Vocal Fatigue Experiences and Mitigation Strategies in the Sacred Harp Singing Community

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Summary: Objectives. Sacred Harp singers sing at a high volume for sustained periods of time without collective warm-up or cool-down exercises, ostensibly putting them at elevated risk for vocal fatigue (VF) and associated vocal pathologies. Participants are also likely to lack formal vocal training. The purpose of this study was to (1) assess singers' experiences with VF, (2) document singers' strategies for mitigating VF, and (3) determine whether vocal training was associated with decreased vocal difficulties.

Study design. Self-reporting via online questionnaire containing quantitative and qualitative items.

Methods. This study employed an online questionnaire that combined demographic items, open-ended questions, and the Evaluation of the Ability to Sing Easily (EASE). Participants were recruited at one in-person event and via social media and a mailing list.

Results. This study returned 134 valid responses. Singers with formal choral experience scored lower on the EASE and two subscales, but length of experience had no impact. There were no correlations between vocal training and EASE scores. Women scored higher on the EASE than men and nonbinary individuals, while age, length of experience with Sacred Harp singing, and frequency of attendance at annual singing events were all negatively correlated with EASE score. Singers reported a wide range of mitigation strategies, most of which are unique to the Sacred Harp context.

Conclusions. Sacred Harp singers do not appear to struggle more with VF than other populations of singers. However, a few characteristics of their practice put them at risk, and many singers would benefit from professional guidance concerning vocal health.

Key Words: EASE–Vocal fatigue–Shape-note singing–Sacred Harp–Vocal training–Vocal load.

INTRODUCTION

Vocal fatigue (VF) has been defined as a feeling of local tiredness and weak voice after a period of voice use.[1] Symptoms include the perception of increased vocal effort, laryngeal discomfort, neck or shoulder tension, throat or neck pain, reduced pitch range, loss of vocal flexibility, reduced vocal projection or power, reduced vocal control, and voice loss.[1] For the purposes of this study, VF constitutes a collection of symptoms, not a diagnosis or disorder. VF is a concern for professional voice users in a variety of fields, but singers—whether professional or amateur—appear to be at particularly high risk.[2,3] While studies have addressed VF among diverse populations of singers, including those pursuing opera,[4] musical theater,[5,6] popular styles,[2] Carnatic styles,[7,8] church music,[9] and choral singing,[10–14] this is the first known consideration of VF among Sacred Harp singers.

Sacred Harp singing can be considered a type of amateur a cappella choral singing, but its practices and values differ markedly from those of a typical community, collegiate, or church choir. Sacred Harp singers gather at local practice singings, which might take place on a weekly, biweekly, or monthly basis and usually last 1.5–2 hours, and travel to attend annual all-day singings (1 day) and conventions (2–3 days), which typically include 4–5 hours of singing per day.[15] At both informal practice singings and formal annual singings, participants take turns entering the "hollow square" that is formed by the four voice parts (treble, alto, tenor, bass) to lead a song of their choosing.[16] Singing is interrupted only by short breaks, which are usually scheduled to take place at the end of each hour. Sacred Harp singing is entirely participatory. While singers often seek to improve their abilities, they are not preparing for a performance, and songs are never "rehearsed" in a conventional sense. Participants sing for themselves and for each other, not for an audience.

The songs come from a modern edition of *The Sacred Harp*, a collection of Christian songs harmonized in four parts that was first published in the US state of Georgia in 1844.[17] Although the texts are religious in nature, present-day singers do not necessarily profess Christian beliefs.[18,19] Similarly, although Sacred Harp singing first developed in the US South, it is now prevalent across the US and in the UK, Europe, and some Pacific states.[20] *The Sacred Harp* is the most prominent of several shape-note tunebooks currently in use. The designation "shape-note" refers to the use of shaped noteheads to indicate specific scale degrees. Each shape corresponds with a solfège syllable, and songs are always sung on solfège first.[21] While practices are fairly consistent across singings dedicated to different shape-note books, and many singers use a variety of books, this study specifically targeted Sacred Harp singers.

There are no music directors or coaches in Sacred Harp singing.[16] If an experienced singer comments on what they are hearing from the group, they will probably speak to

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tempo, key (songs are pitched without the use of an instrument or pitch pipe), or what is termed "accent" (patterns of articulation). It is very unlikely that a singer would ever comment on vocal production techniques or sound, unless to compliment the work of a particularly strong section. While there is an important pedagogical role for singing-school teachers, their focus is on the accurate singing of pitches and rhythms from notation.[18] It would be unusual for a teacher to address voice production, given the "come as you are" ethos of inclusivity and participation.

There are several characteristics of Sacred Harp singing that might indicate increased risk of VF or injury. Formal vocal warm-ups and cool-downs are never employed at singings. Although some research into the efficacy of warm-ups and cool-downs has produced ambiguous results,[22] several studies have found that singers self-report significant benefits.[23–25] At a singing, participants are likely to sing for many hours with minimal rest. A typical convention schedule requires 2 days of singing from 9:30 am to noon and from 1 to 3:30 pm, with one or two short breaks in each session. Hunter and Titze found that subjects who completed a 2-hour vocal loading exercise required 4–6 hours to achieve 90% recovery, yet Sacred Harp singers take only an hour's rest (during which they converse) between morning and afternoon sessions.[26] Sacred Harp singers are also likely to sing for several days without rest, whether attending a multiday convention or a string of annual singings, despite the fact that full recovery from vocal loading can take 12–18 hours.[16] Throughout these sessions, singers produce sound at a consistently high volume. The combination of lengthy singing sessions with high-exertion style results in a heavy vocal load, which has been associated with VF, dysphonia, and injury.[27] Additionally, some singers—most notably female altos—employ a belting style that contributes to increased vocal load.[28]

Sacred Harp singers may or may not have previous vocal training, whether in the form of lessons or participation in a formal choir. While increased vocal training has sometimes been correlated with decreased voice problems,[29,30] this is not always the case. In their study of amateur musical theater singers, Vella et al found that amount of vocal training had no impact on singers' self-reported vocal health, and also that study participants reported symptoms at a rate comparable to professional musical theater singers.[6] Likewise, in their study of amateur Croatian choral singers, Žaja et al hypothesized that classical training would result in decreased VF but ultimately found no difference in perceived singing problems between amateurs and professionals.[13] Although Coelho et al maintain that "long term vocal training is a determinant factor for the maintenance of a healthy voice," their study of amateur choral singers in Brazil found a correlation between increased experience (not training) and reduced difficulty with VF, especially hoarseness.[10] It is possible that singers in their study were successful in developing strategies to mitigate VF independent of formal training.

Vocal training has also been associated with increased knowledge of vocal function and hygiene, which could lead to reduced difficulty with VF and injury. Vella et al, for example, note that treatment of untrained singers can be complicated by their "poor ability to recognize abusive behaviors that can lead to vocal impairment."[6] The correlation between vocal training and vocal knowledge, however, is not always strong. In their study of collegiate choir singers, Santa Maria et al—counter to their hypothesis—found no difference in vocal hygiene between trained and untrained singers.[31] Likewise, in their investigation into vocal health and awareness among amateur choral singers, Ravall and Simberg found that, while participants with vocal education were more knowledgeable than those without, overall levels of knowledge concerning vocal physiology and hygiene were very low.[10]

The Evaluation of the Ability to Sing Easily (EASE) scale was developed and validated by Phyland et al for use with healthy musical theater singers.[32,33] The EASE scale was designed to evaluate a respondent's current vocal function, as self-reported using a series of 20 positive and negative statements regarding perception and sensation of the singing voice. The statements, each of which is presented as a five-point Likert-type item, are distributed across two subscales: VF (10 items) and Pathologic-Risk Indicators (PRI; 10 items). Most researchers to use the EASE scale have followed Phyland et al in adding a Vocal Concern (VC; 2 items) subscale, which is not part of the EASE but can provide valuable information. A low score on the EASE scale and subscales indicates the absence of symptoms/concern and is associated with vocally healthier singers, while a high score is associated with less healthy singers. EASE has been used to evaluate both amateur and professional singers across a range of disciplines in half a dozen countries.[6,8,24,25,34,35]

METHODS

This study was approved by the Institutional Review Board at the University of North Georgia. Data were collected between 5 July and 22 August 2023 using an online questionnaire. The questionnaire was distributed by means of QR code fliers posted at Camp Fasola, an event in Alabama that attracts Sacred Harp singers from around the world, and online via the Sacred Harp Friends Facebook group (3813 members) and the Fasola listserv (membership unknown). The four sections of the questionnaire, which can be viewed in the Appendix, contained (1) demographic items, (2) quantitative items pertaining to vocal training, (3) qualitative items pertaining to VF experiences and mitigation strategies, and (4) the EASE scale (with VC subscale included).

For categorical variables (gender, history of voice lessons, formal choir experience), Kruskal-Wallis one-way analysis of variance was performed. For quantitative variables, Spearman and Kendall correlation coefficients with the EASE scale and subscales were computed. The

qualitative items were coded using a general inductive approach.[36] Quotes are attributed to study participants in terms of gender (F = female, M = male, NB = nonbinary), years active as a Sacred Harp singer, and formal training (t = trained [indicating experience with voice lessons and/or formal choir], ut = untrained [indicating no experience with lessons or choir]).

RESULTS AND DISCUSSION

A total of 154 responses were returned. Only six responses were recorded at Camp Fasola, with the remainder resulting from online distribution. Twenty were eliminated because the respondent only completed the demographic items, leaving 134 responses for inclusion in the analysis. Of these, 133 respondents answered at least one open-ended question and 131 completed the EASE scale. The majority of respondents who completed the EASE scale identified as female (82; 62.6%), while 33.6% (44) identified as male and 3.8% (5) nonbinary/third gender. The ages of respondents ranged from 20 to 84, although most were older, with nearly half (60; 48%) falling between 60 and 84 years in age (Table 1).

EASE scale

Stacked bar plots representing responses to the three subsections of the EASE scale are included as Figure 1. Descriptive statistics for the EASE scale and subscales are provided in Table 2. While the Spearman correlations among subscales were smaller in this dataset than those found by Phyland et al, the internal consistency of all the subscales and the overall scale was satisfactory (Cronbach's α above 0.86 in all cases).[33] Overall, scores on the EASE scale and VF, PRI, and VC subscales were low in comparison to other studies using this instrument, including those conducted by Phyland et al (musical theater singers in Australia), Pacheco and Behlau (musical theater singers in Brazil), Devadas et al (Carnatic singers), and D'haeseleer et al (various styles).[35]

TABLE 1.
Participant Demographics

		Count	Percent
Gender	Female	82	62.60
	Male	44	33.59
	Nonbinary/third gender	5	3.82
	Total	131	
Age	18-29	12	9.60
	30-39	24	19.20
	40-49	17	13.60
	50-59	12	9.60
	60-69	29	23.20
	70-79	26	20.80
	80+	5	4.00
	Total	125	
	No answer	6	

Only respondents who completed the EASE scale were included in the demographic analysis.

One aim of this study was to determine whether vocal training or participation in formal choirs was related to VF. No association was found with vocal training, but respondents who indicated that they had sung in a formal choir scored significantly lower on the EASE ($\chi^2 = 4.22$, $P = 0.040$), PRI ($\chi^2 = 3.90$, $P = 0.048$), and VC scales ($\chi^2 = 4.84$, $P = 0.028$) than respondents who had not done so (Table 3). Years of experience singing with a formal choir had no impact on the EASE scores.

Gender differences in VF score were detected, with participants who identified as female scoring higher ($\chi^2 = 11.21$, $P = 0.004$). In developing the EASE-BR scale, Pacheco and Behlau also found that women scored higher on both the VF and PRI subscales, leading them to suggest a possible "need to give greater attention to women's vocal care and conditioning."[5] A weak negative correlation was detected between age and VC score ($\rho = -0.18$, $P = 0.044$; $\tau = -0.14$, $P = 0.042$). Zuim et al and Phyland et al similarly found that younger singers were more likely to record higher PRI scores, but the latter noted that this finding "must be interpreted with caution" given the limitations of the study and possible survivorship bias (Table 4).[30,33] The present study also detected a weak negative correlation between years of experience with Sacred Harp singing and EASE score ($\rho = -0.19$, $P = 0.038$; $\tau = -0.137$, $P = 0.044$), which might also be an artifact of survivorship bias. Finally, a weak negative correlation was detected between frequency of attendance at annual singings and conventions and VF score ($\rho = -0.21$, $P = 0.025$; $\tau = -0.14$, $P = 0.027$). This supports findings that increased vocal load can have a beneficial effect and may enhance vocal health.[37] It was also confirmed by the qualitative responses of study participants, 18 (13.6%) of whom noted that they struggled more with VF when they were not singing frequently.

Conditions unique to Sacred Harp singing

One hundred thirty-two study participants responded to the item, "Please describe your typical experiences with VF after an extended period of Sacred Harp singing (eg, an all-day singing). How does your voice usually sound and feel?" Responses pertaining to symptoms that were documented using the EASE scale were omitted from qualitative analysis. However, singers also reported circumstances unique to Sacred Harp singing that either contribute to or alleviate VF.

In Sacred Harp singing, participants often feel pressure to sing a part outside of their natural range. This usually occurs at small singings, where there might be a shortage of singers on a particular part. In such cases, strong singers will often sit in the section that needs support, even if it is not their preferred section. Although nobody ever assigns singers to parts, it is characteristic to feel an obligation to serve the community and do what is necessary to support the singing, even if that results in vocal discomfort. Nine respondents indicated that they experience greater VF

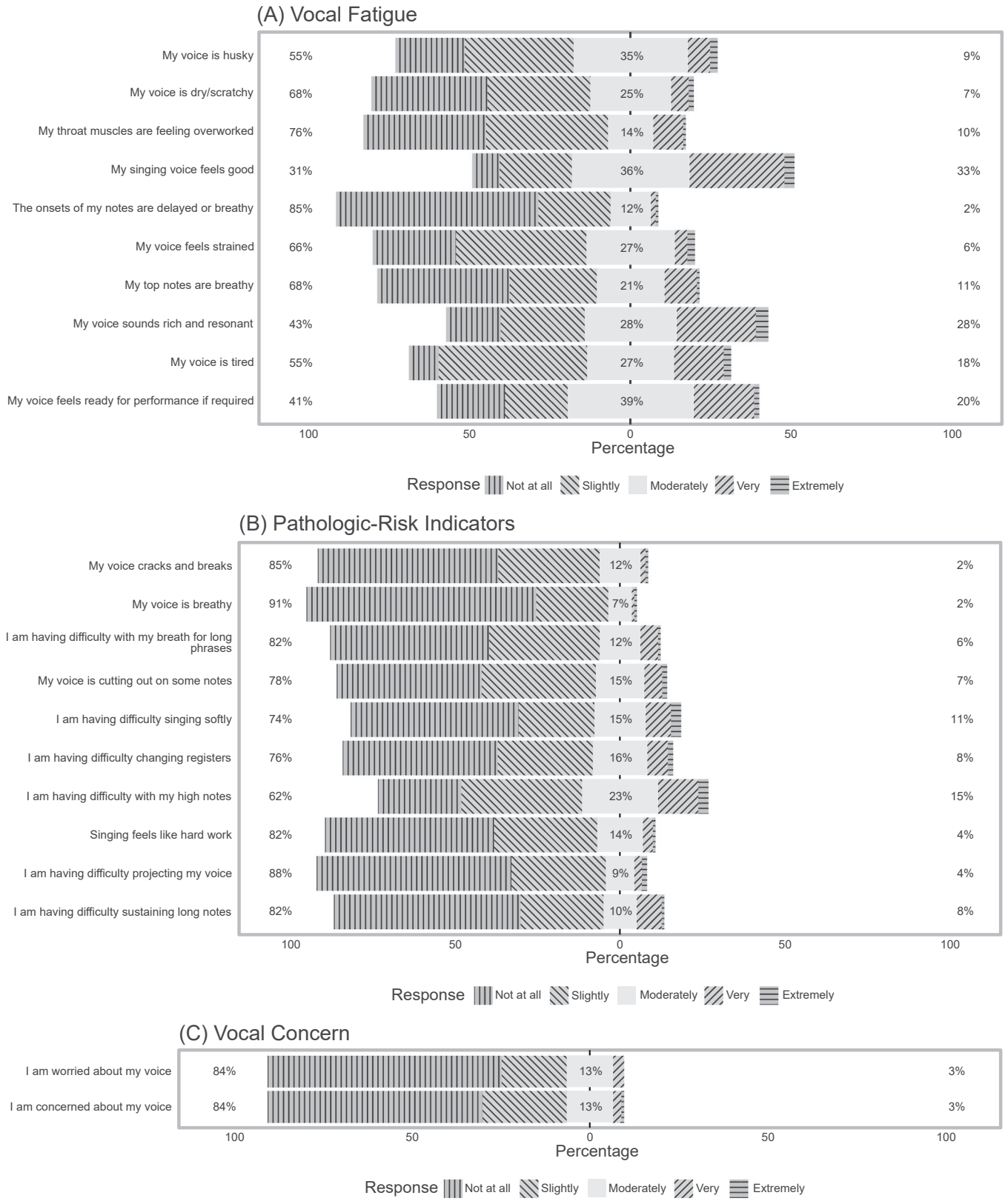

FIGURE 1. Stacked bar plots representing responses to Likert items in the (**A**) Vocal Fatigue, (**B**) Pathologic-Risk Indicators, and (**C**) Vocal Concern subscales.

TABLE 2.
Descriptive Statistics for EASE Total, VF, PRI, and VC Subscales

	VF	PRI	VC	EASE
N	121	123	131	115
Min.	1	0	0	4
1st Qu.	9	3	0	13
Median	13	6	0	20
Mean	14.18	7.54	1.13	21.33
3rd Qu.	19	10	2	28.5
Max.	30	40	7	59
Cronbach α	0.89	0.86	0.94	0.90
Spearman ρ				
VF	1.00			
PRI	0.39	1.00		
VC	0.50	0.52	1.00	
EASE	0.88	0.76	0.58	1.00

All correlations presented were significant, with $P < 0.001$.

when singing outside of their preferred range. After reporting no trouble with VF in their natural range, one respondent continued: "On the other hand, if I'm pinch-hitting treble (I usually sing alto but often have to cover treble when there aren't enough 'native' treble singers) I have MUCH less endurance. Although the treble notes are usually easily within my range, I have to work a lot harder to sing audibly up there—and being audible is obviously the whole point when you're covering a part due to lack of other singers" (NB, 16y, t). Similar remarks were made by the other respondents who reported struggling more with VF after singing outside of their range to support the community.

Six respondents (4.5%) noted that their experience with VF is dependent on the skill of the keyer, who is responsible for setting the starting pitches. If a song is keyed correctly it should be in a comfortable range for all parts. Additionally, there is a convention that songs should be keyed on the low side in the morning and on the high side in the afternoon, when singers have warmed up their voices.[19] An inexperienced keyer, however, is likely to set songs too high or too low, or to be inconsistent within a session. A further two respondents commented that they have less trouble with VF when singing in a resonant space. Singing organizers usually seek out bright, reverberant spaces, to the extent that such environments are integral to the practice.[19] While singers have long indicated an esthetic preference for resonant spaces, they may also benefit vocal health.

Mitigation strategies

Of the 133 respondents who answered the question, "What strategies do you employ to avoid VF at an all-day singing or convention?," only four (3%) reported they do not employ any mitigation strategies. The remaining 128 (97%) described a range of strategies used in various combinations, suggesting that Sacred Harp singers are keenly aware of

TABLE 3.
Summary Statistics (Number of Responses, Median, First and Third Quartile) for the VF, PRI, and VC Subscales, and the EASE Total Scale, Broken Up by Group for the Three Categorical Items (Gender, Previous Voice Lesson Experience, and Previous Formal Choir Participation), with Kruskal-Wallis χ^2 Test Statistics and Associated *P*-Values

		VF				PRI				VC				EASE			
Item	Group	*N*	Q1	Median	Q3	*N*	Q1	Median	Q3	*N*	Q1	Median	Q3	*N*	Q1	Median	Q3
Gender	Female	78	10	14.5	21.75	78	2.25	6	10	82	0	0	2	74	14	23	29.75
	Male	39	7	11	15.5	40	4	7	11.25	44	0	0	2	37	12	17	26
	Nonbinary/third gender	4	7.75	8.5	11	5	5	5	6	5	0	0	0	4	13	13.5	15.5
	Kruskal-Wallis χ^2 (*P*-value)	11.21 (0.004*)				0.94 (0.624)				2.04 (0.361)				3.83 (0.147)			
Voice lessons?	No	76	9	13	18.25	77	4	7	11	85	0	0	2	70	14	19	29.75
	Yes	45	9	13	20	46	2.25	5	10	46	0	0	2	45	12	21	28
	Kruskal-Wallis χ^2 (*P*-value)	0.21 (0.646)				1.52 (0.217)				0.02 (0.880)				0.01 (0.904)			
Formal choir?	No	36	9.75	16	22	37	5	9	12	41	0	1	2	32	16.5	24	30
	Yes	85	8	12	18	86	3	5	9	90	0	0	2	83	12	18	27
	Kruskal-Wallis χ^2 (*P*-value)	2.86 (0.091)				3.90 (0.048*)				4.84 (0.028*)				4.22 (0.040*)			

Significant test results ($P < 0.05$) marked by asterisks.

TABLE 4.
Summary Statistics (Number of Responses, Mean, Median, and Standard Deviation) for Quantitative Items, and Spearman's ρ and Kendall's τ Correlation Coefficients Between the Items and the VF, PRI, and VC Subscales, and the EASE Total Scale (*P*-Values Given in Parentheses)

					VF		PRI		VC		EASE	
Item	*N*	Mean	Median	SD	ρ	τ	ρ	τ	ρ	τ	ρ	τ
Age	125	54.07	58	17.68	− 0.10 (0.271)	− 0.07 (0.270)	− 0.07 (0.459)	− 0.04 (0537)	− 0.18 (0.044*)	− 0.14 (0.042*)	− 0.12 (0.195)	− 0.09 (0.165)
Years involved with Sacred Harp	131	21.29	16	16.31	− 0.17 (0.067)	− 0.12 (0.062)	− 0.07 (0.423)	− 0.05 (0.457)	− 0.16 (0.071)	− 0.13 (0.063)	− 0.19 (0.038*)	− 0.13 (0.044*)
Annual singing/ convention attendance	128	8.45	5.25	8.89	− 0.21 (0.025*)	− 0.14 (0.027*)	− 0.05 (0.573)	− 0.03 (0.609)	− 0.09 (0.333)	− 0.06 (0.354)	− 0.16 (0.082)	− 0.12 (0.079)
Local singing attendance frequency	130	4.12	4	3.46	− 0.03 (0.706)	− 0.03 (0.704)	− 0.08 (0.409)	− 0.06 (0.369)	− 0.01 (0.943)	0.00 (0.950)	− 0.03 (0.727)	− 0.02 (0.793)
Years of vocal training	47	3.46	2	3.38	0.04 (0.813)	0.03 (0.767)	− 0.06 (0.675)	− 0.05 (0.679)	− 0.07 (0.659)	− 0.06 (0.611)	0.00 (0.987)	0.00 (0.984)
Years of formal choir participation	89	16.70	10	15.42	0.10 (0.365)	0.07 (0.360)	0.02 (0.841)	0.01 (0.849)	− 0.15 (0.169)	− 0.12 (0.162)	0.09 (0.447)	0.06 (0.453)

their voices and concerned about vocal health. Some of their strategies reflect the specific practices and values of Sacred Harp singing, while other concern general vocal hygiene.

Strategies unique to Sacred Harp singing

Sacred Harp singing is a fully participatory practice in which singers perform for each other and for their own enjoyment.[38] While there are norms concerning tone production (eg, no vibrato, bright sound, use of chest voice by altos), these norms are not enforced by a music director and individual singers are at liberty to adjust their sound and technique. As one respondent asserted, the fact that Sacred Harp singers "aren't concerned with individual performance means that fatigue just isn't a problem for us" (M, 8y, ut). Although the Sacred Harp style is known for employing high volumes, 41 respondents (30.8%) stated that they sometimes sang quietly to prevent VF. Two respondents explicitly described the practice of adapting their tone to increase vocal comfort: "I use a variety of voices, like operatic, nasal, kermit the frog, chest or head, I don't know exactly what these voices are, but they make my voice feel better" (M, 10y, ut). Heightened autonomy to determine individual sound quality and effort provides Sacred Harp singers with opportunities to protect their voices that are not always available to singers in other contexts.

Similarly, a participant can quit singing at any time, whether for part or all of a song, or for several songs. Refraining from singing was a dominant strategy, with 38 respondents (28.6%) reporting taking breaks. Some sit out songs that they do not care for, while others take opportunities to help out with activities like lunch preparation. Eight singers (6%) reported leaving out notes that are uncomfortably high or low, or choosing the lower note when presented with two options. Eleven singers (8.3%) used the Sacred Harp technique of "accent" to stave off VF. Briefly, accent is the practice of heavily emphasizing strong beats. These singers reported skipping unaccented notes altogether, thereby securing some vocal rest. Some singers, however, find themselves obliged to provide vocal leadership, especially if they sit on the front bench (ie, in the front row) of their section. This can contribute to VF, although singers employ conscious strategies to mitigate the effects. Fifteen respondents (11.3%) stated that they move back in their section in order to sing more quietly when they feel fatigued.

In addition to the option of relocating within a section, Sacred Harp singers are also at liberty to move between sections and to select the octave in which they wish to sing. The tenor and treble sections contain participants of all genders singing in high and low octaves. The alto and bass sections are usually dominated by female- and male-voiced singers respectively, and the parts are sung in unison. Although some singers adhere to a single part, many take advantage of breaks between sessions to change parts, with 30 respondents (22.6%) indicating that they often change parts to avoid VF. Singers tended to move from a low part to a high part (6; 4.5%) or from a high part to a low part (9; 6.8%), while two preferred to oscillate back and forth

between high and low parts. Nine singers (6.8%) reported dropping an octave on high notes or when their voices became tired, while one found that singing up an octave could prevent fatigue.

Strategies associated with general vocal hygiene

Although Sacred Harp singings do not include a formal warm-up period, nine singers (6.8%) reported employing vocal warm-ups on their own. Six (4.5%) completed choral-style warm-ups on their own before arriving at the singing, while the remainder used the first session to carefully ease in to singing: "I sing more quietly during the first hour, and I alternate between singing (the tenor line) in my high register and my low register in order to warm up both of them" (M, 10y, ut). Two employed lip trills or growls between songs. Only one singer mentioned vocal cool-downs.

Thirty respondents (22.6%), both trained and untrained, described using good singing technique to stave off VF. Their strategies encompassed breath support, low tongue placement, tension reduction in the neck and throat, conscious use of head and chest voice, high/forward voice placement, and correct posture.

Sacred Harp singers are seemingly aware of how food and drink affect their vocal health. The majority of respondents (75; 56.4%) mentioned the importance of staying hydrated by drinking water before and during the singing, while 9 (6.8%) mentioned avoiding certain foods that cause reflux or vocal irritation before attending a singing. In a study of amateur choir singers, Robotti et al found that their subjects suffered from reflux at lower rates than the general population, perhaps due to leading healthier lifestyles and direct benefits from singing.[13]

Concern in the community

In response to the final item, "Is there anything else you would like to mention before submitting the survey?," four study participants took the opportunity to express their concerns that pervasive ideology concerning loud singing is damaging the vocal health of Sacred Harp singers. One respondent reflected: "Somehow a myth started up among some Harpers that you must sing as loud as you can, and this practice is not just stupid, it is harmful to the voice" (F, 50y, t). Another respondent warned that this ideology might prevent singers from admitting to vocal difficulty: "In my experience, there's a kind of macho attitude among some Sacred Harp singers around singing as loudly as possible. So I wouldn't be surprised if some singers (maybe even many singers) under-report their vocal problems on this survey" (M, 15y, t). Researchers have documented feelings of shame around VF and injury in other singing communities.[4] While Sacred Harp singers take advantage of the participatory framework to protect their voices, that same framework might also encourage harmful habits.

LIMITATIONS AND FUTURE DIRECTIONS

Better results could be achieved by conducting this study in-person with a fixed group of singers. First, the online methodology introduced limitations. Since singers self-selected for participation in this study, it is possible that the study cohort contained a higher-than-average percentage of individuals who were concerned about or highly aware of their vocal health. The opportunity to participate was also limited to individuals who attended Camp Fasola or followed the Facebook group and/or listserv. Second, an in-person study could control more accurately for vocal load. The EASE scale is intended to register a respondent's self-evaluation of their voice in the moment, without relying on recall. In the case of an online study, it is typical to ask respondents to report their general level of vocal activity, such that broad correlations between vocal load and EASE score can be detected. When administered in-person, however, the EASE scale can reveal impacts of vocal loading in greater detail. Some researchers have employed a pretest/post-test model, in which case the EASE is administered before and after a loading task to evaluate changes in self-reported vocal condition.[24,35] An in-person version of this study, therefore, could ensure a more representative population and document the effects of participating in an all-day singing with greater accuracy. However, in the shape-note context, this approach presents serious challenges. It would require the cooperation of event organizers and singers, and it would interrupt the traditional flow of a singing day. Singers have rigid expectations about how singings begin and end, and they prioritize the opportunity to socialize when they are not singing. It is not likely that the organizer of an annual singing would be willing to mandate participation in such a study, and the low response rate I achieved at an in-person event in the present case suggests that voluntary participation would be limited.

If this study were repeated using the same online methodology, it might be improved by the addition of items to the instrument intended to identify additional factors that contribute to VF, such as dehydration, drug/alcohol use, reflux, illness, and vocal loading outside of Sacred Harp singing. It is also the case that Sacred Harp singing events vary in length and intensity. The relationship between Sacred Harp singing and VF could be better understood if study participants reported their activities in greater detail.

The qualitative portions of this study, especially the inquiry into mitigation strategies, uncovered significant practices that are unique to the Sacred Harp singing community. These insights should be applied to the construction of a more rigorous quantitative study to determine the prevalence of reported behaviors across the population. I expect that such a study would find that the reported behaviors are more prevalent than suggested above.

CONCLUSIONS

Contrary to expectations, Sacred Harp singers do not appear to be at greater risk of vocal discomfort and injury than singers in other populations. That may be due to the fact that the practices of Sacred Harp singing create opportunities for singers to protect their voices by changing parts, moving back in a section, modulating their sound

production, and taking breaks from singing. Vocal training had no impact on self-reported vocal health difficulties, while the impact of participation in a formal choir was minimal. This suggests that participants in the Sacred Harp community have internally fostered healthy approaches to singing. At the same time, the habit of singing at high volume for long periods of time does expose singers to risk, and many have expressed concern about the vocal health of themselves and others. Vocal health professionals who treat Sacred Harp singers should be aware of the community's unique practices, and singers would benefit from increased education concerning vocal health.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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APPENDIX. STUDY INSTRUMENT

1. Age
2. Gender: Male; Female; Nonbinary/third gender; Prefer not to say
3. How many years have you been involved with Sacred Harp singing?
4. About how many annual singings or conventions do you attend each year?
5. About how often do you attend a local practice singing? More than once a week; Once a week; Every other week; Once a month; A few times a year; Never (Note: for analysis, this item was treated as quantitative, with values 16, 8, 4, 2, 1, 0)

   Vocal training
6. Have you taken voice lessons? Yes; No
7. If yes, for about how many years?
8. Have you sung in a formal choir (eg, church choir, college choir)? Yes; No
9. If yes, for about how many years?

   Experiences with vocal fatigue

   Vocal fatigue is defined as a feeling of local tiredness and weak voice after a period of voice use. Symptoms include the perception of increased vocal effort, laryngeal discomfort, neck or shoulder tension, throat or neck pain, reduced pitch range, loss of vocal flexibility, reduced vocal projection or power, reduced vocal control, and voice loss.
10. Please describe your typical experiences with vocal fatigue after an extended period of Sacred Harp singing (eg, an all-day singing). How does your voice usually sound and feel?
11. What strategies do you employ to avoid vocal fatigue at an all-day singing or convention?

    Evaluation of the Ability to Sing Easily (EASE)

    EASE is a singer-derived inventory of positive and negative vocal descriptors related to the singing voice. It is used to quantify vocal fatigue. Select the response that indicates how well each statement reflects your experience (not at all, slightly, moderately, very, or extremely).
12. After a day of singing:
    My voice is husky
    My voice is dry/scratchy
    My throat muscles are feeling overworked
    My singing voice feels good
    The onsets of my notes are delayed or breathy
    My voice feels strained
    My top notes are breathy
    My voice sounds rich and resonant
    My voice is tired
    My voice feels ready for performance if required
13. It is generally true that:
    My voice cracks and breaks
    My voice is breathy
    I am having difficulty with my breath for long phrases
    My voice is cutting out on some notes
    I am having difficulty singing softly
    I am having difficulty changing registers
    I am having difficulty with my high notes
    Singing feels like hard work
    I am having difficulty projecting my voice
    I am having difficulty sustaining long notes
    I am worried about my voice
    I am concerned about my voice
14. Is there anything else you would like to mention before submitting the survey?

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