IMPORTANCE  Food insecurity is a risk factor for poor cardiovascular outcomes that occur disproportionately among individuals from racial and ethnic minority backgrounds who have cardiovascular disease (CVD) or cardiometabolic risk factors.

OBJECTIVE  To assess long-term prevalence of food insecurity among those with CVD or cardiometabolic risk factors in the United States.

DESIGN, SETTING, AND PARTICIPANTS  This serial cross-sectional study includes data for noninstitutionalized US adults from the National Health and Nutrition Examination Survey (1999-2018).

MAIN OUTCOMES AND MEASURES  Food insecurity was assessed using the US Department of Agriculture Adult Food Security Survey Module. We estimated prevalence of food insecurity among adults with prior CVD (myocardial infarction, stroke, heart failure) and cardiometabolic risk factors (hypertension, diabetes, obesity, hyperlipidemia) across racial and ethnic groups and prevalence of Supplemental Nutrition Assistance Program (SNAP) participation among those reporting food insecurity.

RESULTS  In the analytic sample of 57,517 adults, 6,770 individuals (11.8%) reported food insecurity, which was more prevalent among Hispanic (1938 [24.0%]) and non-Hispanic Black (1,202 [18.2%]) than non-Hispanic Asian (100 [8.0%]) and non-Hispanic White adults (3,221 [8.5%]). Among 57,517 adults, 4,527 (7.9%) had any CVD, 2,933 (5.1%) coronary artery disease, 1,536 (2.7%) stroke, 1,363 (2.4%) heart failure, 28,528 (49.6%) hypertension, 17,979 (33.2%) obesity, 6,418 (11.2%) diabetes, and 19,178 (30.8%) dyslipidemia. All CVD and cardiometabolic diseases except coronary artery disease were more prevalent among those with food insecurity. Food insecurity increased over time and was more frequent for patients with CVD but not for cardiometabolic risk factors. From 2011 to 2018, non-Hispanic Black adults with CVD had a decrease in food insecurity prevalence (36.6%; 95% CI, 23.9%-49.4%, to 25.4%; 95% CI, 21.4%-29.3%; P = .04 for trend), whereas adults of other races and ethnicities or data based on cardiometabolic risk factors had no significant change. For individuals who had food insecurity, SNAP participation was higher among those with CVD vs without CVD (54.2%; 95% CI, 46.6%-61.8%, vs 44.3%; 95% CI, 40.5%-48.1%; P = .01).

CONCLUSIONS AND RELEVANCE  The prevalence of food insecurity among patients with CVD increased over time. Although members of non-Hispanic Black and Hispanic groups had the highest food insecurity, non-Hispanic Black individuals with CVD were the only group to have a significant decrease in food insecurity since 2011. Increased recognition of food insecurity and resources for treating it are needed to address the negative consequences of food insecurity on CVD outcomes.
The conditions and environments in which people are born, live, work, develop, and age (ie, social determinants of health [SDOH]) greatly influence health outcomes. Among these SDOH, food insecurity, that is, “having limited or uncertain access to adequate food,” can increase the risk for developing cardiovascular disease (CVD). This increase in risk is hypothesized to occur because individuals with food insecurity have poorer dietary quality, including lower intake of fruits and vegetables, and thereby increased risk for intermediary cardiometabolic risk factors (eg, diabetes, hypertension, obesity, and dyslipidemia). Cardiovascular disease remains the top cause of death in the United States. The US Burden of Disease Collaborators found that diet is the greatest contributor to death from CVD (accounting for more than 400,000 deaths from CVD in 2016). Individuals experiencing food insecurity likely shoulder a greater burden from diet-related CVD. Multiple factors that co-occur with food insecurity, such as a heightened stress response and poor adherence to prescription medication to treat cardiometabolic risk factors, may also help explain the association of food insecurity with increased total and cardiovascular mortality.

Earlier work suggests CVD and food insecurity do not have an equal prevalence across racial and ethnic groups nor has their prevalence been stable over time. Certain racial, ethnic, and socioeconomically disadvantaged groups have the highest risk for both lower-quality diets and CVD, disparities that are widening despite advances in cardiovascular care. Prior observations note that food insecurity among individuals with CVD or cardiometabolic risk factors was on the rise during and immediately after the Great Recession of 2008; food insecurity doubled from 9.1% in 2005 to 18.3% in 2012 and tended to be higher among non-Hispanic Black, Mexican American, and other Hispanic adults than non-Hispanic White adults. It remains unknown if these trends continued or were disrupted in the later postrecession economic recovery period (2011 and after) and if inequities in food insecurity across race and ethnicity persisted as disparities in dietary quality have widened in recent years. We hypothesize that persistent socioeconomic and environmental inequities have led to continued disparities in prevalence of food insecurity across racial and ethnic groups.

Therefore, we used data from the National Health and Nutrition Examination Survey (NHANES) to provide an updated prevalence of food insecurity among individuals with diagnosed CVD or cardiometabolic risk factors. We also sought to understand if the inequitable distribution of food insecurity among those with CVD or cardiometabolic risk factors persists across racial and ethnic groups and how trends changed over the course of the 2008 economic recession. As the medical system evolves to address SDOH, informing the contemporary state of food insecurity among individuals at risk of negative CVD outcomes in the context of race and ethnicity can guide public health officials, hospitals, and clinicians toward implementing actions to address this important SDOH and improve health equity. Given that the Supplemental Nutrition Assistance Program (SNAP) is the largest public food benefit program known to decrease food insecurity, we also defined the frequency that participants report SNAP participation by presence or absence of CVD or cardiometabolic risk factors.

### Methods

We performed a serial cross-sectional study that used data from the continuous NHANES (1999-2018) to define the prevalence of food insecurity among those with and without CVD or cardiometabolic risk factors of interest. NHANES data are collected continuously and are designed to represent the noninstitutionalized civilian population in the United States. Participants are surveyed using a 4-stage cluster sampling design. All participants completed personal and household questionnaires and then received a health examination in the mobile examination center. Full details regarding sample design have been previously published.

We included all adult participants (≥18 years) with nonmissing data on food security. Because we used deidentified, publicly available data, the study was deemed exempt from review by the University of Michigan institutional review board. We reported this study following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

### Outcomes

The primary outcome of interest was food insecurity among US adults with CVD or cardiometabolic risk factors. Food insecurity was assessed in NHANES using the US Department of Agriculture (USDA) Adult Food Security Survey Module, which includes 10 questions about food security (eTable 1 in the Supplement). This module has been determined valid across the racial and ethnic groups included in this study. Those with 3 or more affirmative responses are defined as having food insecurity (low or very low food security) according to USDA guidelines.

### Population Definitions

We studied food insecurity among individuals with CVD or cardiometabolic risk factors. Because SDOHs differentially affect individuals across racial and ethnic groups, food insecurity was evaluated for the entire sample period and individually across 4 racial and ethnic categories (Hispanic, non-Hispanic Asian [hereafter Asian], non-Hispanic Black [hereafter Black], and American Indian/Alaska Native, non-Hispanic White [hereafter White], and non-Hispanic other racial and ethnic group) and 4 cardiometabolic risk factor categories (hypertension, diabetes, obesity, and dyslipidemia).
non-Hispanic White (hereafter White). Data for individuals reporting a race and ethnicity of other or multiracial were not included in stratified analyses of food insecurity. Race and ethnicity definitions and subgroup oversampling in NHANES have changed over time. Starting in 2007, there was no longer only oversampling of Mexican American individuals; instead, all Hispanic individuals were oversampled. Starting in the 2011-2012 sample, Asian individuals were no longer categorized within the “other” race category. Thus, the Hispanic ethnic group was only analytically assessed from 2007 onward and the Asian group from 2011 onward. Furthermore, the 2019-2020 sample was interrupted because of the COVID-19 pandemic. Data are available for combined 2017-2018 and 2019-2020 samples. This 2017-2020 combined sample was excluded from analyses but included in eFigures in the Supplement because of differences in sample weights.

Cardiovascular diseases were defined by self-report and included myocardial infarction (hereafter, coronary artery disease [CAD]), stroke, and heart failure (HF). Cardiometabolic risk factors included hypertension, diabetes, obesity, and hyperlipidemia. Hypertension was defined by self-report, taking antihypertensive medication, or having a mean blood pressure (3 readings) of 130/80 mm Hg or higher. Diabetes was defined by self-report, taking diabetic medication, or having a hemoglobin A_1c of 6.5% or higher. Obesity was defined as having a body mass index of 30 or higher (≥27.5 for the Asian group), calculated from measured weight in kilograms divided by measured height in meters squared in the mobile examination center. Hyperlipidemia was defined as taking cholesterol-lowering medication (statin, bile-acid sequestrants, fibrates, cholesterol absorption inhibitors, PCSK9 inhibitors), having a low-density lipoprotein cholesterol of 160 mg/dL or higher (calculated by Sampson method), or non-high-density lipoprotein cholesterol 190 mg/dL or higher. (To convert cholesterol to millimoles per liter, multiply by 0.0259.) Participation in SNAP was defined by measured height in meters squared in the mobile examination center.

Results

Population Characteristics

The analytic sample (N = 57517) represents 312 million non-institutionalized adults in the United States (Table 1). The sample was 1.6% Asian, 11.2% Black, 13.8% Hispanic, 68.8% White, and 4.6% other or multiracial. Food insecurity was present in 6770 adults (11.8%) but in general increased across the study period from between 8.2% and 10.2% before the Great Recession (1999-2006), 10.5% and 13.3% during the Great Recession (2007-2010), 15.3% and 16.0% immediately after- ward (2011-2014), and 18.2% and 18.5% in the most recent years (2015-2018) (Figure 1A). Participation in SNAP was reported by 7.0% of adults. Any CVD was present in 7.9% (Table 1 lists individual CVDs and cardiometabolic risk factors).

Individuals with food insecurity were more likely to report their race and ethnicity as Black or Hispanic compared with White and report SNAP participation, any CVD, stroke, HF, hypertension, obesity, diabetes, and dyslipidemia (Table 1). The 2011 and later sample was younger; more likely to report food insecurity (3853 of 23145 [16.7%] vs 3320 of 34372 [9.7%]; P < .001); more likely to report SNAP participation; and more likely to have obesity, diabetes, or dyslipidemia (eTable 3 in the Supplement).

Trends in Food Insecurity Among Individuals With CVD and Cardiometabolic Risk Factors

The prevalence of food insecurity was higher among individuals with CVD compared with those without CVD (Figure 1 and eTable 2 in the Supplement). The prevalence of food insecurity among those with CVD was 16.3% (95% CI, 13.5%-19.1%) in 1999-2000 and 38.1% (95% CI, 31.1%-45.1%) in 2017-2018 (P < .001 for trend). Although prevalence of food insecurity among those with CVD increased across the survey period, the magnitude of change was not different from those without CVD (interaction coefficient = 0.02, P = .05 for interaction).

Among individual CVDs, prevalence of food insecurity was lower in 1999-2000 than 2017-2018 for those with CAD (19.4% and 41.3%, respectively), stroke (7.0% and 43.7%, respectively), and HF (11.3% and 45.3%, respectively). The changing prevalence of food insecurity was similar in magnitude among individuals without CAD and stroke (interaction coefficient = 0.02, P = .38, and interaction coefficient = 0.04, P = .07, respectively). But for HF, the magnitude of change was greater than among those without CVD (interaction coefficient = 0.06, P = .003).

For individual cardiometabolic risk factors (eFigure 1 in the Supplement), prevalence of food insecurity was higher among individuals with hypertension vs those without in 2011-2015 and was lower in 1999-2000 (8.5%) than 2017-2018 (19.4%). The magnitude of change in prevalence of food insecurity was...
Food Insecurity, Cardiovascular Disease, and Cardiometabolic Risk Factors Across Race and Ethnicity

Table 1. Population Characteristics (Representing 312,200,471 Noninstitutionalized US Adults)

| Variable | No. (%) | Entire sample (N = 57,517) | Food insecurity (n = 6770) | No food insecurity (n = 44,747) | P value |
|----------|---------|-----------------------------|---------------------------|---------------------------------|---------|
| Age, mean (SD), y | 46.3 (2.2) | 46.3 (1.6) | 46.2 (2.1) | .04 |
| Female | 29,916 (52.0) | 3578 (54.3) | 26,338 (51.8) | .20 |
| Male | 27,601 (48.0) | 3195 (45.7) | 24,406 (48.2) | |
| Racial and ethnic category | | | | | <.001 |
| Asian | 927 (1.6) | 72 (1.2) | 855 (1.7) | |
| Hispanic | 7925 (13.8) | 1937 (27.7) | 5988 (12.0) | |
| Non-Hispanic Black | 6420 (11.2) | 1203 (18.2) | 5217 (10.4) | |
| Non-Hispanic White | 39,595 (68.8) | 3222 (48.0) | 36,373 (71.4) | |
| Other | 2649 (4.6) | 338 (4.9) | 2312 (4.6) | |
| SNAP participation | 4047 (7.0) | 1703 (24.8) | 2344 (4.7) | <.001 |
| Below federal poverty line | 8247 (14.3) | 2759 (40.6) | 5488 (11.0) | <.001 |
| Cardiovascular disease | | | | | |
| Coronary disease | 2933 (5.1) | 370 (7.8) | 2562 (4.8) | .38 |
| Stroke | 1534 (2.7) | 250 (5.0) | 1284 (2.4) | <.001 |
| Heart failure | 1163 (2.4) | 192 (4.2) | 1171 (2.2) | .03 |
| Any cardiovascular disease | 4524 (7.9) | 607 (12.5) | 3917 (7.4) | .02 |
| Cardiometabolic risk factorsb | | | | | |
| Hypertension | 28,531 (49.6) | 3059 (53.3) | 25,472 (49.2) | <.001 |
| Obesity | 17,982 (33.2) | 2508 (40.4) | 15,474 (32.5) | <.001 |
| Diabetes | 6416 (11.2) | 943 (17.8) | 5473 (10.5) | <.001 |
| Dyslipidemia | 16,227 (30.8) | 1761 (33.7) | 14,466 (30.4) | .005 |

Abbreviation: SNAP, Supplemental Nutrition Assistance Program.

* Before 2011, the other category includes non-Hispanic Asian individuals. Other also includes multiracial and those not identifying with the other listed racial and ethnic subgroups.

b There were 45 individuals missing data for hypertension, 3633 missing for obesity, 62 missing for diabetes, and 4776 missing for dyslipidemia.

Trends in Food Insecurity Across Racial and Ethnic Groups by CVD and Cardiometabolic Risk Factors

Across the entire sampling period, prevalence of food insecurity was greater in those without hypertension (interaction coefficient = 0.02, P = .02). Prevalence of food insecurity was higher among patients with diabetes and obesity vs those without these diagnoses in 2009-2016 and generally was lower in 1999-2000 vs 2017-2018 (15.4% to 22.5% and 10.0% to 20.7%, respectively). The magnitude of these changes in prevalence of food insecurity was not greater in those without diabetes and obesity (interaction coefficient = −0.005, P = .62, and interaction coefficient = 0.01, P = .23, respectively). Individuals with dyslipidemia only reported higher prevalence of food insecurity than in those without dyslipidemia in 2009-2010, and although food insecurity was lower in 1999-2000 vs 2017-2018 (9.3% to 19.8%), the magnitude of change was not different in those without dyslipidemia (interaction coefficient = −0.002, P = .82). (Figure 2 in the Supplement contains plots that include the 2017-2020 data.)

Prevalence of food insecurity among Asian adults with CVD did not change over time (24.1%; 95% CI, 21.5%-26.7%, vs 9.9%; 95% CI, 5.1%-14.8%; P = .30 for trend). The highest prevalence of food insecurity among Asian adults with CVD was 24.1% in 2011-2012, which was the only period wherein prevalence of food insecurity was higher among those with vs without CVD. The magnitude of change in prevalence did not differ from Asian adults without CVD (interaction coefficient = 0.09, P = .46).

Prevalence of food insecurity among Black adults with CVD was also lower in 1999-2000 (5.7%; 95% CI, 1.5%-9.8%) compared with 2017-2018 (25.4%; 95% CI, 21.4%-29.3%; P < .001 for trend). The magnitude of change across the sample period was not different from Black adults without CVD (interaction coefficient = 0.01, P = .41). The highest prevalence of food insecurity for Black adults was 37.3% (95% CI, 24.6%-50.0%) in 2013-2014.

Prevalence of food insecurity among Hispanic adults with CVD changed from 31.6% (95% CI, 23.7%-39.5%) in 2007-2008 to 42.2% (95% CI, 29.3%-55.0%) in 2017-2018 (P = .01 for trend). The magnitude of change in prevalence did not differ from Hispanic adults without CVD (interaction coefficient = 0.04, P = .05). The highest prevalence of food insecurity among Hispanic adults with CVD was 65.2% (95% CI, 51.7%-78.6%) in 2015-2016.

Prevalence of food insecurity among White adults with CVD was lower in 1999-2000 (20.2%; 95% CI, 15.9%-24.5%) compared with 2017-2018 (45.1%; 95% CI, 32.4%-57.9%; P < .001). The magnitude of change in prevalence of food insecurity across the sample period was not different from...
White adults without CVD (interaction coefficient = 0.02, \( P = .40 \)). The highest prevalence of food insecurity among White adults with CVD was 45.1% (95% CI, 32.4%-57.9%) in 2017-2018. (eFigure 3 in the Supplement shows plots that include the 2017-2020 data, and eFigures 4-6 in the Supplement show trends in food insecurity by individual CVD.)

### Trends in Food Insecurity Across Race and Ethnicity Since 2011
In the periods for which all racial and ethnic categories were similarly defined (2011-2018), there were differences in prevalence of food insecurity over time. Black adults with CVD had a higher prevalence of food insecurity in 2011-2012 (36.6%; 95% CI, 23.9%-49.4%) compared with 2017-2018 (25.4%; 95% CI,
SNAP Participation Among Individuals With Food Insecurity in Contemporary Periods

In the most contemporary sample periods (2015-2018), SNAP participation was higher among those with food insecurity and any CVD compared with those with food insecurity without any CVD (54.2%; 95% CI, 46.6%-61.8%, vs 44.3%; 95% CI, 40.5%-48.1%; \( P = .01 \)) (Table 2). There was similar SNAP participation among those who reported food insecurity with or without individual CVDs or any individual cardiometabolic risk factors.

Discussion

We report the prevalence of food insecurity in the United States among individuals with CVD or cardiometabolic risk factors across racial and ethnic groups. In more recent years, food insecurity was present among approximately 2 in 5 of those with any CVD and about twice as common than in those without CVD. Across races and ethnicities, there were important differences in trends in food insecurity among those with CVD or without CVD. Among individuals with food insecurity, more than 4 in 10 did not participate in SNAP, an important federal program for food assistance.

Food insecurity is disproportionately experienced by Black and Hispanic adults. Food insecurity is also disproportionately experienced by those with CVD and can increase the risk of negative CVD outcomes. Thus, food insecurity has the potential to exacerbate existing racial and ethnic disparities in health. Our findings confirm that food insecurity disproportionately affects racial and ethnic minority groups, those with CVD, and possibly those with cardiometabolic risk factors. This highlights the potential effect of CVD on social circumstances (and vice versa). Furthermore, in more recent study periods, there was similar experience of frequent food insecurity among individuals with CVD for Black, Hispanic, and White adults alike. Those without CVD remained with disparate rates of food insecurity across races and ethnicities that are similar to known racial and ethnic disparities.
This finding highlights the strengths of the association between food insecurity and CVD, although the cross-sectional nature of the data limits the ability of our study to inform on the directionality of that relationship. We anticipate that this relationship is bidirectional wherein food insecurity likely increases risk for CVD and CVD affects socioeconomic factors that increase risk for food insecurity. These observations lend support to contemporary views that differences in health across racial and ethnic groups are closely tied to social circumstances and differences in life experience. For example, this may be the case to explain the difference in dietary quality among individuals participating in SNAP, with education being the largest explanatory variable. More in-depth analysis to understand other explanatory variables was beyond the scope of this study.

Our study builds on results from an earlier report that found food insecurity approximately doubled from before the Great Recession to immediately afterward. Following the Great Recession, our study showed that this increase in food insecurity has yet to recover. This finding differs from annual USDA reports from the Current Population Survey, which uses the same survey questions but found lower food insecurity starting in 2015, with a return to pre–Great Recession levels by 2018. Our findings may differ because of methodological differences, including sample selection, a smaller sample size in NHANES, and age standardization in our analysis. It is unclear which is more accurate, although the USDA data are curated more frequently and are commonly referenced for food insecurity frequency. We also confirmed findings that before the Great Recession, individuals with a history of CAD or HF had higher food insecurity, and this difference persisted in the contemporary sample periods. Our study adds that food insecurity is highly prevalent among patients with reported stroke, and since the Great Recession, the disparity in food insecurity among those with HF and hypertension is increasing.

As a potent SDOH that is associated with worse outcomes among individuals with CVD or cardiometabolic risk factors, food insecurity could be addressed by public policy, health care systems, and clinicians. As the largest public food benefit program, SNAP decreases food insecurity and is associated with higher prescription drug adherence and lower medical costs and hospitalizations. In 2021, there was a permanent increase in SNAP benefits, which could improve food insecurity. A previous temporary increase in SNAP funding from April 2009 through October 2013 via the American Recovery and Reinvestment Act had been shown to decrease food insecurity. Additional considerations include expanding eligibility for SNAP and expanding efforts to enroll already-eligible individuals. Increasing SNAP benefit amounts could disproportionately benefit Black adults because of their higher proportional SNAP participation than members of other racial and ethnic groups.

Clinicians and health care systems can increase efforts to recognize SDOH through validated screeners, such as the 2-question Food Insecurity Screener, to detect food insecurity among patients. After identification, food insecurity can be addressed through a team-based approach that incorporates referral to social workers, caseworkers, or state social service departments for individuals to apply for food programs (eg, SNAP).

Furthermore, clinicians and health care systems can be partners in increasing patient awareness of local or statewide food access. One example is the Fair Food Network, which championed the Double Up Food Bucks (DUFB) program, which supplements program benefits by allowing SNAP participants to double SNAP dollars (up to $20 per day) for fruits and vegetables. The DUFB program has proven efficacy to improve fruit and vegetable consumption and food security. Furthermore, the DUFB program is active in 25 states and individuals who are already receiving SNAP benefits can quickly be made aware.

Limitations
This study had limitations. First, some factors were based on self-report, which could be subject to error. Second, NHANES is cross-sectional and thus limits our ability to draw causal inferences. Third, NHANES definitions of racial and ethnic groups changed over time in regard to sampling of Asian and Hispanic populations. Thus, we were unable to assess trends in food insecurity among Asian and Hispanic adults before the Great Recession. Fourth, our definitions of cardiometabolic risk factors could have allowed for misclassification if hypertensive, diabetic, or lipid-lowering medications were prescribed for other indications (eg, angiotensin-converting enzyme inhibitors in nondiabetic/nonhypertensive nephropathy).

### Table 2. Supplemental Nutrition Assistance Program Participation Among Those Who Have Food Insecurity Across Cardiovascular Diseases and Cardiometabolic Risk Factors

| Factor                  | % (95% CI)  | P value |
|-------------------------|-------------|---------|
| **Cardiovascular disease** |             |         |
| Any                     | 54.2 (46.6-61.8) | .01     |
| None                    | 44.3 (40.5-48.1) |         |
| **Coronary artery disease** |             | .54     |
| Yes                     | 48.5 (36.8-60.2) |         |
| No                      | 44.9 (41.1-48.7) |         |
| **Stroke**              |             | .06     |
| Yes                     | 52.9 (44.6-61.2) |         |
| No                      | 44.6 (40.9-48.3) |         |
| **Heart failure**       |             | .06     |
| Yes                     | 58.8 (42.5-75.1) |         |
| No                      | 44.0 (40.4-47.7) |         |
| **Hypertension**        |             | .28     |
| Yes                     | 45.4 (41.8-49.0) |         |
| No                      | 42.4 (37.1-47.6) |         |
| **Obesity**             |             | .98     |
| Yes                     | 44.9 (40.0-49.8) |         |
| No                      | 44.8 (40.8-48.8) |         |
| **Diabetes**            |             | .99     |
| Yes                     | 43.8 (35.5-52.1) |         |
| No                      | 43.8 (40.0-47.6) |         |
| **Dyslipidemia**        |             | .74     |
| Yes                     | 43.6 (38.0-49.3) |         |
| No                      | 44.7 (40.1-49.3) |         |
Conclusions

The prevalence of food insecurity among individuals with CVD increased substantially from 1999 to 2018. Disparities in food insecurity persist across race and ethnicity and among those with vs without CVD. As health care systems and clinical care evolve to address SDOH, food insecurity is a potent risk factor for worse cardiovascular outcomes that warrants increased recognition and additional resources to combat its negative health consequences.
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