

## Heart failure and the holidays.

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## Heart failure and the holidays

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### Abstract

**Introduction** Studies suggest increased cardiac morbidity and heart failure exacerbations during winter months with a peak around the holiday season. Major sporting events and intense encounters in sports have been shown to affect cardiovascular outcomes amongst its fans.

**Methods** All patients admitted to Einstein Medical Center between January 1, 2003 and December 31, 2013 with a diagnosis of congestive heart failure were included in the study. They were included on the basis of the presence of an ICD-9CM code representing congestive heart failure as the primary diagnosis. Comparisons were made between the rates of heart failure admissions on the holiday, 4 days following the holiday and the rest of the month for 5 specific days: Christmas day, New Year's day, Independence day, Thanksgiving day and Super Bowl Sunday.

**Results** Our study included 22,727 heart failure admissions at an average of 5.65 admissions per day. The mean patient age was  $68 \pm 15$  years. There was a significant increase in daily heart failure admissions following Independence day (5.65 vs. 5;  $p = 0.027$ ) and Christmas day (6.5 vs. 5.5;  $p = 0.046$ ) when compared to the rest of the month. A

history of alcohol abuse or dependence did not correlate with the reported rise in heart failure admissions immediately following the holidays. The mean number of daily admissions on the holidays were significantly lower for all holidays compared to the following 4 days. All holidays apart from Super Bowl Sunday demonstrated lower admission rates on the holiday compared to the rest of the month.

**Conclusion** Christmas and Independence day were associated with increased heart failure admissions immediately following the holidays. The holidays themselves saw lower admission rates. Overeating on holidays, associated emotional stressors, lesser exercise and postponing medical around holidays may be among the factors responsible for the findings.

**Keywords** Heart failure · Holiday · Over-eating · Independence day · Thanksgiving · New year · Christmas · Super Bowl

### Introduction

The industrialized world is facing an ever-increasing burden of health related challenges associated with an aging population and heart failure (HF) remains a leading cause of morbidity and mortality [1, 2]. Despite the advances, HF is associated with a relatively poor prognosis with high readmission rates. Physician adherence to guideline recommendations, early adoption of evidence-based treatments across all levels of care, optimal risk factor control and execution of measures that provide additional assistance especially to the elderly and high risk patients have been proposed over time as part of a holistic approach to improve HF management [3–6].

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Over the years, researchers have looked for an association between diet and cardiovascular outcomes. There is evidence to suggest that overeating predisposes high risk patients to heart attacks. A study presented at the AHA meeting in the year 2000 found that a single large meal led to a fourfold increase in heart attacks within 2 h of the meal [7]. The pathophysiology behind this phenomenon is complex but may be explained in part by the diversion of circulation to the gastro-intestinal system following a meal. Such diversion compromises blood supply to vital organs such as the heart and brain despite an increased cardiac output causing further stress on the heart. Post-prandial lipemia causes transient endothelial dysfunction increasing atherogenicity [8]. Both whole-body oxygen consumption and total body spillover of noradrenaline have been shown to rise following a large meal in healthy adults. Such changes may cause acute fluctuations in blood pressure and pulse rates [9]. These elevations in blood pressure, changes in blood insulin and fat levels after a meal could potentially result in coronary damage and precipitate plaque rupture [6, 10]. A high salt content in the diet can precipitate acute decompensation in patients with heart failure (HF) [11].

The winter months are commonly associated with significantly higher rates of HF [11, 13, 18]. Phillip and colleagues noticed an increase in cardiac mortality around the Christmas and New Year holidays within the USA [12]. A study performed in England failed to see a spike in cardiac and respiratory deaths on Christmas day but reported higher mortality on New Year's day [14]. Another multicenter retrospective study done in New Jersey found that the 2-week period around Christmas and New Year's was linked to a significant increase in daily HF visits to the emergency department and a higher rate of sudden cardiac death [15]. Kloner and his team contemplated that emotional stress combined with overindulgence was responsible for the poor cardiovascular outcomes around holidays [16]. Their research group also expressed that the large scale celebrations at the time of Y2 K were responsible for a higher rate of ischemic deaths seen that year compared to other years [17]. A change in attitude, lack of normal exercise, poor dietary habits, and postponing medical care during the holiday season probably play just as important a role [18–20]. Holiday drinking and weekend binge drinking have been associated with arrhythmic episodes whereas chronic alcohol use is associated with development of cardiomyopathy and HF [20–22]. Though, the impact of alcohol intake around holidays on clinical HF remains unclear.

We hypothesized that in addition to Christmas and New Year's, other holidays such as Independence Day, Thanksgiving day and Super Bowl Sundays may also put patients at a higher risk may for heart failure exacerbations requiring inpatient care.

## Methods

All patients admitted to Einstein Medical Center between January 1, 2003 and December 31, 2013 with a primary diagnosis of congestive heart failure were included in a retrospective manner. The institutional review board committee at Einstein Medical Center approved the study. The following International Classification of diseases, Ninth revision, and Clinical Modification (ICD-9CM) codes were used for diagnosis of heart failure according to patient's medical records: 428.0, 428.1, 428.2, 428.3, 428.4, 429.9, 402.11, 402.91, 404.91, and 404.93 (refer to Table 1). These codes represent the spectrum of diagnoses under which patients presenting with heart failure were admitted. Trained members of physician billing and medical records department were responsible for assignment of codes according to the ICD-9CM codes. Patient information as race, age, sex, length of stay, and relevant past medical history such as diabetes mellitus, hypertension, hyperlipidemia, end stage renal disease, coronary artery disease, and an acute coronary syndrome during that admission was obtained. We also acquired additional information detailing a history of alcohol abuse or alcohol dependence among our study population. Pregnant patients and those under 18 years of age were excluded from the study.

## Data analysis

HF admissions were divided into 3 groups depending on the date of admission. The mean number of daily heart failure admissions during the 4 days following Independence day (July 5–8 in 2003–2013), Thanksgiving holiday (November 28–December 1 in 2003, November 26–29 in 2004, November 25–28 in 2005, November 24–27 in 2006, November 23–26 in 2007, November 28–December 1 in 2008, November 27–30 in 2009, November 26–29 in 2010, November 25–28 in 2011, November 23–26 in 2012, November 29–December 2 in 2013), Christmas day (December 26–29 in 2003–2013), New Year's day (January 2–5 in 2003–2013) and Super Bowl Sunday (January 27–30 in 2003, February 2–5 in 2004, February 7–10 in 2005, February 6–9 in 2006, February 5–8 in 2007, February 4–7 in 2008, February 2–5 in 2009, February 8–11 in 2010, February 7–10 in 2011, February 6–9 in 2012 and February 4–7 in 2013) formed the 'Post-Holiday' group. The mean number of daily HF admissions during the rest of the calendar month for the respective holiday (excluding the 4 days following the holiday) formed the 'Holiday Month' group. The mean number of daily HF admissions on the actual holidays formed the 'Holiday' group. These three groups were created for the purpose of comparison. The difference in the length of stay for admissions was compared between the Post-Holiday and

**Table 1** Spectrum of heart failure diagnoses under the International Classification of diseases, Ninth revision, and Clinical Modification (ICD-9CM) used for inclusion of patients in the study

|        |  |
|--------|--|
| 428.0  | Congestive heart failure, unspecified  |
| 428.1  | Left heart failure   |
| 428.2  | Systolic heart failure   |
| 428.3  | Diastolic heart failure  |
| 428.4  | Combined systolic and diastolic heart failure  |
| 429.9  | Heart failure, unspecified   |
| 402.11 | Hypertensive heart disease, benign with congestive heart failure                     |
| 402.91 | Hypertensive heart disease, unspecified with congestive heart failure                |
| 404.91 | Hypertensive heart and renal disease, unspecified with congestive heart failure      |
| 404.93 | Hypertensive heart and renal disease with congestive heart failure and renal failure |

Holiday Month groups. Within the Christmas population, we compared the proportion of short-term (1 week) readmissions comprising the Post-Holiday and Holiday Month groups. We evaluated for a link between alcohol-related disorders and heart failure admissions following the holidays.

### Statistics

Demographics and other baseline characteristics were summarized using descriptive statistics. Descriptive statistics were calculated for continuous variables, and frequencies and percentages were displayed for categorical data. Continuous data were expressed as mean  $\pm$  one standard deviation. Two-tailed  $p$  values were used for statistical assessment and a  $p$  value  $<0.05$  was considered significant. Continuous data were expressed as mean  $\pm$  one standard deviation and analyzed using the student's  $t$  test. Fischer's exact test or Chi-square was used for analysis of categorical variables. SPSS version 20 was used to perform data analysis.

## Results

### Baseline characteristics

There were a total of 22,727 heart failure admissions between 1/1/2003 and 12/31/2013 at our institute with an average of 5.65 admissions per day. The demographic data and baseline characteristics have been represented on Table 2. Mean age for patients was  $68 \pm 15$  years and females formed the majority of the study population (52.2 %).

January (2170 admissions) experienced the highest number of HF admissions whereas August (1707 admissions) experienced the least. The monthly variations in heart failure admissions are shown in Fig. 1.

Patients were divided into three groups depending on the date of admission for the purposes of comparison as described in methods.

**Table 2** Baseline characteristics of patients within the cohort

| Patient Characteristic                                      |                       |
|---|-----------------------|
| Total patients ( $n$ )                                      | 22,727                |
| Sex (male)  | 10,854 (47.8 %)       |
| Age (years)   | $68 \pm 15$           |
| Race (African American/Caucasian/Hispanic/Asian/Others) (%) | 75.1/17.3/4.2/1.5/1.9 |
| Hypertension (%)  | 96.5                  |
| Diabetes Mellitus (%)                                       | 64.7                  |
| Hyperlipidemia (%)  | 54.5                  |
| End stage renal disease (%)                                 | 18.5                  |
| Coronary artery disease (%)                                 | 72.8                  |
| Non ST Elevation Myocardial infarction (%)                  | 3.4                   |
| ST Elevation Myocardial infarction (%)                      | 0.7                   |

Figure 2 and Table 3 represent information regarding HF admissions at the time of different holidays and comparisons between the groups as elaborated below.

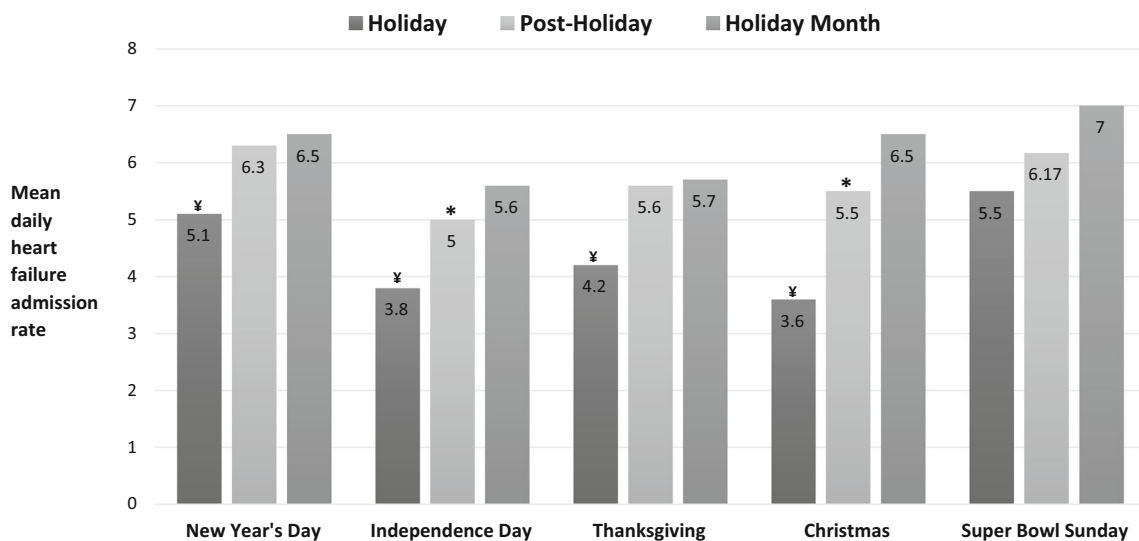
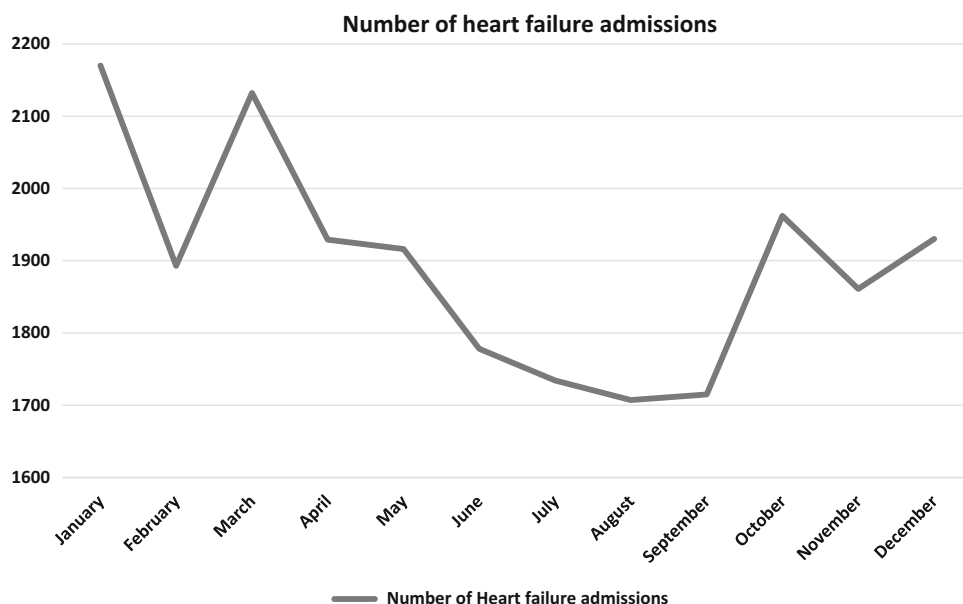
### New year's day

There were a total of 2170 HF admissions in the month of January from 2003 to 2013. There was no difference in the mean daily admissions between the Post-Holiday and Holiday Month groups (6.5 vs. 6.3;  $p = 0.4$ ). The length of stay was shorter for patients Post-Holiday compared to the Holiday Month ( $p = 0.049$ ). The average number of admissions on New Year's day were significantly lesser when compared to both the Post-Holiday and Holiday Month groups ( $p = 0.033$  and  $p = 0.035$ , respectively).

### Independence day

There were a total of 1734 HF in the month of July. The relative difference in means for daily HF admission between the Post-Holiday and Holiday Month groups was 11.3 %. This difference in means was statistically significant (5.65 vs. 5;  $p = 0.027$ ) indicating a higher incidence of admissions following the 4th of July when compared to

**Fig. 1** Monthly variation in heart failure admissions



**Fig. 2** Mean daily heart failure admission rate among different study groups plotted against respective holiday. \* $p$  value <0.05 when comparing Post-Holiday and Holiday Month groups † $p$  value <0.05 when comparing Holiday and Holiday Month groups

the rest of the month. There was no difference in the length of stay between these two groups ( $p = 0.112$ ). There were lesser HF admissions on Independence day compared to the Post-Holiday and Holiday Month groups ( $p = 0.004$  and  $p = 0.033$ , respectively).

**Thanksgiving**

A total of 1895 HF admissions were included in this group. There was no difference in the mean number of daily HF

admissions or length of stay between the Post-Holiday and Holiday Month groups ( $p = 0.78$  and  $p = 0.12$  respectively). The average number of admissions on Thanksgiving day were lesser compared to both the groups ( $p = 0.033$  and  $p = 0.023$ , respectively).

**Christmas**

There were a total of 1930 admissions in this category. The Post-Holiday group had a higher mean daily HF admission

**Table 3** Distribution of heart failure admissions and length of stay among different groups according to holidays

| Variable                            | Post-Holiday | Holiday Month | Holiday |
|-------------------------------------|--------------|---------------|---------|
| <b>New Year's day</b>               |              |               |         |
| Total heart failure admissions (no) | 288          | 1882          | 57      |
| Mean daily admission rate           | 6.5          | 6.3           | 5.1     |
| Length of stay (days)               | 5.2 ± 5.8    | 5.9 ± 6.3     | N/A     |
| <b>Independence day</b>             |              |               |         |
| Total heart failure admissions (no) | 250          | 1484          | 42      |
| Mean daily admission rate           | 5.6          | 5             | 3.8     |
| Length of stay (days)               | 5.2 ± 5.3    | 5.8 ± 6       | N/A     |
| <b>Thanksgiving</b>                 |              |               |         |
| Total heart failure admissions (no) | 253          | 1642          | 47      |
| Mean daily admission rate           | 5.7          | 5.6           | 4.2     |
| Length of stay (days)               | 5 ± 6.2      | 5.6 ± 6.1     | N/A     |
| <b>Christmas</b>                    |              |               |         |
| Total heart failure admissions (no) | 286          | 1644          | 40      |
| Mean daily admission rate           | 6.5          | 5.5           | 3.6     |
| Length of stay (days)               | 5.8 ± 7.1    | 5.5 ± 5.6     | N/A     |
| <b>Super Bowl</b>                   |              |               |         |
| Total heart failure admissions (no) | 308          | 1627          | 61      |
| Mean daily admission rate           | 7            | 6.17          | 5.5     |
| Length of stay (days)               | 6 ± 5.6      | 6 ± 6.4       | N/A     |

rate compared to the Holiday Month group (6.5 vs. 5.5;  $p = 0.046$ ) with a relative difference between the means of 18.18 %. There was no difference in the length of stay between these groups ( $p = 0.511$ ). The mean number of admissions on Christmas was significantly lesser than both between the Post-Holiday and Holiday Month groups ( $p = 0.003$  and  $p = 0.006$ , respectively).

In a separate analysis assessing for difference in readmission rates, there was no difference in the short term readmission rate Post-Holiday compared to the Holiday Month group ( $p = 0.4$ ).

### Super Bowl Sunday

There were a total of 1935 admissions in this group. There was no difference in the average number of daily HF admissions or length of stay between the Post-Holiday and Holiday Month groups ( $p = 0.19$  and  $p = 0.91$ , respectively). The mean daily HF admission rate was lower on Super Bowl Sunday when compared to the Post-Holiday group ( $p = 0.048$ ) but not when it came to the Holiday Month ( $p = 0.45$ ).

### Relation to alcohol

There was no association between alcohol (defined as a history of alcohol abuse or dependence in patients) and rate of hospital admissions between the Post-Holiday and Holiday Month groups as seen on Table 4 for all holidays studied.

**Table 4** Comparison in alcohol-related admissions

|                   | Alcohol related admissions the Post-Holiday group | Alcohol related admissions in the Holiday Month group | <i>p</i> value |
|-------------------|---|---|----------------|
| New Year's day    | 34  | 226   | 1              |
| Independence day  | 34  | 182   | 0.409          |
| Thanksgiving day  | 35  | 202   | 0.476          |
| Christmas day     | 32  | 193   | 0.920          |
| Super Bowl Sunday | 37  | 168   | 0.365          |

### Discussion

We studied a relatively high risk population with a mean age of 68 years, predominantly African American and a significant proportion of the patients suffering from hypertension, prior coronary artery disease, diabetes and hyperlipidemia. Our findings showed a marked increase in heart failure admissions immediately following Independence day and Christmas compared to the rest of the month. For the rest of the holidays although the number of mean daily admission rate was higher following the holidays, this difference was not statistically significant. The complex pathophysiology of congestive heart failure in patients with stable disease involves relatively slow accumulation of fluid in the extracellular space with overactivity of the neuro-hormonal systems. It leads to failure of the compensatory mechanisms and manifests clinically as

an acute exacerbation of heart failure [23–27]. The reason for choosing days immediately following a holiday for assessment of holiday-related heart failure is that the effects of overindulgence on heart failure take time to manifest. Admissions for heart failure on the actual holiday were lesser when compared to the following 4 days for all five events. Similarly heart failure admissions on all holidays apart from Super Bowl Sunday were significantly lesser than the rest of the month. The admissions following New Year's day had a shorter length of stay compared to the rest of the month. The length of stay was similar between the groups for the rest of the holidays. We found no association between alcohol and heart failure admissions in either group.

Our findings were similar to other studies where they found an increase in heart failure admissions after Christmas but unlike these studies we failed to see an increase following New Year's Day [14, 15]. The relative increase in admission rate after Christmas was less prominent in our study (18.18 %) compared to the difference of 33 % found by Reedman et al. [15]. It may be explained by disparities in baseline characteristics between the study populations. Patients were much older in the latter study (77 years vs. 68 years) and their study evaluated patients presenting to the emergency department. On the other hand, we included patients with congestive heart failure that was severe enough to warrant admission to the hospital. We tested the hypothesis that the spike in admissions following holidays may be related to increased readmission rates from premature discharges immediately before or on holidays within the Christmas subgroup. We found to no increase in readmission rates following the holiday.

There has been evidence of increased cardiac morbidity and mortality during the winter months [10, 12–19]. Our monthly variations in heart failure shows a similar overall trend with more HF admissions during winter and lesser admissions during warmer months. We found January to be associated with the highest admission rate. This may be related to temperature among other factors such as failure to acquire care in time, overeating, stress and lack of exercise may also contribute during this time period [16, 28–30]. Prior studies have demonstrated a weight gain among subjects during the holiday weeks compared to non-holiday weeks [28–30]. The study by Yanovsky et al. showed an increase in weight among 195 adults specifically during the holiday season (from mid-November to early or mid-January), with the 6 week period accounting for more than 50 % of weight gain for the given year [29]. We hypothesize that patients with HF would be at the greatest health risk from this weight gain. Baker et al. showed consistent self-monitoring during this period acts as a potential coping mechanism in preventing this weight gain [30]. No prior studies have specifically looked at

Independence day or even Thanksgiving, when it is relatively warmer but other risks directly attributed to holidays remain relevant. Similar to Christmas, we found a significant rise in the rate of daily heart failure admissions following Independence day which backs our hypothesis caution needs to be advised in the case high risk patients during holidays irrespective of the time of the year.

Studies have documented a link between important national sporting events and a higher cardiovascular morbidity and mortality in the general population [31–34]. Negative and positive emotional stressors have both been shown to trigger stress cardiomyopathy in patients [35]. This phenomenon may contribute to the development of decompensated heart failure in some cases. We believe that Super Bowl Sunday shares some risk factors with the holiday season, compounded further by additional emotional stressors related to the game putting HF patients at risk. During the soccer world cup in 2008, there were higher cardiac emergencies in Germany on the day their team played compared to the other days [34] especially among males with known coronary disease. A similar study in Los Angeles showed an increased cardiovascular mortality when the local football team lost the super bowl [36]. The emotional stress of a loss, the rivalry between the teams and the intensity of the game were found to be possible triggers for the increased deaths. On the other hand, the teams' victory may be associated with a reduced death rate amongst fans [36]. We found a high rate of HF admissions following the Super Bowl; however, it was statistically no different compared to the rest of the month. In the year 2005, the Philadelphia Eagles lost to the New England Patriots in Super Bowl XXXIX in a rather closely contested encounter. Interestingly, that particular year was associated with the highest rate of daily heart failure admissions (8.75 admissions per day) at our institute. Thus, the emotional stress of watching a close game and ending up on the losing side may be associated with increased cardiac morbidity among the fans.

Alcohol forms an integral part of the holiday celebrations. Prior studies have not looked at the relation between alcohol and heart failure admissions during the winter months or holidays. We were unable to obtain information about the actual intake of alcohol or the quantity of intake in our patients but did not find any association between patients with a history of alcohol abuse or dependence and heart failure exacerbations.

### Limitations

This is a single center retrospective study performed at a community-based hospital in Philadelphia. We were unable to evaluate for confounding factors that could alter the findings of our study due to its retrospective nature. Our



findings may not be generalized to all population until further data become available. We used ICD-9CM codes to identify patients with heart failure but a review of the entire hospital stay by a physician may be the ideal method of identifying patients. We were unable to acquire information on patient vitals, body habitus, severity of acute heart failure, baseline NYHA class or left ventricular ejection, prior exacerbations, extent of coronary disease and medication information or compliance data which may have affected the outcomes in our patients. We did not adjust for change in temperature during these days which may have a role in heart failure admissions. The exact timing of the admissions was not taken into consideration as long as they were on the same day. We may have missed milder forms of HF exacerbations following holidays that did not need admission but in the process we managed to wean out patients with more clinically relevant heart failure syndromes. The findings of a shorter stay following New Year's day could not be explained and may be alluded to chance.

In conclusion, we found that heart failure admissions on all holidays were lesser on the actual holiday itself. There was an increase in HF admissions for a short duration immediately following Christmas and Independence Day. Overall, this was in keeping with the general understanding that patients tend to stay away from hospitals on holidays. Waiting until symptoms get worse and not seeking medical intervention in time, being away from their homes, outpatient medical offices being closed or unavailable on holidays and possibly even suffering in silence to avoid disrupting the festive mood probably play a role in this delay. All patients at risk for HF should be advised to exercise restraint by their physicians at the time of the holidays and avoid a large caloric intake. Compliance with diet and medications is critical during such times and all patients should be encouraged to practice continuous self-monitoring. Further studies are needed to provide more insights into the underlying mechanisms influencing hospital admissions around different holidays.

#### Compliance with ethical standards

**Conflict of interest** All authors have no conflict of interest.

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