

## ORIGINAL ARTICLE

## Epidemiology/Genetics

# Impact of COVID-19 on life experiences reported by a diverse cohort of older adults with diabetes and obesity

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## Abstract

**Objective:** This study aimed to measure the impact of the COVID-19 pandemic on self-reported life experiences in older adults with diabetes and obesity.

**Methods:** Participants were surveyed in 2020 regarding negative and positive impacts of the pandemic across domains of personal, social, and physical experiences. A cumulative negative risk index (a count of all reported negative impacts of 46 items) and a positive risk index (5 items) were characterized in relation to age, sex, race/ethnicity, BMI, and multimorbidity.

**Results:** Response rate was high (2950/3193, 92%), average age was 76 years, 63% were women, and 39% were from underrepresented populations. Women reported more negative impacts than men (6.8 vs. 5.6;  $p < 0.001$  [of 46 items]) as did persons with a greater multimorbidity index ( $p < 0.001$ ). Participants reporting African American/Black race reported fewer negative impacts than White participants. Women also reported more positive impacts than men (1.9 vs. 1.6;  $p < 0.001$  [of 5 items]).

**Conclusions:** Older adults with diabetes and obesity reported more positive impacts of the pandemic than negative impacts, relative to the number of positive (or negative) items presented. Some subgroups experienced greater negative impacts (e.g., for women, a greater multimorbidity index). Efforts to reestablish personal, social, and physical health after the pandemic could target certain groups.

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## INTRODUCTION

The COVID-19 pandemic and the stay-at-home orders that were established in the spring of 2020 to curtail it were anticipated to have negative impacts on the social, economic, emotional, and physical health of individuals (1). In particular, the requirement of physical distancing, and, thereby, the disruption of traditional social networks, was thought to have the potential to adversely affect psychosocial well-being and health-related behaviors (2), particularly among those who are older and have chronic health conditions (3,4). Examples of negative impacts include difficulty obtaining healthy foods and medications or getting routine medical care due to disruptions in transportation or fear of contracting the virus.

Few research teams were in the position to survey an existing well-characterized cohort of older adults at the time the COVID-19 pandemic began. Investigators of the Look AHEAD (Action for Health in Diabetes) study identified an opportunity to examine the impact of the pandemic on social, economic, emotional, and physical health in the Look AHEAD cohort. The cohort includes large numbers of vulnerable older adults from multiple underrepresented race and ethnic groups with diabetes and obesity. Importantly, this set of traits characterize persons who have been disproportionately burdened by SARS-CoV-2 infection (5-9). Therefore, this report describes the self-reported positive and negative impacts of the COVID-19 pandemic in a cohort of approximately 3,000 Look AHEAD participants who completed a questionnaire between July and December 2020. We hypothesized that older age, being female, being from underrepresented racial/ethnic groups, and having a greater number of morbidities (multimorbidity) as well as having obesity would be associated with more negative and fewer positive impacts of the pandemic.

## METHODS

### Study design

Look AHEAD was a randomized controlled trial conducted at 16 clinical sites in the US. In brief, a total of 5,145 participants with diabetes and overweight or obesity were randomly assigned between 2001 and

### Study Importance

#### What is already known?

- ▶ The COVID-19 pandemic has caused havoc worldwide.
- ▶ It is unknown how the public health measures used to mitigate the pandemic will impact the health and well-being of populations.
- ▶ Few studies have examined the personal and social impacts experienced by persons of older age or with chronic conditions such as diabetes and obesity.

#### What does this study add?

- ▶ Older adults reported both negative and positive impacts of the pandemic.
- ▶ Women and persons with multiple chronic conditions reported a greater number of negative personal and social impacts of the pandemic.
- ▶ Underrepresented groups reported lower negative impacts in the emotional health and well-being domain and greater positive change compared with White participants.

#### How might these results change the direction of research?

- ▶ Future research may evaluate why different groups appear resilient to the negative personal and social impacts of the pandemic and how this may mediate or protect against mental health consequences.

2004 to an intensive lifestyle intervention or a control condition of diabetes support and education to assess the impact of the intervention on cardiovascular morbidity and mortality. Basic eligibility criteria included age 45 to 76 years, type 2 diabetes, BMI  $\geq 25$  kg/m<sup>2</sup> ( $\geq 27$  if taking insulin), blood pressure < 160/100 mm Hg, glycated hemoglobin  $\leq 11\%$ , triglycerides < 600 mg/dL, ability to complete a valid maximal exercise test, and an established relationship with a primary care provider. Detailed descriptions of the study design, interventions, and

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assessments have been published previously (10,11). The intervention was stopped in 2012 because no difference between randomized groups on the primary outcome was found (12); the study continued as an observational study with follow-up extending through 2020. At this time, there were 3,193 participants active in Look AHEAD. All participants provided written informed consent, and the protocol was approved by each site's institutional review board.

## Assessments during COVID-19

Look AHEAD mailed surveys that included a questionnaire assessing the impact of the COVID-19 pandemic to 3,193 participants between July and December 2020. The questionnaire was modeled after the Epidemic-Pandemic Impacts Inventory (EPII) and its geriatric adaptation (EPII-G). The EPII is a comprehensive assessment of pandemic-related experiences (13,14), and it is maintained in NIH Disaster Research Response Repository of COVID-19 Research Tools (<https://dr2.nlm.nih.gov>). Its geriatric adaptation assesses the impacts in older populations (15). A group of Look AHEAD investigators further adapted the 94-item EPII-G questionnaire by selecting a total of 47 items for inclusion and adding 4 questions, resulting in a total of 51 items (Supporting Information Table S1). This adaptation allowed us to reduce participant burden and to minimize redundancy with other questionnaires in the packet (16). Questions were added to capture the impact of the pandemic on diabetes, a condition common to all Look AHEAD participants. The questionnaire inquired whether the COVID-19 pandemic had changed people's lives in seven domains: six negative domains (home life, economic status, emotional health and well-being, physical health problems, physical distancing and quarantine, and infection history) and one positive domain (positive change). Responses were reported as yes/no/not applicable. "Not applicable" responses were counted as "no." Look AHEAD inquired about the impact of each item only on the respondent, not on the impact to "others in the home," which is a part of the original EPII tool.

COVID-19 infection was defined as a "yes" response to one or more of the following items in the infection history domain: tested and currently have this disease, tested positive for this disease but no longer have it, got medical treatment because of severe symptoms of this disease, and hospital stay due to this disease.

## Other assessments

Measures obtained during COVID-19 were combined with data obtained previously in Look AHEAD. These included race/ethnicity, age, sex, socioeconomic status (SES), Look AHEAD treatment assignment, multimorbidity index, and BMI. Participants self-reported race and ethnicity by selecting from the following options: African American/Black, American Indian/Alaskan Native, Asian, Native Hawaiian/Pacific Islander, White, and other. Similarly, ethnicity was queried as being of "Latino, Hispanic or Spanish origin" or not. This report stratifies the data on the four largest racial/ethnic categories

(African American/Black, American Indian/Alaskan Native, Hispanic, and White) and includes a fifth category (other) that combines the smaller groups as well as those who selected multiple race categories. We used a measure of financial assets as reported annually between baseline and year 8 (approximately 10 years prior to COVID-19) as an indicator of SES. Financial assets are an appropriate measure of SES to use in studies of older people, as it measures accumulation of assets over the life-span (17). The question asked, "How much money would you and others currently living in your household have if you cashed in all your checking and savings accounts, stocks and bonds, real estate, sold your home, your vehicles, and all your valuable possessions?" Eleven response categories were provided, ranging from 0 to \$500 to \$1,000,001 or more. Look AHEAD treatment assignment was the original randomization assignment (intervention vs. control). A multimorbidity index was computed using a count of nine conditions ascertained at baseline and through 8 years of follow-up: cancer, cardiac arrhythmia, chronic kidney disease, congestive heart failure, coronary artery disease, depression, dyslipidemia, hypertension, and stroke (diabetes and obesity were not counted, as they were common to all participants) (18). Higher scores refer to greater multimorbidity. BMI was calculated as weight (kilograms) divided by height (meters squared) measured in the clinic visit immediately preceding COVID-19 (within 2 years).

## Analysis plan

The primary measure of interest was a cumulative negative risk index that counts the total number of affirmative responses to the 46 negative impact items. This risk index has been used previously with the EPII questionnaire (19,20). Domain-specific risk indices were also calculated across the six negative domains and one positive domain. Responses of "no" and "not applicable" were combined as a "no" response. Secondary measures of interest were the 51 individual items.

We hypothesized that the risk indices would differ across subgroups, including race/ethnicity, sex, Look AHEAD treatment assignment, age, BMI, and multimorbidity index. These hypotheses were based on the disproportionate burden of COVID-19 experienced by older adults, underrepresented populations, those with a higher BMI, and/or those with multiple chronic conditions. Assignment to the intervention group in Look AHEAD may have led to improved self-care strategies that could be beneficial in managing the physical and social distancing requirements. Furthermore, because race/ethnicity can serve as a proxy for economic measures (among others, social, cultural, etc.), we further evaluated associations that were observed for race/ethnicity by adjusting for assets. Response sets for assets were collapsed into three groups approximately representing tertiles (\$0-\$100,000; \$100,001-\$500,000; >\$500,000). The question was not answered by 20%; therefore, analyses that adjusted for assets have a reduced sample size.

Mean (and median) cumulative negative risk index and domain-specific indices are presented by race/ethnicity and separately for men and women. Owing to the large number of zeros for some

domains (i.e., no negative impacts reported), we also present percentage of scores greater than zero. Poisson regression was used to model the risk indices on race/ethnicity, sex, and treatment assignment and continuous variables of age, BMI, and multimorbidity index. Negative binomial regression was used in instances in which the data were overdispersed. Effect sizes are presented as rate ratios with 95% CIs. Logistic regression was used to characterize the odds of each of the 51 items by subgroup. Because of the large number of statistical comparisons in the analysis of the 51 items individually, the *p* value for significance for these analyses was set at 0.001.

## RESULTS

This report includes 2,950 (92%) of the 3,193 Look AHEAD participants who received and returned a questionnaire. Ninety percent of the questionnaires were completed between July 30 and October 28, 2020 (Supporting Information Table S2). On average, the cohort was 76 years old (range: 62–94 years), included more women than men (63%), and included a large number of participants from underrepresented populations (1,158/2,950 or 39%; Table 1). The cohort had high levels of overweight (26%) and obesity (69%), and all had diabetes. Current or prior COVID-19 infections were reported by 5.6% and were highest in the two American Indian sites (11% and 21%; Supporting Information Table S2).

The average cumulative negative risk index was 6.3 of 46 possible life experiences (Table 2), and the average positive risk index was 1.8 of 5 possible life experiences. Therefore, on average, relatively more of the possible positive experiences were endorsed (36%) than of the possible negative experiences (14%). Participants rarely reported negative impacts in the home life or economic domains.

The average cumulative negative risk index was higher in women than in men: 6.8 versus 5.6 (Figure 1). This pattern was consistent with women reporting, on average, one or more negative experiences than men across all racial/ethnic groups, except the “other” group (Supporting Information Table S3A,B). In a multivariate model, younger age (rate ratio [RR] = 0.995, *p* = 0.03), female sex (RR = 1.20, *p* < 0.001), and a higher multimorbidity index (RR = 1.08, *p* < 0.001) were associated with a higher cumulative negative risk index (Table 3). Being of African American/Black race was associated with a lower risk index (RR = 0.93) relative to the group of White race, and being of other race was associated with a higher risk index (RR = 1.16) relative to the group of White race. BMI and Look AHEAD treatment assignment were not associated with the cumulative negative risk index.

Domain-specific risk indices yielded different findings than the cumulative index, although some patterns emerged. In most domains, women had higher domain-specific risk indices than men (Figure 1). Consistent with the findings for the cumulative negative risk index, in the multivariate model, female sex and higher multimorbidity index were associated with higher risk indices in every negative risk domain except for home life and infection history (Table 4).

There were a range of effects in the negative risk domains across race/ethnicity. All underrepresented groups reported

higher, and often considerably higher, negative impacts in the economic status and infection history domains relative to White participants. Conversely, nearly all underrepresented groups reported lower negative impacts in the emotional health and well-being, physical health problems, and physical distancing and quarantine domains relative to White participants. These domain-specific multivariate models were further adjusted for financial assets to assess whether race/ethnicity was serving as a proxy for SES. Adjusting for assets only partially blunted the association with race/ethnicity (not shown).

Other differences among subgroups were seen only within specific domains (Table 4). Younger age was associated with higher risk indices in the emotional health and well-being domain and in the infection history domain. Greater BMI was associated only with higher risk indices for the physical health problems domain. Look AHEAD intervention treatment assignment was associated only with higher risk indices for the economic domain.

Regarding the positive change domain (Table 4), younger participants, women, and participants who self-identified as African American/Black, Hispanic, or other (compared with White participants) had higher risk indices (greater positive change). American Indian participants had lower risk indices (lesser positive change) compared with White participants and, by extension, with all other underrepresented groups (who had greater positive change than White participants).

Item-specific frequencies are presented in Supporting Information Table S4. The most frequent negative impacts, endorsed by >50% of the cohort, included the following: more time sitting down or being sedentary (72%); less physical activity or exercise (65%); more time spent on screens and devices (65%); and limited physical closeness with child or loved one because of concerns of infection (51%). The most frequent positive impacts included more time doing enjoyable activities (e.g., reading, puzzles; 67%); and more quality time with family or friends in person or from a distance (62%).

Supporting Information Table S4 also shows contrasts for sex, race/ethnicity, and multimorbidity index for each item. The strongest effects were observed for items in the economic domain, in which Hispanic participants had significantly greater odds of endorsing these negative impacts relative to White participants. American Indian participants had significantly greater odds of endorsing negative impacts in the infection history domain relative to White participants, including nearly nine times greater odds of experiencing the death of a close friend or family member.

## DISCUSSION

Older persons, persons from underrepresented racial/ethnic groups, and persons with diabetes and obesity have been disproportionately burdened by SARS-CoV-2 infection, serious illness, and mortality (5–9). This report enabled an assessment of pandemic-related experiences among such groups. Look AHEAD represents a large cohort of older adults (average age: 76 y) with type 2 diabetes and obesity or

TABLE 1 Characteristics of Look AHEAD cohort participating in COVID-19 questionnaire (June-December 2020), by race/ethnicity

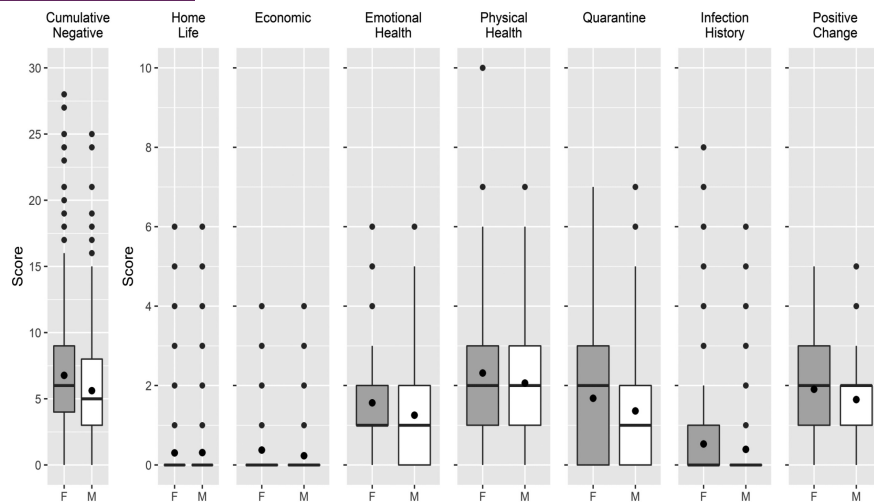
	Overall	African American/Black	AI/AN	Hispanic	White	Other
<i>n</i>	2,950	490	167	407	1,792	94
Age (y)	75.8 ± 6 (62.2-93.7)	75.4 ± 5.9 (63.2-93.7)	71.6 ± 6.1 (62.2-90.6)	75 ± 5.5 (63.2-92.2)	76.5 ± 6 (62.9-93.5)	75.6 ± 5.7 (63.7-88.5)
Gender						
Male	1,091 (37%)	103 (21%)	33 (19.8%)	101 (24.8%)	819 (45.7%)	35 (37.2%)
Female	1,859 (63%)	387 (79%)	134 (80.2%)	306 (75.2%)	973 (54.3%)	59 (62.8%)
BMI (kg/m <sup>2</sup> )	33.6 ± 6.2 (17.4-62.8)	34.2 ± 6.3 (18.2-55.8)	33 ± 7.6 (17.8-62.3)	33.1 ± 6 (20.9-62.8)	33.7 ± 6.1 (17.4-60.3)	32.7 ± 6 (21.8-48.5)
BMI group						
Underweight/normal (<25)	145 (5.4%)	29 (6.4%)	19 (11.7%)	23 (5.8%)	64 (4%)	10 (11.4%)
Overweight (25.0-29.9)	692 (25.7%)	92 (20.3%)	50 (30.7%)	110 (27.9%)	416 (26.1%)	24 (27.3%)
Obesity (>30)	1,855 (68.9%)	333 (73.3%)	94 (57.7%)	261 (66.2%)	1,113 (69.9%)	54 (61.4%)
Multimorbidity index (continuous)	2.9 ± 1 (0-7)	2.8 ± 1 (1-6)	2.6 ± 0.9 (0-5)	2.8 ± 0.9 (1-6)	3 ± 1.1 (0-7)	2.9 ± 1 (1-5)
Multimorbidity index						
Low (≤3)	2,217 (75.2%)	398 (81.2%)	142 (85%)	323 (79.6%)	1,283 (71.7%)	71 (75.5%)
High (>3)	730 (24.8%)	92 (18.8%)	25 (15%)	83 (20.4%)	507 (28.3%)	23 (24.5%)
Asset categories						
\$0-\$100,000	680 (23.1%)	174 (35.5%)	106 (63.5%)	167 (41%)	212 (11.8%)	21 (22.3%)
\$100,001-\$500,000	892 (30.2%)	161 (32.9%)	43 (25.7%)	94 (23.1%)	570 (31.8%)	24 (25.5%)
>\$500,000	839 (28.4%)	69 (14.1%)	6 (3.6%)	44 (10.8%)	683 (38.1%)	37 (39.4%)
Missing	539 (18.3%)	86 (17.6%)	12 (7.2%)	102 (25.1%)	327 (18.2%)	12 (12.8%)
COVID infection						
Yes	165 (5.6%)	27 (5.5%)	26 (15.6%)	33 (8.1%)	77 (4.3%)	2 (2.2%)
No	2,775 (94.4%)	461 (94.5%)	141 (84.4%)	372 (91.9%)	1,710 (95.7%)	91 (97.8%)
Randomization arm						
Control	1,428 (48.4%)	241 (49.2%)	84 (50.3%)	188 (46.2%)	869 (48.5%)	46 (48.9%)
Intervention	1,522 (51.6%)	249 (50.8%)	83 (49.7%)	219 (53.8%)	923 (51.5%)	48 (51.1%)

Note: Data given as mean ± SD (range) or *n* (percent).  
Abbreviations: AI, American Indian; AN, Alaskan Native.

**TABLE 2** Cumulative negative risk index and domain-specific risk indices, by race/ethnicity

	Overall	African American/Black	AI/AN	Hispanic	White	Other
<i>n</i>	2,950	490	167	407	1792	94
Cumulative negative effects score ( <i>n</i> )	2,940	486	167	407	1787	93
Mean ± SD (range)	6.3 ± 4 (0-28)	6.1 ± 4.2 (0-28)	6.2 ± 4.5 (0-24)	6.7 ± 4.3 (0-27)	6.3 ± 3.8 (0-25)	7.3 ± 4.7 (0-25)
Median (IQR)	6 (3-9)	6 (3-9)	5 (3-9)	6 (3-9)	6 (4-8)	6 (4-11)
% with Score > 0	2,772 (94.3%)	446 (91.8%)	157 (94%)	389 (95.6%)	1,692 (94.7%)	88 (94.6%)
% with Score > 10	416 (14.1%)	69 (14.2%)	23 (13.8%)	72 (17.7%)	225 (12.6%)	27 (29%)
Domain: home life ( <i>n</i> )	2,949	489	167	407	1792	94
Mean ± SD (range)	0.3 ± 0.7 (0-6)	0.3 ± 0.6 (0-5)	0.3 ± 0.7 (0-5)	0.3 ± 0.7 (0-5)	0.3 ± 0.6 (0-6)	0.4 ± 0.9 (0-6)
% with Score > 0	659 (22.3%)	91 (18.6%)	35 (21%)	93 (22.9%)	415 (23.2%)	25 (26.6%)
Domain: economic ( <i>n</i> )	2,949	489	167	407	1792	94
Mean ± SD (range)	0.3 ± 0.7 (0-4)	0.3 ± 0.7 (0-4)	0.4 ± 0.8 (0-3)	0.7 ± 1.1 (0-4)	0.2 ± 0.5 (0-4)	0.4 ± 0.8 (0-4)
% with Score > 0	636 (21.6%)	106 (21.7%)	41 (24.6%)	141 (34.6%)	321 (17.9%)	27 (28.7%)
Domain: emotional health and well-being ( <i>n</i> )	2,944	488	167	407	1789	93
Mean ± SD (range)	1.5 ± 1.3 (0-6)	1.4 ± 1.2 (0-5)	1.1 ± 1.2 (0-5)	1.5 ± 1.3 (0-5)	1.5 ± 1.3 (0-6)	1.8 ± 1.5 (0-6)
% with Score > 0	2,182 (74.1%)	353 (72.3%)	97 (58.1%)	301 (74%)	1,358 (75.9%)	73 (78.5%)
Domain: physical health problems ( <i>n</i> )	2,943	488	167	407	1788	93
Mean ± SD (range)	2.2 ± 1.4 (0-10)	2.2 ± 1.5 (0-10)	1.9 ± 1.4 (0-6)	2.1 ± 1.4 (0-7)	2.3 ± 1.4 (0-7)	2.5 ± 1.6 (0-6)
% with Score > 0	2,527 (85.9%)	410 (84%)	135 (80.8%)	340 (83.5%)	1,563 (87.4%)	79 (84.9%)
Domain: physical distancing and quarantine ( <i>n</i> )	2,946	489	167	407	1,790	93
Mean ± SD (range)	1.6 ± 1.4 (0-7)	1.3 ± 1.4 (0, 7)	1.4 ± 1.8 (0, 7)	1.5 ± 1.5 (0, 6)	1.6 ± 1.4 (0, 7)	1.8 ± 1.6 (0, 6)
% with Score > 0	2,037 (69.1%)	305 (62.4%)	85 (50.9%)	259 (63.6%)	1,322 (73.9%)	66 (71%)
Domain: infection history ( <i>n</i> )	2,946	489	167	407	1790	93
Mean ± SD (range)	0.5 ± 0.9 (0-8)	0.6 ± 1 (0-8)	1.1 ± 1.2 (0-6)	0.6 ± 1.1 (0-8)	0.4 ± 0.8 (0-7)	0.4 ± 0.8 (0-3)
% with Score > 0	876 (29.7%)	175 (35.8%)	99 (59.3%)	154 (37.8%)	419 (23.4%)	29 (31.2%)
Domain: positive change ( <i>n</i> )	2,945	488	167	407	1,789	94
Mean ± SD (range)	1.8 ± 1.3 (0-5)	2.1 ± 1.3 (0-5)	1.4 ± 1.3 (0-5)	2.1 ± 1.2 (0-5)	1.7 ± 1.2 (0-5)	2.2 ± 1.3 (0-5)
% with Score > 0	2,389 (81.1%)	421 (86.3%)	106 (63.5%)	356 (87.5%)	1424 (79.6%)	82 (87.2%)

Abbreviations: AI, American Indian; AN, Alaskan native.



**FIGURE 1** Cumulative negative risk index and domain-specific risk indices, by gender. The box represents the IQR, split with a line to represent the median and a diamond to represent the mean. The whiskers extend to 1.5 times the IQR, with outliers represented by circles. IQR, interquartile range

**TABLE 3** Multivariable model for cumulative negative risk index

Variable	Overall <i>n</i> = 2,682	
	Rate ratio (95% CI)	<i>p</i> value
Treatment group		0.499
Control	REF	
Intervention	1.02 (0.97-1.07)	
Age (y)	0.995 (0.991-1.000)	0.033
Gender		<0.001
Male	REF	
Female	1.20 (1.14-1.27)	
Race/ethnicity		0.016
White	REF	
African American/Black	0.93 (0.87-1.00)	
American Indian/Alaskan Native	0.96 (0.86-1.07)	
Hispanic	1.04 (0.97-1.12)	
Other	1.16 (1.01-1.33)	
Multimorbidity index	1.08 (1.05-1.10)	<0.001
BMI (kg/m <sup>2</sup> )	1.004 (1.00-1.01)	0.079

overweight, with large numbers of individuals of Hispanic ethnicity (*n* = 407) and individuals reporting their race as American Indian (*n* = 167) or African American/Black (*n* = 490). The key points of this analysis were as follows: (1) the frequent endorsement of positive impacts of the pandemic, relative to the negative impacts; and (2) the observation that both positive and negative impacts were reported differentially across various subgroups.

This study used a modification of the EPII-G, which is a comprehensive assessment of pandemic-related experiences. To the best of our knowledge, only one study has been published on the experiences of an older-adult cohort in response to COVID-19 using this

instrument. An ethnically diverse sample of 1608 adults aged  $\geq 55$  years (average age: 67 y) in the US and Latin America showed the differential impact of the pandemic on the well-being of these groups (19). Similar to our report, people of Latino ethnicity reported higher economic impact compared with non-Hispanic White participants, and Black and Latino participants reported more positive change. Several publications using the EPII have been limited to young adults (20,21). College-aged women reported more negative impacts of the pandemic than men, irrespective of race or ethnicity, and women and Hispanic participants were more likely to report positive changes (20). The most frequent negative and positive impacts endorsed by these college students overlapped considerably with those reported by the older-aged Look AHEAD cohort. From these few studies using the EPII, similar observations have been made regarding sex and race/ethnicity, despite the disparate ages of the respondents.

The survey used in the present study focused primarily on negative impacts of the pandemic, as indicated by 46 negative items, compared with only 5 items focused on positive impacts; despite this, participants selected having experienced (on average) 1.8 positive impacts, compared with 6.3 negative impacts. Our interpretation is that, on balance, this vulnerable aging cohort with diabetes and obesity identified with positive impacts relatively more often than negative impacts. This observation is consistent with another study in an older-adult population (19). On the other hand, college students reported equally high levels of negative and positive impacts (20). Therefore, although the pandemic has been a catastrophic event worldwide, costing nearly 1 million US lives to date (22), the impact on individuals is highly variable. Older adults may be more likely to find the “silver lining.”

Despite women reporting greater positive experiences than men in the positive change domain, women reported more negative impacts of the pandemic than men. These observations are consistent with those of the sample of 909 college students in which women, irrespective of race or ethnicity, reported higher disruptions related

TABLE 4 Multivariable models for domain-specific risk indices

Treatment group	Home life, n = 2,690		Economic, n = 2,690		Emotional health and well-being, n = 2,686		Physical health problem, n = 2,685		Physical distancing and quarantine, n = 2,688		Infection history, n = 2,688		Positive change, n = 2,687	
	Rate ratio	p value	Rate ratio	p value	Rate ratio	p value	Rate ratio	p value	Rate ratio	p value	Rate ratio	p value	Rate ratio	p value
Control	REF	0.870	REF	0.035	REF	0.575	REF	0.514	REF	0.604	REF	0.814	REF	0.367
Intervention	1.01 (0.86-1.19)		1.20 (1.01-1.42)		0.98 (0.92-1.05)		1.02 (0.97-1.07)		1.02 (0.95-1.09)		1.02 (0.88-1.17)		1.03 (0.97-1.08)	
Age (y)	0.98 (0.97-1.00)	0.052	1.01 (0.99-1.02)	0.278	0.985 (0.980-0.991)	<0.001	1.00 (0.997-1.006)	0.525	1.00 (0.99-1.003)	0.333	0.98 (0.97-1.00)	0.026	0.994 (0.990-1.000)	0.033
Gender	0.639	<0.001	REF	<0.001	REF	<0.001	REF	<0.001	REF	<0.001	REF	0.103	REF	<0.001
Male	REF		REF		REF		REF		REF		REF		REF	
Female	0.96 (0.80-1.14)		1.39 (1.15-1.68)		1.26 (1.17-1.35)		1.13 (1.07-1.20)		1.29 (1.19-1.40)		1.14 (0.97-1.33)		1.11 (1.05-1.19)	
Race/ethnicity	0.341	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
White	REF		REF		REF		REF		REF		REF		REF	
AA/Black	0.84 (0.66-1.07)		1.28 (1.00-1.63)		0.89 (0.81-0.98)		0.94 (0.87-1.01)		0.77 (0.69-0.85)		1.67 (1.37-2.02)		1.19 (1.11-1.29)	
AI/AN	1.04 (0.73-1.48)		1.93 (1.37-2.72)		0.67 (0.57-0.79)		0.84 (0.75-0.95)		0.82 (0.70-0.97)		2.77 (2.13-3.60)		0.75 (0.66-0.87)	
Hispanic	1.06 (0.84-1.35)		3.06 (2.48-3.79)		0.98 (0.89-1.07)		0.90 (0.83-0.97)		0.87 (0.78-0.97)		1.76 (1.44-2.14)		1.15 (1.06-1.25)	
Other	1.31 (0.85-2.00)		1.85 (1.20-2.87)		1.18 (1.00-1.40)		1.11 (0.97-1.27)		1.10 (0.91-1.33)		1.20 (0.79-1.81)		1.24 (1.07-1.43)	
Multimorbidity index	1.17 (1.08-1.27)	<0.001	1.15 (1.06-1.25)	0.001	1.11 (1.07-1.14)	<0.001	1.06 (1.03-1.08)	<0.001	1.06 (1.02-1.10)	0.001	0.998 (0.93-1.07)	0.952	0.97 (0.95-1.00)	0.067
BMI (kg/m <sup>2</sup> )	1.00 (0.99-1.02)	0.533	1.00 (0.99-1.01)	0.948	0.998 (0.992-1.003)	0.393	1.01 (1.004-1.011)	<0.001	1.003 (1.00-1.009)	0.248	1.00 (0.99-1.02)	0.441	0.997 (0.992-1.001)	0.160

Abbreviations: AA, African American; AI, American Indian; AN, Alaskan Native; REF, reference.



to COVID-19 than men and were also more likely to report positive changes than men (20). In our previous work in the Look AHEAD cohort, we reported that women, relative to men, felt a greater sense of threat from the pandemic (16). Others have reported that women were more concerned about the pandemic and, therefore, reported more compliance with public health and social distancing measures (23). These factors may explain our findings that women reported greater negative impacts of the pandemic on physical health (e.g., less physical activity or exercise) and physical distancing and quarantine (e.g., limited physical closeness with child or loved one because of concerns of infection). Women also had more emotional impacts from the pandemic than men. This is consistent with our previous findings from this cohort that, during the pandemic, women reported higher levels of depressive symptoms, loneliness, and anxiety than men (16). Differences between men and women in the impact of the pandemic on emotional health and well-being may be related to gender variations in the way emotions are identified and expressed, genetic or physiological factors, and family caregiving and household responsibilities. Women usually have larger social networks than men and more multifaceted sources of support (24). The pandemic likely disrupted these networks, and the negative impact on mental health may have been further exacerbated because older women are more likely to live alone than men. However, further studies are needed to test these hypotheses.

In this study, the rate of COVID-19 infections differed across US communities and racial/ethnic groups, with individuals from underrepresented populations more commonly affected. Perhaps owing to the disproportionate burden of COVID-19 infection, as well as social, cultural, and economic differences across race and ethnic groups in the US, differences (sometimes striking) in both reported positive and negative experiences were observed. For example, participants from underrepresented groups endorsed greater negative experiences in the domains of economic status and infection history compared with White participants. The finding of greater risk in the domain of infection history is consistent with national data regarding a two- to three-fold greater risk of contracting COVID-19 for persons from underrepresented US populations compared with non-Hispanic White people (6). On the other hand, participants from underrepresented groups endorsed fewer negative experiences in the domains of emotional health/well-being, physical health problems, and physical distancing/quarantine compared with White participants. Participants from underrepresented groups also endorsed more positive experiences (e.g., developed new hobbies or activities) compared with White participants. These racial/ethnic differences across all domains were further evaluated to assess whether a pre-pandemic assessment of assets explained the racial/ethnic differences. For the most part, the findings persisted, leaving us to conclude that social or cultural differences or differences in levels of exposure to the virus drove the differences across racial/ethnic groups in our cohort.

The observation that the underrepresented groups, compared with White participants, reported fewer negative experiences (in some domains) and more positive experiences was counter to our hypothesis. However, the literature supports these findings. Babul

and colleagues (19) reported greater positive change in Latino and Black participants compared with non-Latino White participants with ages > 55 years; similar findings were reported in the college-aged sample (20). Two other studies have concurred with an observation of lower levels of distress and worry among Black individuals compared with White individuals during COVID-19 (25,26). Possible explanations for the difference in resilience include a greater life purpose or satisfaction (27,28), social support, or coping skills in some groups and/or cultures, all of which require further exploration.

Multimorbidity was common in the Look AHEAD cohort. Nearly all participants had at least two comorbid conditions: diabetes and overweight or obesity. One-quarter of the cohort had three or more additional chronic conditions. Persons with a high multimorbidity index (>3) consistently reported greater negative impacts of the pandemic across all the risk domains except infection history. Regarding specific life experiences, those with a high multimorbidity index were nearly three times more likely to report being unable to get home-based paid help for care for disability, chronic illness, or dementia.

Older age, higher BMI, and assignment to the control intervention were hypothesized to be associated with greater negative impacts of the pandemic. Older age was not associated with greater negative impacts as we had hypothesized. Others have observed that the pandemic had a greater impact on mental health among younger persons, those living with young children, and those who are employed (29). Higher BMI was associated with greater negative impacts only in the physical health problems domain. We attribute the mostly null associations with BMI to be due to a restricted distribution of BMI in the Look AHEAD cohort (69% with obesity and only 5% with BMI < 25). Finally, Look AHEAD treatment assignment also lacked association with reported impacts of the pandemic, dismissing our hypothesis that the behaviors and skills learned during the Look AHEAD trial would translate beyond its impact on weight loss.

Individuals reported substantial impacts to their lives that occurred since the COVID-19 pandemic began. The three most frequently endorsed negative impacts, reported by 65% or more, included the following: more time sitting down or being sedentary; less physical activity or exercise; and spending more time on screens and devices, all of which can have detrimental long-term impacts on the health of older persons with diabetes and obesity (30). On the other hand, difficulty in obtaining diabetes-specific care was infrequently reported, a finding that may underscore the uniquely motivated population of adults with diabetes participating in this long-term study.

Strengths of this study include a large well-characterized cohort with diversity across race and ethnicity. The survey, conducted within months of the initial stay-at-home orders implemented in the US in March to May 2020, yielded a high response rate (92%) and high levels of item completeness (>99% overall). A panel of standardized measures obtained in previous visits of the Look AHEAD cohort enriched the data set (BMI, multimorbidity index, and financial assets).

There are also limitations. These results reflect one period of time in 16 US communities, whereas the pandemic has been dynamic in its impact over time and by location. Another limitation is that we do not have a control period prior to the pandemic with which

to compare the endorsement of these experiences. In addition, the instrument used in this study was not validated; however, neither was the tool from which it was adapted. As done in prior publications with the EPII instrument, we focused on a measure of cumulative negative impacts and positive impacts; this approach weights all items equally, although some items would likely have a greater impact than others. Also, the results from this sample of clinical trial participants may not be generalizable to the population of older adults. Indeed, Look AHEAD participants report greater wealth than US seniors (31) and are likely to be more health-conscious, which may influence how they perceive the pandemic has influenced their lives. Finally, despite the intent to measure the impact of the pandemic on the lives of an aging, multiethnic cohort in late 2020, there were other events that likely affected the lives of these individuals, including significant nationwide attention to police brutality and a divisive national election. We are unable to separate the impact of these concurrent events from those attributable to the pandemic.

In conclusion, we studied the negative and positive impacts of the pandemic in a large cohort of older adults from communities across the US, shortly after the period of strict lockdown. The cohort was diverse with regard to race and ethnicity and participants had multiple chronic conditions, including diabetes and obesity or overweight, all conditions that increase the risk of COVID-19 disease and severity. We observed that positive impacts of the pandemic were reported more often than negative impacts, relative to the number of positive (or negative) items presented. Women and those with more comorbidities reported more negative impacts of the pandemic. Participants from underrepresented groups, despite reporting a higher COVID-19 infection history, appear to have been more resilient to the pandemic, reporting more positive impacts overall and fewer negative impacts than White participants in several domains. In summary, some groups appear more resilient to the negative personal and social impacts of the pandemic. Identifying the factors that lead to resilience may suggest strategies that support the resumption of healthy lives following the pandemic. **O**

#### CONFLICT OF INTEREST

AC reports grants from Eli Lilly and Company and WW International, Inc. (formerly Weight Watchers) outside the submitted work. JC has served on scientific advisory boards for Boehringer-Ingelheim and Novo Nordisk A/S. TW serves on advisory boards for Novo Nordisk A/S and WW International, Inc. RW serves on the advisory board for NOOM. The other authors declared no conflict of interest. Signed duality of interest forms from all authors are available at <https://www.lookaheadtrial.org/public/doi/index.cfm>.

#### AUTHOR CONTRIBUTIONS

TAW, BL, JMC, KCJ, and RRW participated in data collection; LEW and MJH contributed to data analysis; LEW, AMC, TAW, JMM, KMH, BL, JMC, KCJ, MJH, SZY, and RRW contributed to data interpretation; LEW conducted the literature search; MJH generated figures and tables. All authors contributed to study design, were involved in writing and/or editing the paper, and provided final approval of the

submitted and published versions. Full list of Look AHEAD Study Group members available in online Supporting Information.

#### CLINICAL TRIAL REGISTRATION






[ClinicalTrials.gov](https://clinicaltrials.gov) identifier: NCT00017953.

#### DATA AVAILABILITY STATEMENT

Because the Look AHEAD study originated as a clinical trial (2001-2012), we are identifying it as a clinical trial. It has since transitioned into an observational study. The data presented in this manuscript are part of the observational study phase of Look AHEAD.

- a. Participant data are broadly available through the National Diabetes and Digestive and Kidney Diseases (NIDDK) Data Repository, and these data represent the period 2001 to 2012.
- a. Look AHEAD study documents are available on the [ClinicalTrials.gov](https://clinicaltrials.gov) website. These include the study protocol and a statistical analysis plan.
- a. NIDDK requires that an investigator provide institutional review board approval for data to be released from its repository.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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