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# **Monitoring the Future Longitudinal Panel Study mortality data 1976– 2021 report**

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**MONITORING THE FUTURE LONGITUDINAL PANEL STUDY  
MORTALITY DATA 1976–2021 REPORT**

*by:*

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## **SECTION 1 - Overview**

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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). A primary goal is to examine potential consequences of substance use across the life course, including mortality. Therefore, the MTF Longitudinal Panel Study now includes measures of mortality linked to the National Death Index (NDI) including dates of death, place of death, and cause(s) of death.

This document describes the process of linking the MTF Longitudinal Panel data to NDI and methods used to identify the correct NDI record for MTF participants and to code them for use. Furthermore, we include a comparison of the death rates in the MTF Longitudinal Panel Study to national death rates for the same age groups, as well as key findings from the first MTF Longitudinal Panel Study mortality data.

## **SECTION 2 - Protocol of NDI Submission and Coding**

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### **MTF Longitudinal Panel Study cohorts included in the first mortality datafile**

Since 1976, MTF has enrolled ~2,450 individuals each year from its nationally representative annual sample of 12<sup>th</sup> graders (Miech et al., 2025) into the MTF Longitudinal Panel Study (Patrick et al., 2025). These panel members are followed up every other year in young adulthood (i.e., modal ages 19/20 to 29/30), and in adulthood starting at modal age (hereafter referred to simply as “age”) 35 and then every five years thereafter (i.e., ages 35, 40, 45, 50, 55, 60, and 65). The MTF Longitudinal Panel Study now includes over 115,000 individuals up to age 65 who were first surveyed in 12<sup>th</sup> grade at age 18 in 1976–2024.

In 2022, the MTF team submitted information for the MTF Longitudinal Panel respondents from cohorts 1976–2019 to NDI. Over the course of data cleaning/coding, we additionally reviewed the mortality status of respondents from cohorts 1976–2021 to align the mortality data with the existing MTF Longitudinal Panel Study 1976–2021 at the National Addiction & HIV Data Archive Program (NAHDAP). Therefore, the MTF Longitudinal Panel Study Mortality Data 1976–2021 file includes MTF Longitudinal Panel members from the high school cohorts of 1976–2021 whose mortality status was confirmed through either 1) the MTF NDI match process (limited to high school cohorts 1976–2019) or 2) the MTF internal tracking process (including 1976–2021 cohorts, tracking through August 2025).

### **MTF data submission to NDI**

#### **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.<sup>1</sup>

In 2020 and 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

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<sup>1</sup> Usually, a record is deemed as a possible match if a particular NDI death record satisfies at least one of 7 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 two 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>).

from the 2006 cohort were submitted to NDI. The pilot submission included first, middle, and last name, as well as month and year of birth.

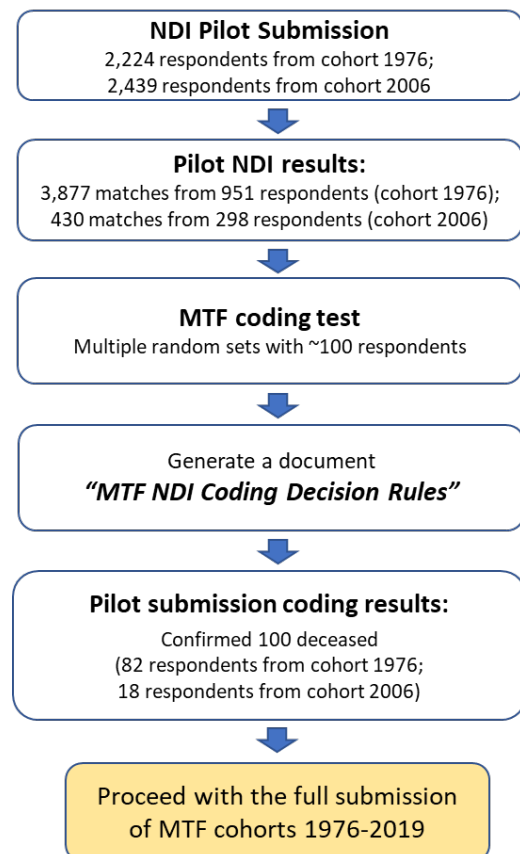
From the pilot submission, we received 3,877 possible NDI record matches for 951 MTF respondents from the 1976 cohort and 430 possible matches for 298 respondents from the 2006 cohort. To sort true matches from false matches of NDI records to MTF Longitudinal Panel respondents, two trained coders reviewed 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,<sup>2</sup> 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 1**.

### NDI full submission: cohorts 1976–2019

In January 2022, the MTF team submitted information for 105,731 MTF Longitudinal Panel respondents from cohorts 1976–2019 to NDI. The 100 confirmed deceased cases from the pilot submission were excluded because their death status was already known. Due to the NDI two-year lag in their data, the submission search covered deaths that could have occurred 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



**Figure 1.** MTF NDI pilot submission for MTF cohorts 1976 and 2006

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

respondents who had at least one NDI record match. Each case was reviewed by two coders based on “*MTF NDI Coding Decision Rules*”; coders could not see the results of the other coder. The initial coding was completed in Fall 2023.

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

The initial coding of the NDI full submission yielded 92.3% agreements (16,437 cases alive; 2,442 deceased; 1,426 unconfirmed NDI matches<sup>3</sup>) and 7.7% disagreements between coders (1,696 cases). To examine reliability between coders, we calculated Cohen’s Kappa coefficients (Table 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.<sup>4</sup>

**Table 1.** Cohen’s Kappa coefficients for NDI coders

Coders	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	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.

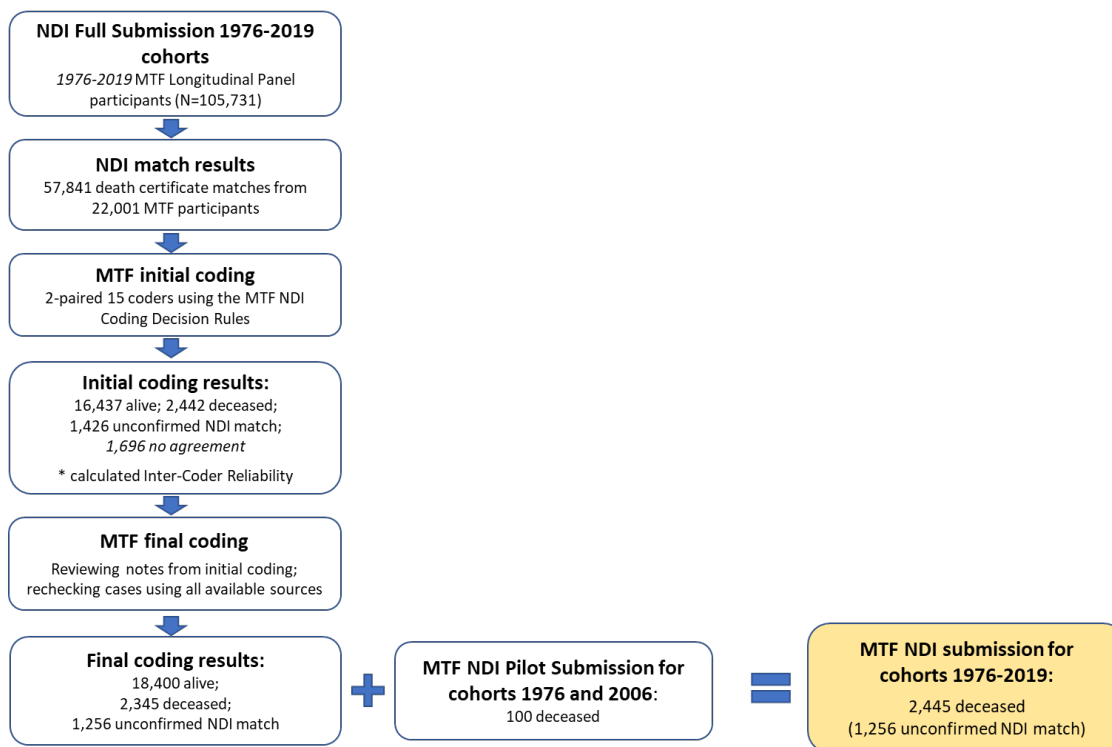
## Final coding results for the NDI full submission

In 2024, MTF conducted 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, we had 2,345 deceased, 18,400 alive, and 1,256 unconfirmed NDI matches.<sup>3</sup> Combining with deceased cases from the pilot submission (N=100), the NDI submission of MTF cohorts 1976–2019 yielded

<sup>3</sup> 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.

<sup>4</sup> Generally, Kappa values of greater than 0.75 represent excellent agreement ([https://elentra.healthsci.queensu.ca/assets/modules/reproducibility/kappa\\_values.html](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.

2,445 deceased successfully linked to a death certificate and 1,256 unconfirmed NDI matches (see Figure 2).



**Figure 2.** MTF NDI full submission and coding results for MTF cohorts 1976–2019

## SECTION 3 - Comparison with National Mortality Rates

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For the MTF Longitudinal Panel respondents from cohorts 1976–2019 whose information was submitted to NDI and whose death was confirmed by MTF (N=2,445), we assessed how closely the total observed deaths aligned with the expected number based on US mortality statistics. Because the MTF Longitudinal Panel study represents individuals who do not drop out of high school, the observed proportion of deaths should align with the expected proportion derived from US mortality statistics for those with a high school degree or higher.

We estimated the mortality rate of MTF Longitudinal Panel participants based on the US mortality statistics. These approaches took into account MTF's exclusion of those who dropped out of high school in two different ways; both approaches produced a comparable number of deaths. Details about both approaches follow.

### Adjust US year-specific death rates for high school graduates

To obtain age-specific death rates specific to high school graduates, we started with US age-specific yearly death rates (**Table 2**) and then adjusted them to predict mortality rates without those with less than 12 years of education (**Table 3**).<sup>5</sup> By year, we estimated the proportion of deaths among individuals aged 15–64 with less than 12 years of education (referred to as “those who dropped out of high school” hereafter). Then, the overall death rates were adjusted by subtracting the proportion of deaths among those who dropped out of high school. As the education variable is available only from 1989 onward in the US mortality statistics, yearly death rates for those who dropped out of high school were used in 1989–2020; a constant average proportion of deaths among those who dropped out of high school before 1989 was used to calculate the death rates without those who dropped out of high school for the years of 1976–1988 in **Table 3**.

Next, we calculated the expected number of deaths for each MTF 12<sup>th</sup> grade cohort (**Table 4**). For example, the 1976 cohort started with 2,224 members at age 18 in 1976. In 1977, the cohort turned age 19; applying the 1977 mortality rate for high school graduates (78.50 per 100,000) leads to an expectation of two deaths, and consequently the expected size of the cohort would be 2,222 going into 1978. Applying the 1978 mortality rate for high school graduates 20–24 years old to the remaining 2,222 members leads to an expectation of two additional deaths, with a total of 1963.2 survivors going into 1979. This process was continued for each year through 2020 because the NDI submission covers death by the year 2020. The same process was then repeated for each of the remaining cohorts, generating the numbers to calculate the cumulative total of expected

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<sup>5</sup> We pulled yearly death rates by education level from the Mortality Multiple Cause Files at the Center for Disease Control (CDC) ([https://www.cdc.gov/nchs/data\\_access/vitalstatsonline.htm](https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm)).

deaths among high school graduates for the 1976–2019 cohorts by the year 2020. With this approach, the expected number of deceased MTF Longitudinal Panel participants was ~3,596 (i.e., 3.4 % of the total sample size of 105,731), which is higher than the 2,445 (2.3%) identified in the MTF NDI submission and coding process (Table 4).

**Table 2. US death rates per 100,000, by age groups**

Year	MTF LP age	Age Groups									
		15-19	20-24	25-34		35-44		45-54		55-64	
				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

**Note:** MTF LP (Monitoring the Future Longitudinal Panel)

**Sources:** For 1976–1978, *Compressed Mortality, 1968-1978* from death certificates

(<https://wonder.cdc.gov/controller/datarequest/D74>); For 1979–1998, *Compressed Mortality, 1999-1998* from death certificates (<https://wonder.cdc.gov/controller/datarequest/D16>); For 1999–2020, *Multiple Cause of Death, 1999-2020* from death certificates (<https://wonder.cdc.gov/controller/datarequest/D77>).

**Table 3. US death rates per 100,000 without those who dropped out of high school, 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										
					25-29	30-34	35-39	40-44	45-59	50-54	55-59	60-64								
1976	21.34%*	18	75.28																	
1977	21.34%*	19	78.50																	
1978	21.34%*	20	77.79	103.52																
1979	21.34%*	21	77.72	103.04																
1980	21.34%*	22	77.01	104.38																
1981	21.34%*	23	70.79	96.67																
1982	21.34%*	24	67.18	90.46	98.40															
1983	21.34%*	25	63.79	84.95	95.41															
1984	21.34%*	26	63.24	86.21	95.89															
1985	21.34%*	27	63.32	84.56	97.85															
1986	21.34%*	28	67.80	89.91	104.93			167.78		399.75										
1987	21.34%*	29	65.68	87.31	105.96			168.80		394.79										
1988	21.34%*	30	68.20	88.57	107.84			173.21		385.83										
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							

**Note:** MTF LP (Monitoring the Future Longitudinal Panel). Authors calculated the US death rates per 100,000 without those who dropped out of high school. The education variable is only available from 1989 in *Mortality multiple cause files 1989-2020*. The average proportion of death rates by those who dropped out of high school during 1989–2020 were used for those before 1989.

**Data Sources:** For 1976–1978, *Compressed Mortality, 1968-1978* from death certificates (<https://wonder.cdc.gov/controller/datarequest/D74>); For 1979–1998, *Compressed Mortality, 1999-1998* from death certificates (<https://wonder.cdc.gov/controller/datarequest/D16>); For 1999–2020, *Multiple Cause of Death, 1999-2020* from death certificates (<https://wonder.cdc.gov/controller/datarequest/D77>); For death by education level, *Mortality multiple cause files 1989-2020* ([https://www.cdc.gov/nchs/data\\_access/vitalstatsonline.htm#Mortality\\_Multiple](https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm#Mortality_Multiple)).

**Table 4. Number of estimated survived and deceased respondents, adjusting yearly death rates for those who dropped out of high school in the MTF Longitudinal Panel Study**

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	2,224	1963.2	322.0	1902.0	260.8	158
1977	2,358	2099.5	319.6	2038.4	258.5	174
1978	2,411	2167.0	302.0	2109.0	244.0	175
1979	2,437	2212.4	278.3	2158.7	224.6	164
1980	2,458	2246.7	262.0	2196.0	211.3	142
1981	2,458	2262.2	243.0	2215.0	195.8	130
1982	2,437	2258.5	221.7	2215.3	178.5	134
1983	2,426	2263.2	202.5	2223.5	162.8	117
1984	2,438	2290.2	184.1	2253.9	147.8	100
1985	2,467	2328.1	173.2	2293.8	138.9	92
1986	2,461	2332.9	159.8	2301.2	128.1	78
1987	2,466	2347.8	147.5	2318.5	118.2	61
1988	2,456	2348.6	134.2	2321.8	107.4	74
1989	2,478	2380.0	122.6	2355.4	98.0	66
1990	2,470	2378.7	114.1	2355.9	91.3	64
1991	2,473	2387.8	106.5	2366.5	85.2	58
1992	2,479	2399.6	99.2	2379.8	79.4	51
1993	2,449	2376.1	91.0	2358.0	72.9	46
1994	2,467	2399.4	84.4	2382.6	67.6	43
1995	2,469	2404.9	80.0	2389.0	64.1	50
1996	2,440	2380.1	74.6	2365.4	59.9	34
1997	2,457	2400.0	70.9	2386.1	57.0	40
1998	2,454	2400.6	66.4	2387.6	53.4	40
1999	2,459	2409.2	61.9	2397.1	49.8	36
2000	2,456	2409.0	58.3	2397.7	47.0	42
2001	2,448	2403.9	54.8	2393.2	44.1	33
2002	2,453	2411.7	51.2	2401.8	41.3	21
2003	2,449	2410.7	47.3	2401.7	38.3	32
2004	2,450	2415.0	43.2	2406.8	35.0	25
2005	2,450	2417.6	40.0	2410.0	32.4	20
2006	2,452	2422.2	36.7	2415.3	29.8	20
2007	2,452	2424.9	33.4	2418.6	27.1	20
2008	2,454	2429.5	30.1	2423.9	24.5	16
2009	2,453	2431.4	26.6	2426.4	21.6	16
2010	2,450	2430.5	23.9	2426.1	19.5	15
2011	2,450	2432.7	21.2	2428.8	17.3	14
2012	2,452	2436.9	18.5	2433.5	15.1	12
2013	2,450	2437.1	15.9	2434.1	12.9	6
2014	2,450	2439.4	13.0	2437.0	10.6	8
2015	2,451	2442.3	10.7	2440.3	8.7	2
2016	2,450	2443.2	8.3	2441.7	6.8	6
2017	2,452	2447.0	6.1	2445.9	5.0	5
2018	2,450	2446.9	3.9	2446.1	3.1	2
2019	2,450	2448.8	1.4	2448.6	1.2	3
<b>Total</b>		-	<b>3,596.2</b>	-	<b>4,466.0</b>	<b>2,445</b>

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).

## 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 three times higher for those who dropped out of high school compared to high school graduates.<sup>6</sup>

First, we calculated the expected number of deaths by 2020 in each 12<sup>th</sup> grade cohort from 1976 to 2019 using US death statistics for the total population, including both high school graduates and those who dropped out of high school (column 4 in **Table 5**). After computing the expected number of deceased for each 12<sup>th</sup> grade cohort, we used the following formula:

*Total number of deaths in the US population cohort by 2020 =*

$1 \times (x)(\# \text{ of high school graduates in the US population cohort at age 18}) +$

$3 \times (x)(\# \text{ of those who dropped out of high school in the US population cohort at age 18})$

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 5**).

With information on the mortality rate ( $x$ ), the # of deceased among high school graduates was calculated as  $(x) \times (\text{original MTF cohort size})$ . We then summed the expected number of deceased for all cohorts. An assumption of a three-times-higher mortality rate for those who dropped out of high school yielded an expected 3,142.2 cases dead, compared to the 2,445 MTF Longitudinal Panel members confirmed as deceased (columns 11 and 12 in **Table 5**). As a sensitivity analysis, an assumption of a 4-times-higher mortality rate for those who dropped out of high school yielded an expected 3,269 deceased, and an assumption of a 2-times-higher rate yielded an expected 4,001 deceased.

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<sup>6</sup> 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 5. Estimated cohort-specific mortality rates for those who dropped out of high school and high school graduates in the MTF Longitudinal Panel Study**

MTF HS Cohort	Size of MTF LP	Estimated Vital Stats.		Dropout rates	Overall # dead = $x \times \text{nondropouts} + 3x \times \text{dropouts}$						Confirmed # deceased by MTF
		# survived	# deceased		# of non-dropouts	# of dropouts	Death rates for non-dropouts	Death rates for dropouts	# deceased dropouts	# deceased non-dropouts	
1976	2,224	1,908	316	0.14	1912.64	311	0.11	0.33	103.75	212.44	158
1977	2,358	2,041	317	0.14	2027.88	330	0.10	0.31	103.89	212.72	174
1978	2,411	2,107	304	0.14	2073.46	338	0.10	0.30	99.83	204.42	175
1979	2,437	2,150	287	0.14	2095.82	341	0.09	0.28	94.29	193.07	164
1980	2,458	2,189	269	0.14	2113.88	344	0.09	0.26	88.30	180.81	142
1981	2,458	2,209	249	0.14	2113.88	344	0.08	0.24	81.55	166.98	130
1982	2,437	2,211	226	0.14	2095.82	341	0.07	0.22	74.00	151.52	134
1983	2,426	2,223	203	0.14	2086.36	340	0.07	0.20	66.76	136.70	117
1984	2,438	2,257	181	0.13	2121.06	317	0.06	0.18	56.14	125.24	100
1985	2,467	2,294	173	0.13	2146.29	321	0.06	0.17	53.56	119.48	92
1986	2,461	2,299	162	0.13	2141.07	320	0.05	0.16	50.14	111.85	78
1987	2,466	2,314	152	0.13	2145.42	321	0.05	0.15	47.03	104.91	61
1988	2,456	2,315	141	0.13	2136.72	319	0.05	0.14	43.70	97.49	74
1989	2,478	2,346	132	0.13	2155.86	322	0.04	0.13	40.98	91.42	66
1990	2,470	2,348	122	0.12	2173.60	296	0.04	0.12	35.50	86.77	64
1991	2,473	2,360	113	0.12	2176.24	297	0.04	0.11	32.72	79.98	58
1992	2,479	2,375	104	0.11	2206.31	273	0.03	0.10	28.03	75.58	51
1993	2,449	2,356	93	0.11	2179.61	269	0.03	0.09	25.25	68.10	46
1994	2,467	2,383	84	0.11	2195.63	271	0.03	0.08	22.82	61.55	43
1995	2,469	2,389	80	0.11	2197.41	272	0.03	0.08	21.65	58.40	50
1996	2,440	2,365	75	0.11	2171.60	268	0.03	0.08	20.25	54.60	34
1997	2,457	2,386	71	0.11	2186.73	270	0.02	0.07	19.22	51.84	40
1998	2,454	2,387	67	0.11	2184.06	270	0.02	0.07	18.02	48.60	40
1999	2,459	2,396	63	0.11	2188.51	270	0.02	0.06	16.96	45.75	36
2000	2,456	2,397	59	0.11	2185.84	270	0.02	0.06	15.84	42.71	42
2001	2,448	2,394	54	0.11	2178.72	269	0.02	0.05	14.68	39.58	33
2002	2,453	2,403	50	0.11	2183.17	270	0.02	0.05	13.55	36.55	21
2003	2,449	2,403	46	0.10	2204.10	245	0.02	0.05	11.39	34.16	32
2004	2,450	2,409	41	0.10	2205.00	245	0.01	0.04	10.17	30.50	25
2005	2,450	2,412	38	0.09	2229.50	221	0.01	0.04	8.66	29.17	20
2006	2,452	2,417	35	0.09	2231.32	221	0.01	0.04	8.00	26.95	20
2007	2,452	2,420	32	0.09	2231.32	221	0.01	0.03	7.33	24.71	20
2008	2,454	2,425	29	0.08	2257.68	196	0.01	0.03	6.05	23.18	16
2009	2,453	2,427	26	0.08	2256.76	196	0.01	0.03	5.46	20.92	16
2010	2,450	2,427	23	0.07	2278.50	172	0.01	0.03	4.31	19.08	15
2011	2,450	2,430	20	0.07	2278.50	172	0.01	0.02	3.74	16.57	14
2012	2,452	2,435	17	0.07	2280.36	172	0.01	0.02	3.18	14.10	12
2013	2,450	2,436	14	0.07	2278.50	172	0.01	0.02	2.63	11.63	6
2014	2,450	2,439	11	0.07	2278.50	172	0.00	0.01	1.99	8.83	8
2015	2,451	2,442	9	0.06	2303.94	147	0.00	0.01	1.47	7.66	2
2016	2,450	2,443	7	0.06	2303.00	147	0.00	0.01	1.17	6.12	6
2017	2,452	2,447	5	0.06	2304.88	147	0.00	0.01	0.88	4.61	5
2018	2,450	2,446	4	0.06	2303.00	147	0.00	0.00	0.61	3.16	2
2019	2,450	2,448	2	0.06	2303.00	147	0.00	0.00	0.33	1.73	3
<b>Total</b>									<b>1365.76</b>	<b>3142.16</b>	<b>2,445</b>

**Note:** MTF LP (Monitoring the Future Longitudinal Panel); Dropouts (those who dropped out of high school); Non-dropouts (high school graduates).

## **Conclusions on the quality of MTF's NDI matched mortality estimates**

These results indicate that the MTF Longitudinal Panel mortality estimates from the NDI submission have a sensitivity between 68% to 75%. 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 coding procedures identified 2,445 cases, which compares to an expected number of 3,269 to 3,596 dead based on national death rates of same-aged US adults who have a high school education. These numbers correspond to MTF identifying 68% to 75% 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 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 1,256 individuals. Note that for these 1,256 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 (if they did not participate or were suppressed early on 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. In the future, all “unconfirmed NDI match” cases will be resubmitted to the NDI for possible updates to death records, so additional deaths from these cases may be identified.

Researchers conducting mortality analyses using MTF Longitudinal Panel 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 mortality status among respondents coded as “unconfirmed NDI match” on the basis of their individual-level covariates in conjunction with information from the aggregate data. However, we urge researchers to determine the methods that will work best for their studies.

## **SECTION 4 - MTF Longitudinal Panel Mortality Data 1976–2021**

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During the final round of coding for the NDI full submission (cohorts 1976–2019), the MTF team reviewed the mortality status of respondents from the cohorts 2020–2021 to align the mortality data with the existing MTF Longitudinal Panel Study data available at NAHDAP. As a result, we identified 441 additional cases who were confirmed deceased via the MTF NDI Coding Decision Rules. We were not able to match them to NDI death certificates because they were not included in the NDI submission (i.e., 2020–2021 cohorts).

Combining these cases, the first MTF Longitudinal Panel Mortality Data 1976–2021 file includes 2,886 deceased cases, including both those with an NDI death record (N=2,445) and those confirmed deceased without NDI information (N=441), and 1,256 unconfirmed NDI match cases. 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 who are confirmed deceased but without NDI information, as well as unconfirmed NDI match, will be included in the next NDI submission.

## SECTION 5 - Overview of the MTF Longitudinal Panel Mortality Data 1976–2021 File

### Contents of the data

The MTF Longitudinal Panel Mortality Data 1976–2021 file (MTF NDI-Mortality file) is available as an ASCII file (N=4,142). The file contains cases confirmed deceased (N=2,886), including those without NDI information (N=441) and those with NID information (N=2,445), as well as unconfirmed NDI match cases (N=1,256). Cases whose death status were confirmed and matched to NDI have a set of records from NDI, including cause(s) of death, dates of birth (month and year), dates of death (month and year), and place of death, as well as the MTF Longitudinal Panel unique ID. Contents of the MTF NDI-Mortality file are included in **Table 6**.

**Table 6. MTF Longitudinal Panel Mortality Data 1976–2021 file variable list (54 variables)**

	Variable Name	Variable Label (IRN: Label)	Note
1	MTFID	Unique MTF IDs	MTF Longitudinal Panel unique IDs
2	NDI_V101	80001: BY YEAR OF ADMINST	MTF high school cohorts
3	NDI_MORTALITY	90131: Mortality status	Deceased status including unconfirmed NDI match <sup>1</sup>
4	NDI_DEAD	90132: NDI linkage status for Confirmed deceased	NDI linkage status for confirmed deceased
5	NDI_DOBYSR	90133: Date of Birth - Year	Year of birth
6	NDI_DOBMO	90134: Date of Birth - Month	Month of birth
7	NDI_DODYSR	90135: Date of Death - Year	Year of death
8	NDI_DODMO	90136: Date of Death - Month	Month of death
9	NDI_DSTATE	90137: State of Death	Place of death
10	NDI_DSTFIPS	90138: FIPS State of Death	Place of death (FIPS codes)
11	NDI_ICDFLAG	90139: ICD-9 or ICD-10	ICD codes for cause of death
12	NDI_CAUSE	90140: Cause of Death	Codes for underlying (primary) cause of death
13	NDI_NUMECOND	90141: Number of Entity-Axis Conditions	Number of multiple causes of death (entity-axis coding) <sup>2</sup>
14	NDI_ECOND01	90142: Entity-Axis 1st Condition	1 <sup>st</sup> condition by entity-axis
15	NDI_ECOND02	90143: Entity-Axis 2nd Condition	2 <sup>nd</sup> condition by entity-axis
16	NDI_ECOND03	90144: Entity-Axis 3rd Condition	3 <sup>rd</sup> condition by entity-axis
17	NDI_ECOND04	90145: Entity-Axis 4th Condition	4 <sup>th</sup> condition by entity-axis
18	NDI_ECOND05	90146: Entity-Axis 5th Condition	5 <sup>th</sup> condition by entity-axis
19	NDI_ECOND06	90147: Entity-Axis 6th Condition	6 <sup>th</sup> condition by entity-axis
20	NDI_ECOND07	90148: Entity-Axis 7th Condition	7 <sup>th</sup> condition by entity-axis
21	NDI_ECOND08	90149: Entity-Axis 8th Condition	8 <sup>th</sup> condition by entity-axis
22	NDI_ECOND09	90150: Entity-Axis 9th Condition	9 <sup>th</sup> condition by entity-axis
23	NDI_ECOND10	90151: Entity-Axis 10th Condition	10 <sup>th</sup> condition by entity-axis
24	NDI_ECOND11	90152: Entity-Axis 11th Condition	11 <sup>th</sup> condition by entity-axis
25	NDI_ECOND12	90153: Entity-Axis 12th Condition	12 <sup>th</sup> condition by entity-axis
26	NDI_ECOND13	90154: Entity-Axis 13th Condition	13 <sup>th</sup> condition by entity-axis
27	NDI_ECOND14	90155: Entity-Axis 14th Condition	14 <sup>th</sup> condition by entity-axis
28	NDI_ECOND15	90156: Entity-Axis 15th Condition	15 <sup>th</sup> condition by entity-axis
29	NDI_ECOND16	90157: Entity-Axis 16th Condition	16 <sup>th</sup> condition by entity-axis
30	NDI_ECOND17	90158: Entity-Axis 17th Condition	17 <sup>th</sup> condition by entity-axis
31	NDI_ECOND18	90159: Entity-Axis 18th Condition	18 <sup>th</sup> condition by entity-axis

32	NDI_ECOND19	90160: Entity-Axis 19th Condition	19 <sup>th</sup> condition by entity-axis
33	NDI_ECOND20	90161: Entity-Axis 20th Condition	20 <sup>th</sup> condition by entity-axis
34	NDI_NUMRCOND	90162: Number of Record-Axis Conditions	Number of multiple causes of death (record-axis coding) <sup>2</sup>
35	NDI_RCOND01	90163: Record-Axis 1st Condition	1 <sup>st</sup> condition by record-axis
36	NDI_RCOND02	90164: Record-Axis 2nd Condition	2 <sup>nd</sup> condition by record-axis
37	NDI_RCOND03	90165: Record-Axis 3rd Condition	3 <sup>rd</sup> condition by record-axis
38	NDI_RCOND04	90166: Record-Axis 4th Condition	4 <sup>th</sup> condition by record-axis
39	NDI_RCOND05	90167: Record-Axis 5th Condition	5 <sup>th</sup> condition by record-axis
40	NDI_RCOND06	90168: Record-Axis 6th Condition	6 <sup>th</sup> condition by record-axis
41	NDI_RCOND07	90169: Record-Axis 7th Condition	7 <sup>th</sup> condition by record-axis
42	NDI_RCOND08	90170: Record-Axis 8th Condition	8 <sup>th</sup> condition by record-axis
43	NDI_RCOND09	90171: Record-Axis 9th Condition	9 <sup>th</sup> condition by record-axis
44	NDI_RCOND10	90172: Record-Axis 10th Condition	10 <sup>th</sup> condition by record-axis
45	NDI_RCOND11	90173: Record-Axis 11th Condition	11 <sup>th</sup> condition by record-axis
46	NDI_RCOND12	90174: Record-Axis 12th Condition	12 <sup>th</sup> condition by record-axis
47	NDI_RCOND13	90175: Record-Axis 13th Condition	13 <sup>th</sup> condition by record-axis
48	NDI_RCOND14	90176: Record-Axis 14th Condition	14 <sup>th</sup> condition by record-axis
49	NDI_RCOND15	90177: Record-Axis 15th Condition	15 <sup>th</sup> condition by record-axis
50	NDI_RCOND16	90178: Record-Axis 16th Condition	16 <sup>th</sup> condition by record-axis
51	NDI_RCOND17	90179: Record-Axis 17th Condition	17 <sup>th</sup> condition by record-axis
52	NDI_RCOND18	90180: Record-Axis 18th Condition	18 <sup>th</sup> condition by record-axis
53	NDI_RCOND19	90181: Record-Axis 19th Condition	19 <sup>th</sup> condition by record-axis
54	NDI_RCOND20	90182: Record-Axis 20th Condition	20 <sup>th</sup> condition by record-axis

**Note: IRN [Item Reference Number]**

<sup>1</sup> *unconfirmed NDI match* cases were those whom the MTF team was unable to confirm 1) whether the NDI match was actually the MTF Longitudinal Panel respondent, or 2) whether they were deceased based on the MTF NDI Coding Decision Rules. See sections II and III for more details.

<sup>2</sup> 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 9<sup>th</sup> Revision (ICD-9) for deaths occurring from 1976–1998 and used the 10<sup>th</sup> 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.<sup>7</sup>

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).

<sup>7</sup> ICD-9: [https://archive.cdc.gov/www\\_cdc.gov/nchs/icd/icd9cm.htm](https://archive.cdc.gov/www_cdc.gov/nchs/icd/icd9cm.htm); ICD-10: <https://www.cdc.gov/nchs/icd/icd-10/index.html>

The *multiple causes of death* are other significant conditions that contribute to death but are 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 7 digits: the first 2 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. Digit 7 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 5 digits, where the first 4 digits represent condition codes according to ICD-9 or ICD-10, and digit 5 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). Digit 5 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>).

## Summary of the data

### Demographics of those confirmed deceased (N=2,886)

**Table 7** presents demographic characteristics of cases confirmed as deceased in the dataset: about 62% male; 17% Black, 70% White, 6% Hispanic, and 7% either other racial groups or missing. About 43% of cases among those confirmed deceased with NDI information occurred in the South, 25% in the Midwest, 17% in the West, and 15% in the Northeast. By age, about 2% of confirmed deceased died before age 20, 8% each at ages 20–24 and 25–29, 14% at ages 50–54, 12% at ages 55–59, and 3% at or after age 60.

**Table 7. Weighted demographic characteristics among those confirmed deceased (N=2,886)**

Variables	Weighted Proportion (unweighted n)	Variables	Weighted Proportion (unweighted n)
Sex (n=2,884)		Age at death (n=2,445)	
Men	0.615 (1,842)	Under age 20	0.019 (45)
Women	0.385 (1,042)	20-24	0.084 (202)
Race (n=2,886)		25-29	0.078 (194)
Black	0.169 (415)	30-34	0.112 (275)
White	0.702 (2,125)	35-39	0.124 (307)
Hispanic	0.056 (143)	40-44	0.129 (313)
Others or missing	0.074 (203)	45-49	0.160 (377)
Place of death (n=2,443)		50-54	0.140 (349)
South	0.428 (1,017)	55-59	0.122 (301)
Midwest	0.246 (617)	60 or older	0.031 (82)
West	0.174 (414)		
Northeast	0.153 (395)		

**Note:** Age at death was calculated from year of birth and year of death. No information on the place of death is available in the death certificate for 2 cases. Census Regions:

[https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us\\_regdiv.pdf](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 NDI-Mortality file include malignant neoplasm of breast (3.4%); acute myocardial infarction (3.2%); accidental poisoning by and exposure to other and unspecified drugs, medicaments, and biological substances (2.7%); intentional self-harm (suicide) by other and unspecified firearm discharge (2.7%); accidental poisoning by and exposure to narcotics and psychodysleptics (hallucinogens) (2.5%); person injured in unspecified motor-vehicle accident, traffic (2.5%); and atherosclerotic heart disease of native coronary artery (2.5%) (Table 8).

**Table 8.** Weighted proportions of the top five causes of death in the MTF Longitudinal Panel Mortality Data 1976–2021 file (N=2,445)

Top Ranking	ICD Code	Description	Weighted proportion (unweighted n)
1	C50.9	Malignant neoplasm of breast, unspecified	0.0338 (71)
2	I21.9	Acute myocardial infarction, unspecified	0.0316 (76)
3	X44	Accidental poisoning by and exposure to other and unspecified drugs, medicaments, and biological substances	0.0271 (91)
3	X74	Intentional self-harm (suicide) by other and unspecified firearm discharge	0.0271 (71)
4	X42	Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	0.0254 (84)
4	V89.2	Person injured in unspecified motor-vehicle accident, traffic	0.0254 (56)
5	I25.1	Atherosclerotic heart disease of native coronary artery	0.0248 (61)

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/](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](https://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD10/allvalid2023-detailed-titles-headings.pdf).

## Using the MTF Longitudinal Panel Mortality Data 1976–2021 file with the existing MTF data

A unique identifier (MTFID) is included in the MTF Longitudinal Panel Mortality Data 1976–2021 file. Researchers will need to match on MTFID to link the mortality data to the MTF Longitudinal Panel datasets in the Virtual Data Enclave (VDE) of the NAHDAP.

# APPENDIX A - MTF-NDI Coding Decision Rules

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## 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

Before examining death certificate matches, the MTF respondent (R) must be located in Accurint or in an obituary confirming that we have identified our R who participated in the 12<sup>th</sup> 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 three 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, we 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 three 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, 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 the MTF R, code as "*Deceased*"
  - b. If not, code as "*Unconfirmed NDI match*"

(Notes: Unconfirmed NDI match cases are Rs with an NDI match, but the MTF team was not able to confirm or disconfirm that the R 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.

## REFERENCES

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Miech, R. A., Johnston, L. D., Patrick, M. E., & O'Malley, P. M. (2025). Monitoring the Future national survey results on drug use, 1975–2024: Overview and detailed results for secondary school students. Monitoring the Future Monograph Series. Ann Arbor, MI: Institute for Social Research, University of Michigan.

Patrick, M. E., Miech, R. A., Johnston, L. D., & O'Malley, P. M. (2025). Monitoring the Future Panel Study annual report: National data on substance use among adults ages 19 to 65, 1976–2024. Monitoring the Future Monograph Series. Ann Arbor, MI: Institute for Social Research, University of Michigan. <https://dx.doi.org/10.7302/26783>