop a full set of NDI coding procedures. Using developed coding procedures, two coders again reviewed each case with at least one possible NDI match. An MTF supervisor worked with coders to decide and document how to review cases, including interpreting and coding the search results. This iterative process is documented in *MTF-NDI Coding Decision Rules* (Appendix A).

Using the coding decision rules, 100 MTF Longitudinal Panel respondents were confirmed deceased with a valid NDI match (i.e., death certificate): 82 respondents from the 1976 cohort and 18 respondents from the 2006 cohort. The pilot protocol is visually depicted in Figure 2-1.

[1] Usually, a record is deemed as a possible match if a particular NDI death record satisfies at least one of seven conditions or matching criteria: 1) SSN; 2) exact month and +/-1 year of birth, first and last name; 3) exact month and +/-1 year of birth, first and middle initials, last name; 4) exact month and day of birth, first and last name; 5) exact month and year of birth, first name, father's surname; 6) exact month and year of birth, first name, last name, and father's surname; and 7) if the subject is female, exact month and year of birth, first name, last name (on user's record), and father's name (on NDI record). However, MTF does not collect information on SSN, day of birth, or father's surname. Therefore, possible record matches in MTF are based on 2 possible conditions: (1) exact month and +/-1 year of birth, first and last name, or (2) exact month and +/-1 year of birth, first and middle initials, last name (https://www.cdc.gov/nchs/data/ndi/2024-NDI-User-Guide.pdf).

[2] *Accurint* is a LexisNexis service where public records are searchable to help verify identities (https://www.accurint.com).

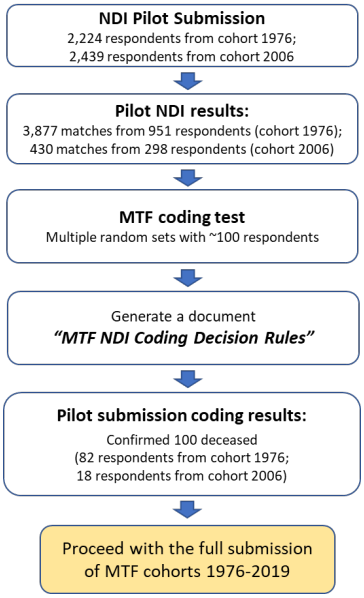



**Figure 2-1.** MTF NDI Pilot Submission in 2019–2021 for MTF cohorts 1976 and 2006

## 2-2. NDI full submission: Cohorts 1976–2019

In January 2022, the MTF team submitted information for 105,731 MTF Longitudinal Panel participants from cohorts 1976–2019 to NDI. The sample size is different than the total sample of N=107,346 in Tables 3-3 and 3-4 because 1) only half of the 2019 cohort was included in the NDI submission, 2) limited information was available to send to NDI, and 3) several cases were removed over the course of data management. Furthermore, the 100 confirmed deceased cases from the pilot submission were excluded because their death status was already known. Because the NDI has a two-year lag in their data, the submission search covered deaths through 2020.

In March 2022, we received 57,841 records for 22,001 potential MTF respondents. In January 2023, MTF started training 15 coders to review the mortality status of the 22,001 potential MTF respondents who had at least one NDI record match. Each case was reviewed by two coders based on *MTF NDI Coding Decision Rules*; no coder could see the results of another coder. The initial coding was completed in Fall 2023.

## 2-3. Initial coding results for the NDI full submission and inter-coder reliability

The initial coding of the NDI Full Submission yielded 92.3% agreement (16,437 cases alive; 2,442 deceased; 1,426 unconfirmed NDI matches[3]) and 7.7% disagreement between coders (1,696

[3] Unconfirmed NDI match cases are respondents with an NDI match for whom the MTF team was not able to confirm or disconfirm whether the respondent and the NDI match were the same person.

cases). To examine reliability between coders, we calculated Cohen's Kappa coefficients (Table 2-1). The MTF coders' inter-coder reliability (ICR) ranged from 0.25 (between Coder 2 and Coder 6) to 1.00 (between Coder 7 and Coder 9). The overall Kappa coefficient for the initial coding was 0.79, which indicates an "excellent" agreement[4].

**Table 2-1.** Cohen's Kappa Coefficients for NDI Coders

| Coders | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | With any coder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | | | | | | | | | | | | | | | 0.806 |
| **2** | 0.765 | | | | | | | | | | | | | | 0.743 |
| **3** | 0.736 | - | | | | | | | | | | | | | 0.738 |
| **4** | 0.877 | 0.783 | - | | | | | | | | | | | | 0.778 |
| **5** | 0.803 | - | - | - | | | | | | | | | | | 0.803 |
| **6** | 0.856 | 0.250 | 0.504 | - | - | | | | | | | | | | 0.822 |
| **7** | 0.866 | 0.732 | - | - | - | - | | | | | | | | | 0.767 |
| **8** | 0.736 | - | 0.809 | - | - | 0.774 | - | | | | | | | | 0.768 |
| **9** | 0.811 | 0.746 | 0.876 | - | - | 0.624 | 1.000 | 0.743 | | | | | | | 0.810 |
| **10** | 0.848 | 0.642 | - | - | - | - | - | - | 0.833 | | | | | | 0.829 |
| **11** | 0.782 | - | 0.601 | - | - | 0.836 | - | 0.836 | 0.788 | 0.484 | | | | | 0.784 |
| **12** | 0.884 | - | - | - | - | - | - | - | - | - | 0.836 | | | | 0.816 |
| **13** | 0.741 | 0.345 | 0.679 | - | - | 0.737 | - | 0.703 | 0.791 | - | 0.716 | 0.717 | | | 0.718 |
| **14** | 0.557 | - | - | - | - | - | - | - | - | - | 0.779 | 0.870 | 0.754 | | 0.819 |
| **15** | - | - | 0.740 | - | - | - | - | 0.873 | - | - | 0.773 | - | - | - | 0.790 |

Note: "-" indicates insufficient cell size or an uneven distribution of the observations across the categories for the Kappa calculation.

## 2-4. Final coding results for the NDI full submission (updated in October 2025)

In 2024, MTF began a second round of coding for the NDI Full Submission (cohorts 1976–2019) by reviewing previous coding notes from the 15 coders and rechecking each case using all available sources from the *MTF NDI Coding Decision Rules*. After this round of coding ended in October 2025, there were 2,345 deceased, 18,400 alive, and 1,256 unconfirmed NDI matches.[3] Combining with the deceased cases from the pilot submission (N=100) yielded 2,445 deceased successfully linked to a death certificate and 1,256 unconfirmed NDI matches (see Figure 2-2), as of October 2025.

[4] Generally, Kappa values of greater than 0.75 represent excellent agreement (https://elentra.healthsci.queensu.ca/assets/modules/reproducibility/kappa_values.html). Kappa values of 0.4 to 0.75 are considered moderate to good, and Kappa values of less than 0.4 are considered poor agreement. A Kappa of 0 means that there is no agreement. A kappa of 1.0 means that there is a perfect agreement between all raters.

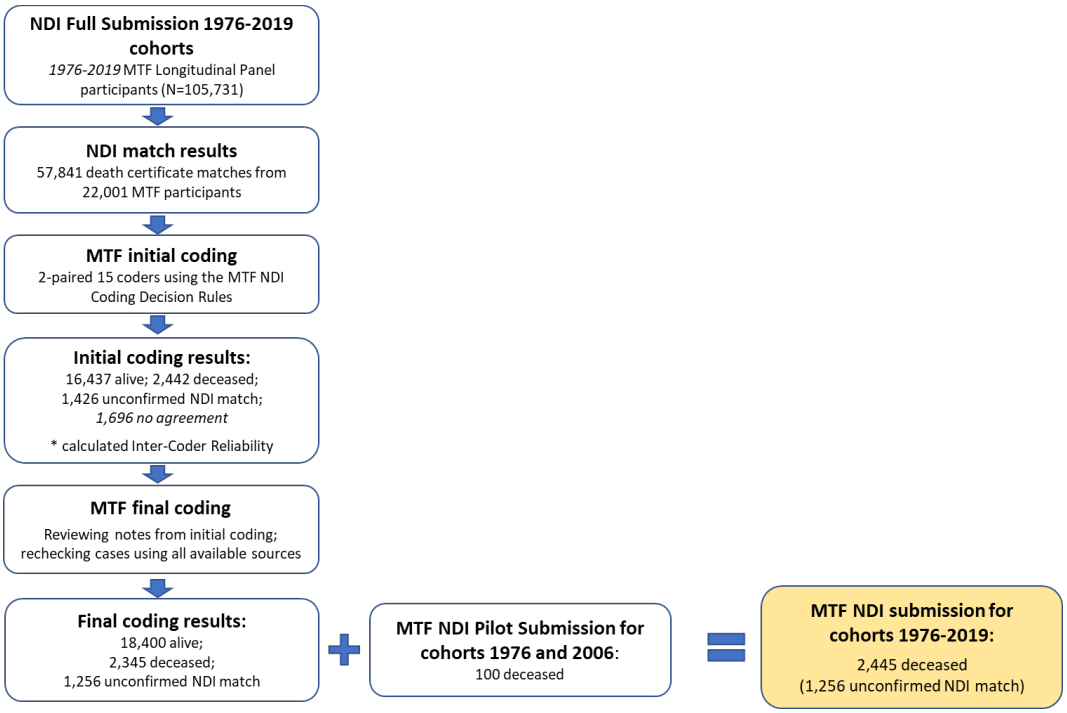



**Figure 2-2.** MTF NDI Full Submission and Coding Results for MTF Cohorts 1976–2019, as of October 2025

# SECTION 3 - MTF Mortality Tracking Results Through March 2026 and Comparison With National Mortality Rates

In June 2026, the MTF team updated the mortality status of the MTF Longitudinal Panel participants from cohorts 1976–2019 as of March 2026. The updates involved obtaining dates of death from Accurint or obituaries for individuals who had not previously been matched with the NDI but were identified as deceased through the MTF tracking process. Since the CDC's NDI submission portal is currently unavailable (as of June 2026), we were unable to link these cases with NDI records. The updates yield a total of 3,773 confirmed deceased cases (2,435 cases linked with NDI information and 1,338 cases without NDI information), as well as 1,226 unconfirmed NDI matched cases (see Section 2 for more details about this category).

The updated datafile, *MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026)*, is now available for use. This datafile includes the full sample of MTF Longitudinal Panel participants from cohorts 1976–2019 (N=107,436), with mortality status updated through March 2026. It also includes the *MTF Longitudinal Panel Eligibility and Sampling Weight (PESW)*, which is described further in Section 4.

In the remainder of this section, we report on how closely the total observed deaths in the March 2026 updated datafile align with the expected number based on U.S. mortality statistics. Because the MTF Longitudinal Panel Study represents individuals who have not dropped out of high school by 12$^{th}$ grade, the observed proportion of deaths should align with the expected proportion derived from U.S. mortality statistics for those with a high school degree or higher. For these analyses, two approaches were used to take into account MTF's exclusion of those who dropped out of high school by 12$^{th}$ grade; both approaches produced a comparable number of deceased cases (4,751 and 5,516).

## 3-1. Approach 1: Adjust U.S. year-specific death rates for high school graduates

MTF Longitudinal Panel participants were in school in the spring of 12$^{th}$ grade. Therefore, the most comparable national data is on high school graduates (although MTF Longitudinal Panel participants may or may not have graduated). To obtain age-specific death rates specific to high school graduates, we started with U.S. age-specific yearly death rates (Table 3-1) and then adjusted them to predict mortality rates without those with less than 12 years of education (referred to as "those who dropped out of high school" hereafter; Table 3-2). For each year, we estimated the proportion of deaths among individuals in each age group among those who dropped out of high school. Then, the overall death rates were adjusted by subtracting the proportion of deaths among those who dropped out of high school. The education variable is available in the U.S. mortality statistics only from 1989 onward, and death counts by educational level for 2025 and

2026 were not yet available as of June 2026. A constant average proportion of deaths among those who dropped out of high school across 1989–2024 was used to calculate the death rates without those who dropped out of high school for the years of 1976–1988 and 2025–2026 in Table 3-2.

Next, we calculated the expected number of deaths for each MTF 12th grade cohort (Table 3-3). For example, the 1976 cohort started with 2,217 members at age 18 in 1976. In 1977, the cohort turned age 19; applying the 1977 mortality rate for high school graduates (78.98 per 100,000) leads to an expectation of 2 deaths, and, consequently, the expected size of the cohort would be 2,215 going into 1978. Applying the 1978 mortality rate for high school graduates 20–24 years old to the remaining 2,215 members leads to an expectation of two additional deaths, with a total of 2,213 survivors going into 1979 (details not shown in tables). This process was continued for each year through 2026 because MTF tracking continues through March 2026. The same process was then repeated for each of the remaining cohorts, generating the numbers to calculate the cumulative total of expected deaths among high school graduates for the 1976–2019 cohorts by the year 2026. With this approach, the expected number of deceased cases was ~5,516 (i.e., 5.1% of the total sample size of 107,346), which is higher than the 3,773 (3.5%) identified in the MTF NDI submission and tracking process (Table 3-3).

**Table 3-1.** Yearly U.S. Death Rates Per 100,000 From 1976 to 2026, by Age Groups

| Year | MTF LP age | Age Groups | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 15-19 | 20-24 | 25-34 | | 35-44 | | 45-54 | | 55-64 | | 65-69 |
| | | | | 25-29 | 30-34 | 35-39 | 40-44 | 45-59 | 50-54 | 55-59 | 60-64 | |
| 1976 | 18 | 95.70 | | | | | | | | | | |
| 1977 | 19 | 99.80 | | | | | | | | | | |
| 1978 | 20 | 98.90 | 131.60 | | | | | | | | | |
| 1979 | 21 | 98.80 | 131.00 | | | | | | | | | |
| 1980 | 22 | 97.90 | 132.70 | | | | | | | | | |
| 1981 | 23 | 90.00 | 122.90 | | | | | | | | | |
| 1982 | 24 | 85.40 | 115.00 | 125.10 | | | | | | | | |
| 1983 | 25 | 81.10 | 108.00 | 121.30 | | | | | | | | |
| 1984 | 26 | 80.40 | 109.60 | 121.90 | | | | | | | | |
| 1985 | 27 | 80.50 | 107.50 | 124.40 | | | | | | | | |
| 1986 | 28 | 86.20 | 114.30 | 133.40 | | 213.30 | | 508.20 | | | | |
| 1987 | 29 | 83.50 | 111.00 | 134.70 | | 214.60 | | 501.90 | | | | |
| 1988 | 30 | 86.70 | 112.60 | 137.10 | | 220.20 | | 490.50 | | | | |
| 1989 | 31 | 85.90 | 108.60 | 140.00 | | 222.20 | | 480.10 | | | | |
| 1990 | 32 | 87.90 | 109.90 | 139.20 | | 223.20 | | 473.40 | | | | |
| 1991 | 33 | 88.70 | 109.90 | 138.00 | | 224.10 | | 467.40 | | | | |
| 1992 | 34 | 83.60 | 104.90 | 136.00 | | 228.40 | | 453.90 | | | | |
| 1993 | 35 | 85.80 | 107.90 | 139.80 | | 234.70 | | 456.70 | | | | |
| 1994 | 36 | 85.50 | 107.00 | 140.00 | | 237.90 | | 457.30 | | | | |
| 1995 | 37 | 82.10 | 104.70 | 137.30 | | 239.40 | | 454.30 | | | | |
| 1996 | 38 | 77.50 | 99.50 | 122.30 | | 220.50 | | 440.00 | | | | |
| 1997 | 39 | 73.60 | 96.40 | 110.10 | | 202.20 | | 423.90 | | | | |
| 1998 | 40 | 69.50 | 92.70 | 104.30 | | 198.60 | | 415.80 | | | | |
| 1999 | 41 | 68.60 | 90.80 | 90.40 | 113.40 | 160.80 | 236.30 | 346.60 | 501.40 | 801.60 | | |
| 2000 | 42 | 67.10 | 93.60 | 91.20 | 111.00 | 159.20 | 239.10 | 352.50 | 509.00 | 792.60 | | |
| 2001 | 43 | 66.30 | 94.60 | 96.80 | 113.70 | 165.90 | 240.10 | 356.00 | 505.10 | 784.00 | | |
| 2002 | 44 | 67.00 | 95.00 | 96.10 | 113.30 | 162.50 | 243.80 | 357.90 | 514.00 | 762.30 | | |
| 2003 | 45 | 65.40 | 97.00 | 97.20 | 112.60 | 160.20 | 242.10 | 359.90 | 516.30 | 754.60 | | |
| 2004 | 46 | 64.90 | 94.60 | 98.20 | 109.60 | 153.00 | 233.00 | 353.20 | 509.90 | 729.60 | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | 47 | 63.80 | 98.00 | 100.20 | 113.30 | 151.10 | 235.00 | 354.10 | 518.70 | 728.30 | | |
| 2006 | 48 | 63.00 | 100.50 | 103.90 | 114.40 | 150.40 | 231.10 | 349.00 | 514.10 | 723.20 | | |
| 2007 | 49 | 60.30 | 98.10 | 101.90 | 112.90 | 147.30 | 223.20 | 341.00 | 505.90 | 717.70 | | |
| 2008 | 50 | 55.90 | 93.40 | 99.40 | 111.30 | 143.50 | 217.60 | 339.20 | 504.30 | 716.00 | | |
| 2009 | 51 | 51.90 | 88.40 | 97.80 | 111.40 | 143.90 | 215.20 | 334.20 | 505.20 | 714.20 | | |
| 2010 | 52 | 49.40 | 86.50 | 96.00 | 110.20 | 138.80 | 201.10 | 324.00 | 491.70 | 711.70 | | |
| 2011 | 53 | 48.90 | 86.10 | 96.70 | 113.00 | 140.20 | 201.70 | 323.50 | 494.60 | 712.30 | | |
| 2012 | 54 | 47.20 | 84.60 | 98.10 | 112.90 | 140.50 | 198.70 | 315.70 | 491.50 | 717.20 | | |
| 2013 | 55 | 44.80 | 83.40 | 97.60 | 114.80 | 141.90 | 200.30 | 315.10 | 491.60 | 721.80 | | |
| 2014 | 56 | 45.50 | 83.80 | 99.70 | 117.30 | 147.20 | 202.40 | 311.30 | 491.30 | 730.60 | | |
| 2015 | 57 | 48.30 | 89.30 | 106.40 | 127.40 | 154.20 | 206.10 | 308.70 | 493.00 | 731.80 | | |
| 2016 | 58 | 51.20 | 97.20 | 118.20 | 140.30 | 169.80 | 215.90 | 313.10 | 494.20 | 737.70 | | |
| 2017 | 59 | 51.50 | 95.60 | 121.00 | 145.40 | 173.80 | 218.40 | 313.20 | 488.00 | 736.50 | | |
| 2018 | 60 | 49.20 | 90.40 | 116.50 | 141.80 | 174.40 | 216.90 | 312.70 | 478.70 | 733.60 | 1051.90 | |
| 2019 | 61 | 48.70 | 90.20 | 114.70 | 143.60 | 177.70 | 222.60 | 312.50 | 472.00 | 724.30 | 1052.40 | |
| 2020 | 62 | 58.60 | 109.00 | 140.70 | 178.60 | 220.30 | 277.80 | 382.70 | 562.40 | 848.20 | 1237.10 | |
| 2021 | 63 | - | 115.70 | 157.20 | 203.80 | 252.90 | 324.70 | 435.50 | 621.30 | 916.20 | 1321.20 | |
| 2022 | 64 | - | 99.00 | 141.00 | 184.80 | 226.70 | 285.30 | 372.70 | 529.30 | 802.80 | 1180.10 | |
| 2023 | 65 | - | 96.00 | 126.10 | 168.70 | 208.80 | 266.60 | 339.50 | 481.20 | 721.10 | 1072.70 | 1509.10 |
| 2024 | 66 | - | 82.70 | 104.80 | 142.90 | 185.80 | 243.10 | 316.80 | 456.30 | 678.50 | 1033.10 | 1476.60 |
| 2025 | 67 | - | 75.60 | 94.30 | 127.50 | 176.10 | 232.00 | 314.90 | 434.20 | 652.00 | 1009.00 | 1491.70 |
| 2026 | 68 | - | 25.10 | 31.20 | 42.70 | 61.00 | 83.00 | 117.30 | 157.60 | 242.10 | 375.00 | 580.10 |

**Note: MTF LP = Monitoring the Future Longitudinal Panel. Death counts for 2025–2026 are provisional through May 30, 2026 as of June 7, 2026. For 2026 deaths, the counts are partial as of June 7, 2026.**

**Data Sources: For 1976–1978, *Compressed Mortality, 1968–1978* from death certificates; for 1979–1998, *Compressed Mortality, 1999–1998* from death certificates; for 1999–2020, *Multiple Cause of Death, 1999–2020* from death certificates; for 2021–2024, *Multiple Cause of Death, 2018–2024* from death certificates. All data are downloaded from https://wonder.cdc.gov.**

**Table 3-2.** Yearly U.S. Death Rates Per 100,000 Without Those Who Dropped Out of High School From 1976 to 2026, by Age Groups

| Year | Death rates for those who dropped out of high school | MTF LP age | US Death Rates per 100,000, without those who dropped out of high school | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 15-19 | 20-24 | 25-34 | | 35-44 | | 45-54 | | 55-64 | | 65-69 |
| | | | | | 25-29 | 30-34 | 35-39 | 40-44 | 45-59 | 50-54 | 55-59 | 60-64 | |
| 1976 | 20.86%* | 18 | 75.74 | | | | | | | | | | |
| 1977 | 20.86%* | 19 | 78.98 | | | | | | | | | | |
| 1978 | 20.86%* | 20 | 78.27 | 104.15 | | | | | | | | | |
| 1979 | 20.86%* | 21 | 78.19 | 103.67 | | | | | | | | | |
| 1980 | 20.86%* | 22 | 77.48 | 105.02 | | | | | | | | | |
| 1981 | 20.86%* | 23 | 71.23 | 97.26 | | | | | | | | | |
| 1982 | 20.86%* | 24 | 67.59 | 91.01 | 99.00 | | | | | | | | |
| 1983 | 20.86%* | 25 | 64.18 | 85.47 | 96.00 | | | | | | | | |
| 1984 | 20.86%* | 26 | 63.63 | 86.74 | 96.47 | | | | | | | | |
| 1985 | 20.86%* | 27 | 63.71 | 85.08 | 98.45 | | | | | | | | |
| 1986 | 20.86%* | 28 | 68.22 | 90.46 | 105.57 | | 168.81 | | 402.19 | | | | |
| 1987 | 20.86%* | 29 | 66.08 | 87.85 | 106.60 | | 169.83 | | 397.20 | | | | |
| 1988 | 20.86%* | 30 | 68.61 | 89.11 | 108.50 | | 174.27 | | 388.18 | | | | |
| 1989 | 22.22% | 31 | 66.81 | 84.47 | 108.89 | | 172.83 | | 373.42 | | | | |
| 1990 | 23.56% | 32 | 67.19 | 84.01 | 106.40 | | 170.61 | | 361.87 | | | | |
| 1991 | 24.92% | 33 | 66.60 | 82.51 | 103.61 | | 168.25 | | 350.92 | | | | |
| 1992 | 24.72% | 34 | 62.93 | 78.97 | 102.38 | | 171.94 | | 341.70 | | | | |
| 1993 | 24.28% | 35 | 64.97 | 81.70 | 105.86 | | 177.71 | | 345.81 | | | | |
| 1994 | 24.24% | 36 | 64.77 | 81.06 | 106.06 | | 180.23 | | 346.45 | | | | |
| 1995 | 23.90% | 37 | 62.48 | 79.68 | 104.49 | | 182.18 | | 345.72 | | | | |
| 1996 | 23.72% | 38 | 59.12 | 75.90 | 93.29 | | 168.20 | | 335.63 | | | | |
| 1997 | 23.59% | 39 | 56.24 | 73.66 | 84.13 | | 154.50 | | 323.90 | | | | |
| 1998 | 23.17% | 40 | 53.40 | 71.22 | 80.13 | | 152.58 | | 319.46 | | | | |
| 1999 | 22.79% | 41 | 52.97 | 70.11 | 69.80 | 87.56 | 124.15 | 182.45 | 267.61 | 387.13 | 618.92 | | |
| 2000 | 22.28% | 42 | 52.15 | 72.75 | 70.88 | 86.27 | 123.73 | 185.83 | 273.96 | 395.59 | 616.01 | | |
| 2001 | 21.72% | 43 | 51.90 | 74.05 | 75.78 | 89.00 | 129.87 | 187.95 | 278.68 | 395.39 | 613.72 | | |
| 2002 | 21.40% | 44 | 52.66 | 74.67 | 75.53 | 89.05 | 127.73 | 191.63 | 281.31 | 404.00 | 599.17 | | |
| 2003 | 24.74% | 45 | 49.22 | 73.00 | 73.15 | 84.74 | 120.57 | 182.20 | 270.86 | 388.57 | 567.91 | | |
| 2004 | 22.31% | 46 | 50.42 | 73.49 | 76.29 | 85.15 | 118.87 | 181.02 | 274.40 | 396.14 | 566.83 | | |
| 2005 | 21.76% | 47 | 49.92 | 76.68 | 78.40 | 88.65 | 118.22 | 183.86 | 277.05 | 405.83 | 569.82 | | |
| 2006 | 22.24% | 48 | 48.99 | 78.15 | 80.79 | 88.96 | 116.95 | 179.70 | 271.38 | 399.76 | 562.36 | | |
| 2007 | 21.01% | 49 | 47.63 | 77.49 | 80.49 | 89.18 | 116.35 | 176.31 | 269.36 | 399.61 | 566.91 | | |
| 2008 | 19.29% | 50 | 45.12 | 75.38 | 80.23 | 89.83 | 115.82 | 175.62 | 273.77 | 407.02 | 577.88 | | |
| 2009 | 18.56% | 51 | 42.27 | 71.99 | 79.65 | 90.72 | 117.19 | 175.26 | 272.17 | 411.43 | 581.64 | | |
| 2010 | 19.49% | 52 | 39.77 | 69.64 | 77.29 | 88.72 | 111.75 | 161.91 | 260.85 | 395.87 | 572.99 | | |
| 2011 | 19.02% | 53 | 39.60 | 69.72 | 78.31 | 91.51 | 113.53 | 163.34 | 261.97 | 400.53 | 576.82 | | |
| 2012 | 19.15% | 54 | 38.16 | 68.40 | 79.31 | 91.28 | 113.59 | 160.65 | 255.24 | 397.38 | 579.86 | | |
| 2013 | 18.90% | 55 | 36.33 | 67.64 | 79.15 | 93.10 | 115.08 | 162.44 | 255.55 | 398.69 | 585.38 | | |
| 2014 | 18.78% | 56 | 36.96 | 68.06 | 80.98 | 95.27 | 119.56 | 164.39 | 252.84 | 399.03 | 593.39 | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 18.44% | 57 | 39.39 | 72.83 | 86.78 | 103.91 | 125.77 | 168.10 | 251.78 | 402.09 | 596.86 | | |
| 2016 | 18.81% | 58 | 41.57 | 78.92 | 95.97 | 113.91 | 137.86 | 175.29 | 254.21 | 401.24 | 598.94 | | |
| 2017 | 18.55% | 59 | 41.95 | 77.87 | 98.55 | 118.43 | 141.56 | 177.89 | 255.10 | 397.48 | 599.88 | | |
| 2018 | 18.37% | 60 | 40.16 | 73.79 | 95.10 | 115.75 | 142.36 | 177.06 | 255.26 | 390.76 | 598.84 | 858.67 | |
| 2019 | 18.36% | 61 | 39.76 | 73.64 | 93.64 | 117.24 | 145.07 | 181.73 | 255.13 | 385.34 | 591.32 | 859.18 | |
| 2020 | 18.74% | 62 | 47.62 | 88.57 | 114.33 | 145.13 | 179.02 | 225.74 | 310.98 | 457.01 | 689.25 | 1005.27 | |
| 2021 | 17.70% | 63 | ^ | 95.22 | 129.38 | 167.73 | 208.14 | 267.23 | 358.42 | 511.33 | 754.03 | 1087.35 | |
| 2022 | 17.53% | 64 | ^ | 81.65 | 116.28 | 152.40 | 186.96 | 235.29 | 307.37 | 436.51 | 662.07 | 973.23 | |
| 2023 | 16.58% | 65 | ^ | 80.08 | 105.19 | 140.73 | 174.18 | 222.40 | 283.21 | 401.42 | 601.54 | 894.85 | 1258.89 |
| 2024 | 16.24% | 66 | ^ | 69.27 | 87.78 | 119.69 | 155.63 | 203.62 | 265.35 | 382.20 | 568.31 | 865.32 | 1236.80 |
| 2025 | 20.86%* | 67 | ^ | 59.83 | 74.63 | 100.90 | 139.37 | 183.60 | 249.21 | 343.63 | 515.99 | 798.52 | 1180.53 |
| 2026 | 20.86%* | 68 | ^ | ^ | 24.69 | 33.79 | 48.28 | 65.69 | 92.83 | 124.72 | 191.60 | 296.78 | 459.09 |

**Note: MTF LP = Monitoring the Future Longitudinal Panel. Authors calculated the U.S. death rates per 100,000, excluding those with less than a high school education.**

***Education variable only available from 1989–2024 in *Mortality multiple cause files*. The average proportion of death rates by those who dropped out of high school during 1989–2024 was used before 1989 and after 2024.**

**^Not considered: the latest cohort is the 2019 cohort, with modal age 18 in 2019; modal age 19 in 2020; modal age 20 in 2021, and so on. Ages 15–19 are no longer considered from 2021 onward; ages 20–24 are no longer considered in 2026.**

**Data Sources: For 1976–1978, *Compressed Mortality, 1968–1978* from death certificate; for 1979–1998, *Compressed Mortality, 1999–1998* from death certificates; for 1999–2020, *Multiple Cause of Death, 1999–2020* from death certificates. For death by education level, *Mortality multiple cause files 1989–2020 and 2018–2024*.**

**All data are downloaded from https://wonder.cdc.gov.**

**Table 3-3. Number of Estimated Survived and Deceased Respondents Adjusting Yearly Death Rates up to 2026 for Those Who Dropped Out of High School in the MTF Longitudinal Panel Study, by MTF High School Cohorts 1976–2019**

| MTF HS Cohort | Size of MTF LP cohort | Estimated mortality, including those who dropped out of high school | | Estimated mortality, excluding those who dropped out of high school | | Confirmed # deceased, coded by MTF |
|---|---|---|---|---|---|---|
| | | # survived | # died | # survived | # died | |
| 1976 | 2,217 | 1,757.1 | 459.9 | 1838.7 | 378.3 | 261 |
| 1977 | 2,355 | 1,896.4 | 458.6 | 1977.3 | 377.7 | 282 |
| 1978 | 2,409 | 1,970.3 | 438.7 | 2049.5 | 359.5 | 264 |
| 1979 | 2,432 | 2,024.1 | 407.9 | 2098.0 | 334.0 | 257 |
| 1980 | 2,452 | 2,071.0 | 381.0 | 2140.4 | 311.6 | 214 |
| 1981 | 2,455 | 2,099.5 | 355.5 | 2164.5 | 290.5 | 203 |
| 1982 | 2,432 | 2,105.5 | 326.5 | 2165.6 | 266.4 | 193 |
| 1983 | 2,420 | 2,120.0 | 300.0 | 2175.7 | 244.3 | 167 |
| 1984 | 2,435 | 2,159.4 | 275.6 | 2213.0 | 222.0 | 161 |
| 1985 | 2,459 | 2,202.7 | 256.3 | 2250.6 | 208.4 | 145 |
| 1986 | 2,452 | 2,214.9 | 237.1 | 2259.4 | 192.6 | 103 |
| 1987 | 2,451 | 2,231.5 | 219.5 | 2272.9 | 178.1 | 106 |
| 1988 | 2,447 | 2,245.1 | 201.9 | 2283.5 | 163.5 | 121 |
| 1989 | 2,469 | 2,282.7 | 186.3 | 2318.1 | 150.9 | 104 |
| 1990 | 2,460 | 2,288.4 | 171.6 | 2321.0 | 139.0 | 89 |
| 1991 | 2,464 | 2,303.3 | 160.7 | 2333.8 | 130.2 | 88 |
| 1992 | 2,466 | 2,315.8 | 150.2 | 2344.4 | 121.6 | 71 |
| 1993 | 2,439 | 2,300.5 | 138.5 | 2326.9 | 112.1 | 73 |
| 1994 | 2,460 | 2,330.2 | 129.8 | 2354.8 | 105.2 | 78 |
| 1995 | 2,454 | 2,332.4 | 121.6 | 2355.5 | 98.5 | 64 |
| 1996 | 2,428 | 2,314.0 | 114.0 | 2335.6 | 92.4 | 55 |
| 1997 | 2,452 | 2,342.8 | 109.2 | 2363.4 | 88.6 | 59 |
| 1998 | 2,449 | 2,346.0 | 103.0 | 2365.4 | 83.6 | 61 |
| 1999 | 2,451 | 2,354.4 | 96.6 | 2372.6 | 78.4 | 59 |
| 2000 | 2,450 | 2,359.4 | 90.6 | 2376.4 | 73.6 | 55 |
| 2001 | 2,441 | 2,355.4 | 85.6 | 2371.5 | 69.5 | 49 |
| 2002 | 2,442 | 2,361.4 | 80.6 | 2376.5 | 65.5 | 35 |
| 2003 | 2,442 | 2,366.5 | 75.5 | 2380.5 | 61.5 | 50 |
| 2004 | 2,448 | 2,377.7 | 70.3 | 2390.7 | 57.3 | 36 |
| 2005 | 2,449 | 2,383.5 | 65.5 | 2395.6 | 53.4 | 32 |
| 2006 | 2,448 | 2,386.9 | 61.1 | 2398.1 | 49.9 | 25 |
| 2007 | 2,443 | 2,386.2 | 56.8 | 2396.6 | 46.4 | 27 |
| 2008 | 2,452 | 2,399.4 | 52.6 | 2409.0 | 43.0 | 30 |
| 2009 | 2,451 | 2,403.0 | 48.0 | 2411.7 | 39.3 | 29 |
| 2010 | 2,447 | 2,403.2 | 43.8 | 2411.2 | 35.8 | 26 |
| 2011 | 2,448 | 2,408.0 | 40.0 | 2415.2 | 32.8 | 20 |
| 2012 | 2,446 | 2,409.7 | 36.3 | 2416.3 | 29.7 | 21 |
| 2013 | 2,447 | 2,414.2 | 32.8 | 2420.2 | 26.8 | 11 |
| 2014 | 2,444 | 2,414.9 | 29.1 | 2420.2 | 23.8 | 17 |
| 2015 | 2,450 | 2,424.4 | 25.6 | 2429.0 | 21.0 | 4 |
| 2016 | 2,446 | 2,423.8 | 22.2 | 2427.8 | 18.2 | 8 |
| 2017 | 2,450 | 2,430.7 | 19.3 | 2434.2 | 15.8 | 9 |
| 2018 | 2,446 | 2,429.5 | 16.5 | 2432.5 | 13.5 | 6 |
| 2019 | 2,448 | 2,434.4 | 13.6 | 2436.8 | 11.2 | 5 |
| **Total** | 107,346 | 100,580.1 | 6,765.9 | 101,830.4 | **5,515.6** | **3,773** |

**Note: MTF LP = Monitoring the Future Longitudinal Panel. Authors calculated estimated mortality, including and excluding those who dropped out of high school (columns 3–6).**

## 3-2. Approach 2: Estimate cohort-specific mortality for high school graduates

The second approach was to calculate cohort-specific mortality for both high school graduates and those who dropped out of high school combined, and then to estimate the portion attributed to high school graduates. This approach assumed that mortality rates were 3 times higher for those who dropped out of high school compared to high school graduates.[5]

First, we calculated the expected number of deaths by 2026 in each 12th grade cohort from 1976 to 2019 using U.S. death statistics for the total population, including both high school graduates and those who dropped out of high school (column 4 in Table 3-4). After computing the expected number of deceased for each 12th grade cohort, we used the following formula:

$$Total\ number\ of\ deaths\ in\ the\ U.S.\ population\ cohort\ by\ 2020 = 1\ \times (x)(\#of\ high\ school\ graduates\ in\ the\ U.S.\ population\ cohort\ at\ age\ 18) + 3\ \times (x)(\#\ of\ those\ who\ dropped\ out\ of\ high\ school\ in\ the\ U.S.\ population\ cohort\ at\ age\ 18)$$

To solve for the mortality rate $(x)$, we used cohort-specific data on the percentage of those who dropped out of high school, which decreased from 14% in 1976 to 6% in 2019 (column 5 in Table 3-4).

With information on the mortality rate $(x)$, the number of deceased among high school graduates was calculated as $(x) \times$ (original MTF cohort size). We then summed the expected number of deceased for all cohorts. An assumption of a 3-times-higher mortality rate for those who dropped out of high school yielded an expected 4,751 deceased cases, compared to the 3,773 MTF Longitudinal Panel members confirmed as deceased (columns 11 and 12 in Table 3-4). As a sensitivity analysis, an assumption of a 4-times-higher mortality rate for those who dropped out of high school yielded an expected 4,323 deceased, and an assumption of a 2-times-higher rate yielded an expected 5,275 deceased.

[5] Montez, J. K., Hummer, R. A., & Hayward, M. D. (2012). Educational attainment and adult mortality in the United States: A systematic analysis of functional form. Demography, 49(1), 315-336. doi: 10.1007/s13524-011-0082-8

**Table 3-4.** Estimated Cohort-Specific Mortality Rates up to 2026 for Those Who Dropped Out of High School and High School Graduates in the Cohorts Represented in the MTF Longitudinal Panel Study, by MTF High School Cohorts 1976–2019

| MTF HS Cohort | Size of MTF LP | Estimated Vital Stats. | | Dropout rates | Overall # dead = x×nondropouts +3x×dropouts | | | | | | Confirmed # deceased by MTF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | # survived | # deceased | | # of nondropouts | # of dropouts | Death rates for nondropouts | Death rates for dropouts | # deceased dropouts | # deceased nondropouts | |
| 1976 | 2,224 | 1,763 | 461 | 0.14 | 1912.64 | 311 | 0.16 | 0.49 | 151.40 | 310.00 | 261 |
| 1977 | 2,358 | 1,899 | 459 | 0.14 | 2027.88 | 330 | 0.15 | 0.46 | 150.66 | 308.49 | 282 |
| 1978 | 2,411 | 1,972 | 439 | 0.14 | 2073.46 | 338 | 0.14 | 0.43 | 144.06 | 294.98 | 264 |
| 1979 | 2,437 | 2,028 | 409 | 0.14 | 2095.82 | 341 | 0.13 | 0.39 | 134.11 | 274.61 | 257 |
| 1980 | 2,458 | 2,076 | 382 | 0.14 | 2113.88 | 344 | 0.12 | 0.36 | 125.31 | 256.58 | 214 |
| 1981 | 2,458 | 2,102 | 356 | 0.14 | 2113.88 | 344 | 0.11 | 0.34 | 116.79 | 239.13 | 203 |
| 1982 | 2,437 | 2,110 | 327 | 0.14 | 2095.82 | 341 | 0.10 | 0.31 | 107.37 | 219.85 | 193 |
| 1983 | 2,426 | 2,125 | 301 | 0.14 | 2086.36 | 340 | 0.10 | 0.29 | 98.70 | 202.09 | 167 |
| 1984 | 2,438 | 2,162 | 276 | 0.13 | 2121.06 | 317 | 0.09 | 0.27 | 85.41 | 190.54 | 161 |
| 1985 | 2,467 | 2,210 | 257 | 0.13 | 2146.29 | 321 | 0.08 | 0.25 | 79.59 | 177.56 | 145 |
| 1986 | 2,461 | 2,223 | 238 | 0.13 | 2141.07 | 320 | 0.08 | 0.23 | 73.66 | 164.31 | 103 |
| 1987 | 2,466 | 2,245 | 221 | 0.13 | 2145.42 | 321 | 0.07 | 0.21 | 68.36 | 152.50 | 106 |
| 1988 | 2,456 | 2,253 | 203 | 0.13 | 2136.72 | 319 | 0.07 | 0.20 | 62.71 | 139.90 | 121 |
| 1989 | 2,478 | 2,291 | 187 | 0.13 | 2155.86 | 322 | 0.06 | 0.18 | 57.88 | 129.13 | 104 |
| 1990 | 2,470 | 2,298 | 172 | 0.12 | 2173.60 | 296 | 0.06 | 0.17 | 50.02 | 122.28 | 89 |
| 1991 | 2,473 | 2,312 | 161 | 0.12 | 2176.24 | 297 | 0.05 | 0.16 | 46.83 | 114.48 | 88 |
| 1992 | 2,479 | 2,328 | 151 | 0.11 | 2206.31 | 273 | 0.05 | 0.15 | 40.84 | 110.13 | 71 |
| 1993 | 2,449 | 2,310 | 139 | 0.11 | 2179.61 | 269 | 0.05 | 0.14 | 37.62 | 101.46 | 73 |
| 1994 | 2,467 | 2,337 | 130 | 0.11 | 2195.63 | 271 | 0.04 | 0.13 | 35.22 | 94.99 | 78 |
| 1995 | 2,469 | 2,347 | 122 | 0.11 | 2197.41 | 272 | 0.04 | 0.12 | 33.08 | 89.22 | 64 |
| 1996 | 2,440 | 2,325 | 115 | 0.11 | 2171.60 | 268 | 0.04 | 0.12 | 30.98 | 83.56 | 55 |
| 1997 | 2,457 | 2,348 | 109 | 0.11 | 2186.73 | 270 | 0.04 | 0.11 | 29.60 | 79.83 | 59 |
| 1998 | 2,454 | 2,351 | 103 | 0.11 | 2184.06 | 270 | 0.03 | 0.10 | 27.93 | 75.32 | 61 |
| 1999 | 2,459 | 2,362 | 97 | 0.11 | 2188.51 | 270 | 0.03 | 0.10 | 26.20 | 70.67 | 59 |
| 2000 | 2,456 | 2,365 | 91 | 0.11 | 2185.84 | 270 | 0.03 | 0.09 | 24.57 | 66.26 | 55 |
| 2001 | 2,448 | 2,362 | 86 | 0.11 | 2178.72 | 269 | 0.03 | 0.09 | 23.21 | 62.60 | 49 |
| 2002 | 2,453 | 2,372 | 81 | 0.11 | 2183.17 | 270 | 0.03 | 0.08 | 21.90 | 59.05 | 35 |
| 2003 | 2,449 | 2,373 | 76 | 0.10 | 2204.10 | 245 | 0.03 | 0.08 | 18.94 | 56.81 | 50 |
| 2004 | 2,450 | 2,380 | 70 | 0.10 | 2205.00 | 245 | 0.02 | 0.07 | 17.59 | 52.78 | 36 |
| 2005 | 2,450 | 2,385 | 65 | 0.09 | 2229.50 | 221 | 0.02 | 0.07 | 14.98 | 50.50 | 32 |
| 2006 | 2,452 | 2,391 | 61 | 0.09 | 2231.32 | 221 | 0.02 | 0.06 | 14.01 | 47.21 | 25 |
| 2007 | 2,452 | 2,395 | 57 | 0.09 | 2231.32 | 221 | 0.02 | 0.06 | 13.04 | 43.93 | 27 |
| 2008 | 2,454 | 2,401 | 53 | 0.08 | 2257.68 | 196 | 0.02 | 0.06 | 10.90 | 41.79 | 30 |
| 2009 | 2,453 | 2,405 | 48 | 0.08 | 2256.76 | 196 | 0.02 | 0.05 | 9.94 | 38.10 | 29 |
| 2010 | 2,450 | 2,406 | 44 | 0.07 | 2278.50 | 172 | 0.02 | 0.05 | 8.07 | 35.75 | 26 |
| 2011 | 2,450 | 2,410 | 40 | 0.07 | 2278.50 | 172 | 0.01 | 0.04 | 7.38 | 32.70 | 20 |
| 2012 | 2,452 | 2,416 | 36 | 0.07 | 2280.36 | 172 | 0.01 | 0.04 | 6.70 | 29.68 | 21 |
| 2013 | 2,450 | 2,417 | 33 | 0.07 | 2278.50 | 172 | 0.01 | 0.04 | 6.05 | 26.78 | 11 |
| 2014 | 2,450 | 2,421 | 29 | 0.07 | 2278.50 | 172 | 0.01 | 0.03 | 5.37 | 23.79 | 17 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2015 | 2,451 | 2,425 | 26 | 0.06 | 2303.94 | 147 | 0.01 | 0.03 | 4.11 | 21.49 | 4 |
| 2016 | 2,450 | 2,428 | 22 | 0.06 | 2303.00 | 147 | 0.01 | 0.02 | 3.58 | 18.68 | 8 |
| 2017 | 2,452 | 2,433 | 19 | 0.06 | 2304.88 | 147 | 0.01 | 0.02 | 3.10 | 16.19 | 9 |
| 2018 | 2,450 | 2,433 | 17 | 0.06 | 2303.00 | 147 | 0.01 | 0.02 | 2.66 | 13.87 | 6 |
| 2019 | 2,450 | 2,436 | 14 | 0.06 | 2303.00 | 147 | 0.00 | 0.01 | 2.20 | 11.46 | 5 |
| Total | | | | | | | | | **2032.63** | **4751.03** | **3,773** |

**Notes: MTF LP = Monitoring the Future Longitudinal Panel. Dropouts = those who dropped out of high school. Non-dropouts = those who were still in high school in the spring of 12th grade.**

## 3-3. Conclusions on the quality of MTF's mortality tracking estimates

These results indicate that the MTF Longitudinal Panel mortality estimates from the MTF tracking have a sensitivity between 68% to 79%. The statistical term "sensitivity", or true positive rate, measures the percentage of respondents who were deceased and correctly coded as such. Specifically, the MTF NDI submission and tracking procedures identified 3,773 cases as of March 2026, which compared to an expected number of 4,751 to 5,516 deaths based on national death rates of same-aged U.S. adults who have a high school education. These numbers correspond to MTF identifying 68% to 79% of MTF Longitudinal Panel participants who were expected to be deceased, assuming minimal false positives and treating the national estimates as a gold standard.

These findings suggest that as of March 2026, approximately 1,000 MTF Longitudinal Panel members from the 1976–2019 cohorts could have been deceased but have not yet been identified as such, and many of these are likely within the "unconfirmed NDI match" mortality group of 1,226 individuals. Note that for these 1,226 cases, the MTF team was unable to confirm 1) whether the NDI match was actually the MTF Longitudinal Panel respondent, and/or 2) whether they were deceased based on the *MTF NDI Coding Decision Rules*. One reason to expect deceased individuals in the "unconfirmed NDI match" group is that its members tend to be older than the average age of all MTF Longitudinal Panel respondents. This is largely because the earlier MTF cohorts had relatively less tracking information available (e.g., no email addresses, and possible earlier suppression as refused, lost, or nonresponsive). Because age is a strong predictor of mortality, older groups would be expected to have higher mortality levels. Additionally, MTF Longitudinal Panel decedents without published obituaries and/or with limited public information on their residence or employment histories are more challenging to track, making them more likely to end up in the "unconfirmed NDI match" category. The MTF team will continue to track mortality status of those coded as "unconfirmed NDI match" as more information becomes available.

Researchers conducting mortality analyses using MTF Longitudinal Panel mortality data may or may not choose to incorporate cases in the "unconfirmed NDI match" category. In theory, possible options for doing so would likely include ordinal logit analyses and multiple imputation methods. In ordinal logit analyses, researchers would use a trichotomous mortality outcome with categories of alive, unconfirmed NDI match, and deceased. In essence, this procedure would use the existing data to assign an aggregate probability of mortality to all members of the "unconfirmed NDI match" category. Multiple imputation methodologies would use regression models to predict morality status among respondents coded as "unconfirmed NDI match" on the basis of their individual-level covariates in conjunction with information from the aggregate data. We encourage researchers to determine the methods that will work best for their work.

# SECTION 4 - MTF Longitudinal Panel Eligibility and Sampling Weight

## 4-1. Purpose and design

The mortality data are unlike the survey data from the MTF Longitudinal Panel Study because we search for mortality status for all respondents selected for the MTF Longitudinal Panel Study, regardless of how often—or whether—they respond to the surveys. Consequently, procedures to calculate weights do not incorporate any data obtained from the MTF Longitudinal Panel Study surveys; they rely only on the panel eligibility and selection information.

The cohort-specific MTF Longitudinal Panel Eligibility and Sampling Weight (PESW) is calculated using a pooled analysis weighting procedure that weights back to the initial 12th grade samples, accounting for 1) the fraction of 12th grade students not eligible for panel selection, and 2) the panel sample selection process, including oversampling of those reporting substance use in 12th grade. Detailed discussion of the MTF Longitudinal Panel eligibility and selection processes is provided elsewhere (Patrick et al., 2022, 2025). In brief, MTF enrolls new, annual nationally representative samples of approximately 12,000–19,000 U.S. 12th grade students in the spring of each year. From each year's 12th grade cohort, 2,450 individuals are selected to participate in the MTF Longitudinal Panel Study, with eligibility contingent on providing contact information and valid data on sex; respondents reporting substance use in 12th grade are oversampled. The pooled regression models used for calculating the probability of MTF Longitudinal Panel sample selection include all respondents from each 12th grade cohort, and regress the dichotomous MTF Longitudinal Panel sample selection indicator on key 12th grade administrative and self-report measures (see Patrick et al., 2022 for further details). Final PESW values are then obtained by multiplying the inverse of the probability of MTF Longitudinal Panel sample selection by the 12th grade sample probability weight. All respondents selected for the MTF Longitudinal Panel Study thus have a PESW, regardless of their level of participation or attrition from the study.

## 4-2. Analyses using MTF PESW

All analyses using data from the MTF Longitudinal Panel Study that have a mortality status as an outcome should use the PESW. For all analyses where the outcome is not a mortality status, the age-specific MTF Longitudinal Panel Analysis Weights (PAWs) which account for sampling and attrition should be used (see Patrick et al., 2022). The PAWs are available on the main MTF Longitudinal Panel Study datasets in the Virtual Data Enclave of the National Addiction & Health Data Archive Program (NAHDAP).

As noted above, the PESW has been developed to weight back to the 12th grade nationally representative (i.e., national probability) samples. Each typical full panel cohort has an approximate size of 2,450, while each annual 12th grade sample has an approximate size of

12,000–19,000. Using the PESW without normalization in analyses will result in a weighted sample *n* that reflects the number of 12th grade students in the original MTF cross-sectional samples, which is much larger than the actual MTF Longitudinal Panel sample sizes. Unless using analytical methods that automatically normalize provided weights (such as SAS SURVEY commands, or Stata SVY commands), it is advisable to normalize the PESW for analyses so that significance levels are not inappropriately affected by the weighted *n*. For a detailed discussion of normalization procedures, please see Appendix C in Patrick et al., 2022.

# SECTION 5 - File Summary: MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026)

## 5-1. Contents of the data

The *MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026)* datafile (hereafter referred to simply as "*MTF Mortality Data Update*") is available as an ASCII file (N=107,346). The file contains cases confirmed deceased (N=3,773), including those with NDI information (N=2,435) and those without NDI information (N=1,338), as well as unconfirmed NDI match cases (N=1,226). Unconfirmed NDI match cases are respondents with NDI matches for whom the MTF team was not able to confirm or rule out whether the respondent and the NDI match were the same person (see Section 2 and Section 3 of the current report for more details).

The *MTF Mortality Data Update* file also includes the PESW. By using PESW in analyses, researchers will be able to produce estimates of mortality outcomes that weight back to the full nationally representative MTF 12th grade samples for the classes of 1976–2019.

Cases whose death status was matched to NDI have a set of records from NDI, including cause(s) of death (*NDI_CAUSE*), date of birth (*NDI_DOBYR, NDI_DOBMO*), date of death (*NDI_DODYR, NDI_DODMO*) and place of death (*NDI_DSTATE* or *NDI_DSTFIPS*). Cases confirmed through the MTF respondent tracking process also have information on date of death (*DODYR_MTF*, *DODMO_MTF*). All cases have a PESW (*ELISAPL_WGT*). Contents of the *MTF Mortality Data Update* are included in Table 5-1.

**Table 5-1.** MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026): Variable List

| | Variable Name | Variable Label (IRN: Label) | Note |
|---|---|---|---|
| 1 | V101 | 80001: BY YEAR OF ADMINST | MTF high school cohorts |
| 2 | V104 | 80004: BY R's ID-SERIAL # | ID |
| 3 | MTFID | Unique MTF IDs | MTF Longitudinal Panel unique IDs |
| 4 | DODYR_MTF | 90209: YEAR OF DEATH_MTF, NOT NDI | Year of Death, from MTF tracking |
| 5 | DODMT_MTF | 90210: MONTH OF DEATH_MTF NOT NDI | Month of Death, from MTF tracking |
| 6 | V34 | 89504: BY R's AGE IN MONTH | From MTF surveys |
| 7 | ELISAPL_WGT | 90211: MTF PANEL ELIG/SAMPL WEIGHT | Analysis weight for use with any mortality analyses |
| 8 | NDI_V101 | 80001: BY YEAR OF ADMINST for those linked to NDI | MTF high school cohorts |
| 9 | NDI_MORTALITY | 90131: Mortality status | Deceased status including unconfirmed NDI match |
| 10 | NDI_DEAD | 90132: NDI linkage status for Confirmed deceased | NDI linkage status for confirmed deceased |
| 11 | NDI_DOBYR | 90133: Date of Birth - Year | Year of birth, from NDI |
| 12 | NDI_DOBMO | 90134: Date of Birth - Month | Month of birth, from NDI |
| 13 | NDI_DODYR | 90135: Date of Death - Year | Year of death, from NDI |
| 14 | NDI_DODMO | 90136: Date of Death - Month | Month of death, from NDI |
| 15 | NDI_DSTATE | 90137: State of Death | Place of death, from NDI |
| 16 | NDI_DSTFIPS | 90138: FIPS State of Death | Place of death (FIPS codes), from NDI |
| 17 | NDI_ICDFLAG | 90139: ICD-9 or ICD-10 | ICD codes for cause of death |

| | | | |
|---|---|---|---|
| 18 | NDI_CAUSE | 90140: Cause of Death | Codes for underlying (primary) cause of death, from NDI |
| 19 | NDI_NUMECOND | 90141: Number of Entity-Axis Conditions | Number of multiple causes of death (entity-axis coding)[1], from NDI |
| 20 | NDI_ECOND01 | 90142: Entity-Axis 1st Condition | 1st condition by entity-axis, from NDI |
| 21 | NDI_ECOND02 | 90143: Entity-Axis 2nd Condition | 2nd condition by entity-axis, from NDI |
| 22 | NDI_ECOND03 | 90144: Entity-Axis 3rd Condition | 3rd condition by entity-axis, from NDI |
| 23 | NDI_ECOND04 | 90145: Entity-Axis 4th Condition | 4th condition by entity-axis, from NDI |
| 24 | NDI_ECOND05 | 90146: Entity-Axis 5th Condition | 5th condition by entity-axis, from NDI |
| 25 | NDI_ECOND06 | 90147: Entity-Axis 6th Condition | 6th condition by entity-axis, from NDI |
| 26 | NDI_ECOND07 | 90148: Entity-Axis 7th Condition | 7th condition by entity-axis, from NDI |
| 27 | NDI_ECOND08 | 90149: Entity-Axis 8th Condition | 8th condition by entity-axis, from NDI |
| 28 | NDI_ECOND09 | 90150: Entity-Axis 9th Condition | 9th condition by entity-axis, from NDI |
| 29 | NDI_ECOND10 | 90151: Entity-Axis 10th Condition | 10th condition by entity-axis, from NDI |
| 30 | NDI_ECOND11 | 90152: Entity-Axis 11th Condition | 11th condition by entity-axis, from NDI |
| 31 | NDI_ECOND12 | 90153: Entity-Axis 12th Condition | 12th condition by entity-axis, from NDI |
| 32 | NDI_ECOND13 | 90154: Entity-Axis 13th Condition | 13th condition by entity-axis, from NDI |
| 33 | NDI_ECOND14 | 90155: Entity-Axis 14th Condition | 14th condition by entity-axis, from NDI |
| 34 | NDI_ECOND15 | 90156: Entity-Axis 15th Condition | 15th condition by entity-axis, from NDI |
| 35 | NDI_ECOND16 | 90157: Entity-Axis 16th Condition | 16th condition by entity-axis, from NDI |
| 36 | NDI_ECOND17 | 90158: Entity-Axis 17th Condition | 17th condition by entity-axis, from NDI |
| 37 | NDI_ECOND18 | 90159: Entity-Axis 18th Condition | 18th condition by entity-axis, from NDI |
| 38 | NDI_ECOND19 | 90160: Entity-Axis 19th Condition | 19th condition by entity-axis, from NDI |
| 39 | NDI_ECOND20 | 90161: Entity-Axis 20th Condition | 20th condition by entity-axis, from NDI |
| 40 | NDI_NUMRCOND | 90162: Number of Record-Axis Conditions | Number of multiple causes of death (record-axis coding)[1], from NDI |
| 41 | NDI_RCOND01 | 90163: Record-Axis 1st Condition | 1st condition by record-axis, from NDI |
| 42 | NDI_RCOND02 | 90164: Record-Axis 2nd Condition | 2nd condition by record-axis, from NDI |
| 43 | NDI_RCOND03 | 90165: Record-Axis 3rd Condition | 3rd condition by record-axis, from NDI |
| 44 | NDI_RCOND04 | 90166: Record-Axis 4th Condition | 4th condition by record-axis, from NDI |
| 45 | NDI_RCOND05 | 90167: Record-Axis 5th Condition | 5th condition by record-axis, from NDI |
| 46 | NDI_RCOND06 | 90168: Record-Axis 6th Condition | 6th condition by record-axis, from NDI |
| 47 | NDI_RCOND07 | 90169: Record-Axis 7th Condition | 7th condition by record-axis, from NDI |
| 48 | NDI_RCOND08 | 90170: Record-Axis 8th Condition | 8th condition by record-axis, from NDI |
| 49 | NDI_RCOND09 | 90171: Record-Axis 9th Condition | 9th condition by record-axis, from NDI |
| 50 | NDI_RCOND10 | 90172: Record-Axis 10th Condition | 10th condition by record-axis, from NDI |
| 51 | NDI_RCOND11 | 90173: Record-Axis 11th Condition | 11th condition by record-axis, from NDI |
| 52 | NDI_RCOND12 | 90174: Record-Axis 12th Condition | 12th condition by record-axis, from NDI |
| 53 | NDI_RCOND13 | 90175: Record-Axis 13th Condition | 13th condition by record-axis, from NDI |
| 54 | NDI_RCOND14 | 90176: Record-Axis 14th Condition | 14th condition by record-axis, from NDI |
| 55 | NDI_RCOND15 | 90177: Record-Axis 15th Condition | 15th condition by record-axis, from NDI |
| 56 | NDI_RCOND16 | 90178: Record-Axis 16th Condition | 16th condition by record-axis, from NDI |
| 57 | NDI_RCOND17 | 90179: Record-Axis 17th Condition | 17th condition by record-axis, from NDI |
| 58 | NDI_RCOND18 | 90180: Record-Axis 18th Condition | 18th condition by record-axis, from NDI |
| 59 | NDI_RCOND19 | 90181: Record-Axis 19th Condition | 19th condition by record-axis, from NDI |
| 60 | NDI_RCODN20 | 90182: Record-Axis 20th Condition | 20th condition by record-axis, from NDI |

**Note: IRN = Item Reference Number.**

[1] **See Exhibit 8 or Appendix B in NDI User Guide for more details (https://www.cdc.gov/nchs/data/ndi/2024-NDI-User-Guide.pdf).**

**NDI coded the causes of death using the International Classification of Diseases 9th Revision (ICD-9) for deaths occurring from 1976–1998, and used the 10th Revision (ICD-10) beginning in 1999. Both ICD-9 and ICD-10 codes are included for the cause of death in the MTF NDI-Mortality File. The MTF team has created a variable, *"NDI_ICDFLAG"*, to indicate which ICD version was used by NDI to code the cause of death. Lists of the ICD-9 and ICD-10 codes are available at the CDC:**

**ICD-9: https://archive.cdc.gov/www_cdc_gov/nchs/icd/icd9cm.htm**

**ICD-10: https://www.cdc.gov/nchs/icd/icd-10/index.html**

The *underlying cause of death* (*NDI_CAUSE*) is the primary cause of death that initiates other events or conditions leading directly to death. The ICD-9 codes are numeric, whereas ICD-10 codes always start with a letter. Whenever the codes (either ICD-9 or ICD-10) have four digits, an implied decimal point occurs after the third digit. For example,

- The value "*0429*" of the *NDI_CAUSE* variable should be read as *042.9* (Human immunodeficiency virus [HIV] disease—unspecified).
- The value "*A419*" of the *NDI_CAUSE* variable should be read as A41.9 (Sepsis, unspecified organism).

The *multiple causes of death* are other significant conditions that contribute to death, but not part of the underlying cause of death. The multiple causes of death are presented in both entity- and record-axis codes in the NDI. Entity-axis codes refer to the original coding conditions on the death certificate which do not reflect the context of other conditions. Record-axis codes are, on the other hand, produced within the context of every other condition on the death certificate.

The entity-axis codes (*NDI_ECOND01 – NDI_ECOND20*) consist of seven digits: the first two digits represent the location of the information on the death certificate, and digits 3–6 indicate ICD-9 or ICD-10 codes. Similar to the underlying cause of death, an implied decimal point should occur after the third digit for ICD-9 and ICD-10 codes. The last digit indicates a flag for the nature of injury (1=the code in digits 3–6 is a Nature of Injury ICD-9 code; 0=All other codes), which is available only for ICD-9 codes. The record-axis codes (*NDI_RCOND01 – NDI_RCOND20*) consist of five digits, where the first four digits represent condition codes according to ICD-9 or ICD-10, and the fifth digit is a flag indicating the nature of injury (1=the codes in digits 1–4 is a Nature of Injury ICD-9 code; 0=All other codes). The fifth digit only exists for ICD-9 codes. Details about the entity- and record-axis codes are available on the NDI User Guide (https://www.cdc.gov/nchs/data/ndi/2024-NDI-User-Guide.pdf).

## 5-2. Summary of the data

### Demographics of those confirmed deceased from the MTF Longitudinal Panel Study cohorts 1976–2019 by March 2026

Table 5-2 presents demographic characteristics of MTF cases confirmed deceased through March 2026 (N=3,773): 61% male; 71% White, 16% Black, 5% Hispanic, and 8% either other racial groups or missing. About 42% of deaths among those confirmed deceased with NDI information (where location of death is available) occurred in the South, 25% in the Midwest, 18% in the West, and 16% in the Northeast. By age, 2% died before age 20; 7% at ages 20–24; 6% at ages 25–29; each about 14% at ages 45–49, 50–54, and 55–59; and 11% at or after age 60.

**Table 5-2.** Survey-Weighted Demographic Characteristics Among Those Confirmed Deceased, Using MTF Panel Eligibility and Selection Weights (N=3,773)

| Variables | Weighted Proportion (unweighted n) | Variables | Weighted Proportion (unweighted n) |
|---|---|---|---|
| Sex (n=3,767) | | Age at death (n=3,753[1]) | |
| Male | 0.607 (2,346) | Under age 20 | 0.020 (83) |
| Female | 0.393 (1,421) | 20-24 | 0.074 (301) |
| Race (n=3,773) | | 25-29 | 0.063 (256) |
| Black | 0.161 (519) | 30-34 | 0.096 (369) |
| White | 0.709 (2,776) | 35-39 | 0.096 (391) |
| Hispanic | 0.052 (189) | 40-44 | 0.112 (428) |
| Others or missing | 0.078(289) | 45-49 | 0.142 (513) |
| Place (Census regions) of death (n=2,434) | | 50-54 | 0.143 (511) |
| South | 0.422 (1,011) | 55-59 | 0.142 (505) |
| Midwest | 0.246 (615) | 60 or older | 0.112 (396) |
| West | 0.175 (414) | | |
| Northeast | 0.157 (394) | | |

Note: Age at death was calculated from month/year of birth obtained from MTF surveys and death/year of death from NDI or Accurint/obituary.

[1] 20 cases were excluded due to missing on self-reported dates of birth.

Census Regions: https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

## Top five causes of death

The top five causes of death from the *MTF Mortality Data Update (March 2026)* include drug overdoses (X44 and X42; 5.1%), malignant neoplasm of breast (C50.9; 3.4%), acute myocardial infarction (I21.9; 3.2%), atherosclerotic heart disease of native coronary artery (I25.1; 2.6%), and intentional self-harm (suicide) by other and unspecified firearm discharge (X74; 2.5%; Table 5-3).

**Table 5-3.** Survey-Weighted Proportions of the Top 5 Causes of Death Among Deceased Cases Linked to NDI Using MTF Panel Eligibility and Selection Weights (N=2,435)

| Top Ranking | ICD Code | Description | Weighted proportion (Unweighted N) |
|---|---|---|---|
| 1 | X42; X44 | Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified (X42); Accidental poisoning by and exposure to other and unspecified drugs, medicaments, and biological substances (X44) | 0.0508 (175) |
| 2 | C50.9 | Malignant neoplasm of breast, unspecified | 0.0338 (71) |
| 3 | I21.9 | Acute myocardial infarction, unspecified | 0.0324 (76) |
| 4 | I25.1 | Atherosclerotic heart disease of native coronary artery | 0.0257 (61) |
| 5 | X74 | Intentional self-harm (suicide) by other and unspecified firearm discharge | 0.0253 (71) |

Note: ICD-9 codes were extracted from Appendix E - List of Three-Digit Categories at https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD9-CM/2011/.

ICD-10 codes were extracted from https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD10/allvalid2023-detailed-titles-headings.pdf.

# SECTION 6 - Using the MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026) With Existing MTF Survey Data

A unique identifier (MTFID) is included in the *MTF Mortality Data Update (March 2026)*. Researchers will need to match on MTFID to link the mortality data to the MTF Longitudinal Panel datasets in the Virtual Data Enclave of the National Addiction & Health Data Archive Program (NAHDAP).[6]

For those who are interested in all-cause mortality (i.e., death from any cause), a death indicator, *NDI_MORTALITY==2*, should be used. For dates of death from any source, researchers may combine NDI dates of death (*NDI_DODYR*, *NDI_DODMO*) with dates from the MTF tracking (*DODYR_MTF*, *DODMO_MTF*). For dates of birth, researchers may use the self-reported date of birth in months (*V34*), which is available for all deceased cases regardless of the confirmation source, or dates of birth from NDI (*NDI_DOBYR*, *NDI_DOBMO)*, which is only available for deceased cases linked to NDI.

For all analyses using MTF Longitudinal Panel data that have a mortality status as an outcome, researchers should use PESW included in the *MTF Longitudinal Panel Study Mortality Data & Weights for Cohorts 1976–2019 (Updated March 2026)* file. Please see Section 4 of this report for more details.

[6] https://www.icpsr.umich.edu/web/NAHDAP/series/2520

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# APPENDIX A

## MTF Longitudinal Panel tracking data resources

### Accurint

Accurint is a multi-faceted database that combines data from a variety of state and national sources into one intuitive, searchable, and wide-ranging resource.

From their website:

*"Accurint® is a LexisNexis® service that brings data to life. Accurint provides information products that allow organizations to quickly and easily extract valuable knowledge from huge amounts of data. These innovative products are made possible by integrating powerful technology, tens of billions of data records on individuals and businesses, and proprietary data-linking methods.*

*Accurint® is the most widely accepted locate-and-research tool available to government, law enforcement, and commercial customers. Its proprietary data-linking technology returns search results in seconds to the User's desktop.*

*Key features include:*

- *People Search… locates neighbors, associates and possible relatives.*
- *Advanced Person Search… helps find individuals when only old or fragmented data is available.*
- *Real-Time Phones… includes a history of land line and cell phone numbers.*

*LexisNexis® is an industry leader in the responsible use of data and protection of individual privacy. Accurint, using public records and non-public information, provides invaluable fraud detection and identity solutions for the public and private sectors. Accurint helps safeguard citizens and reduces financial losses."*

The Survey Research Center of the Institute for Social Research at the University of Michigan tested several similar applications and found that Accurint is the most accurate source of information for tracking subjects for the MTF project.

For the purposes of the NDI Full Submission Protocol, 15 trained coders were assigned an **Accurint user ID** and **password** to use in their coding work. Coders only used Accurint for University of Michigan work, specifically using it when they were logged on to the Ann Arbor/Survey Research Operation VPN.

### Obituaries

MTF coders used the Google search engine to search for obituaries to confirm the status of Longitudinal Panel respondents. A search must match at least 2 pieces of information relevant to an MTF Longitudinal Panel respondent (R): R's name, R's high school and class year, R's address(es), or R's parent or spouse information.

### MTF tracking database

The MTF Data Collection Team has been tracking the location of MTF Longitudinal Panel respondents since 1976, and currently tracks over 115,000 individuals. The tracking is conducted using a database designed as a set of very large tables that store data for each respondent, including respondent status (active, deceased, lost, etc.), response to the surveys, address and contact information, contact people other than respondents, etc. If we receive any notification about death of a MTF Longitudinal Panel respondent from a contact person, we update the respondent's status as "deceased" and attempt to confirm the status using Accurint and obituary searches.

## MTF Longitudinal Panel tracking coding procedures

### Find the current location of the MTF respondent (R)

Before examining death certificate matches, the MTF respondent (R) must be located in Accurint or in an Obituary confirming that we have identified our respondent that participated in the 12th grade. To do this, we established rules such that we have enough information that confirms our R's identity. For each R, their name(s) given to us by themselves (original or current) and at least two other pieces of information from Accurint or the Obituary must match our longitudinal tracking information. There are four types of information that can be used to match with R's name(s): addresses provided by R; R's high school name and class year; R's known relative's names (must have been given to us by R); and R's known relative's addresses.

1. Accurint search rules

   An Accurint record must link back to MTF R's name(s) in at least two ways:

   - The address of R
   - The address of a relative (specific name and contact information given to us by R)
   - R's known relative's last name

   Once we find a known relative in Accurint, use Accurint's "Relatives" list to find R at an old or new address, or with a possible new last name, but the old name must be listed.

2. Obituaries search rules

An obituary must link back to MTF R's name(s) in at least two ways:

- The address of R
- R's known relative's name(s)
- R's high school and class year

## Confirm R's mortality status

1. Deceased in Accurint
    a. Code as "*Deceased*".
2. If not deceased in Accurint, go to Step 3.
3. Search for obituaries:
    a. If an obituary is found, code as "*Deceased*" and identify if there is a matching death certificate.
    b. If an obituary is not found, move onto Step 4.
4. Use the last-activity-date in the internal database to rule out mismatched death certificates by date of death (DOD).
    a. If R is Active in the internal database, and all death certificates are ruled out, then R is coded "*Alive*".
    b. If R's participation has been suppressed (e.g., refused, lost, nonresponse, unable) in the database; and all death certificates are ruled out; and the last-activity-date in Accurint is within two years of the search day date, R is coded "*Alive*".
    c. If one or more death certificates cannot be ruled out, go to Step 5.
5. Search Accurint or obituaries using the specific death certificate information (e.g., dates of death) to find out if this is the MTF R.
    a. If able to confirm this is our R, code as "Deceased".
    b. If not, code as "Unconfirmed NDI match".

Note: Unconfirmed NDI match cases are respondents with an NDI match but the MTF team was not able to confirm or disconfirm that the respondent and the NDI match were the same person.

## Death certificate matching

If found deceased, confirm the death certificate information to a resource found when searching for R. That is, confirm whether the DOD on the death certificate matches either DOD of Accurint or DOD of R's obituary.