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MAJOR ARTICLE

Singing Is a Risk Factor for Severe Acute Respiratory Syndrome Coronavirus 2 Infection: A Case-Control Study of Karaoke-Related Coronavirus Disease 2019 Outbreaks in 2 Cities in Hokkaido, Japan, Linked by Whole Genome Analysis

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Background. Singing in an indoor space may increase the risk of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. We conducted a case-control study of karaoke-related coronavirus disease 2019 (COVID-19) outbreaks to reveal the risk factors for SARS-CoV-2 infection among individuals who participate in karaoke.

Methods. Cases were defined as people who enjoyed karaoke at a bar and who tested positive for SARS-CoV-2 by reverse-transcription polymerase chain reaction between 16 May and 3 July 2020. Controls were defined as people who enjoyed karaoke at the same bar during the same period as the cases and tested negative. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. ORs of key variables adjusted for each other were also estimated (aOR).

Results. We identified 81 cases, the majority of whom were active elderly individuals (median age, 75 years). Six cases died (case fatality ratio, 7%). Among the cases, 68 (84%) were guests, 18 of whom had visited ≧2 karaoke bars. A genome analysis conducted in 30 cases showed 6 types of isolates within 4 single-nucleotide variation difference. The case-control study revealed that singing (aOR, 11.0 [95% CI, 1.2–101.0]), not wearing a mask (aOR, 3.7 [95% CI, 1.2–11.2]), and additional hour spent per visit (aOR, 1.7 [95% CI, 1.1–2.7]) were associated with COVID-19 infection.

Conclusions. A karaoke-related COVID-19 outbreak that occurred in 2 different cities was confirmed by the results of genome analysis. Singing in less-ventilated, indoor and crowded environments increases the risk of acquiring SARS-CoV-2 infection. Wearing a mask and staying for only a short time can reduce the risk of infection during karaoke.

Keywords. COVID-19; karaoke; mask; SARS-CoV-2; singing; whole genome sequencing.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is mainly transmitted through droplets or short-range aerosol. Transmission is believed to occur a few days before the onset of symptoms [1]. Airborne or long-range aerosol transmission can occur under certain circumstances, such as long stays in crowded, less-ventilated spaces, or around individuals undergoing aerosol-generating procedures in healthcare settings [1, 2]. The risk of droplet or airborne transmission is affected by the virus level in the infectious individual's upper respiratory tract [3] and the ability to shed droplets from the respiratory tract [4]. Singing around others may potentially be one risky activity for SARS-CoV-2 infection because people shed more droplet particles when they speak, especially in a loud voice [5]. When people sing songs in a group with infected individuals and if their risk of transmission is high (eg, a few days before the onset of symptoms [6]), SARS-CoV-2 transmission may occur. In fact, coronavirus disease 2019 (COVID-19) outbreaks have been reported in choirs and choruses [7, 8]. Because people

Received 6 December 2021; editorial decision 18 March 2022; accepted 22 March 2022; published online 23 March 2022.

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Open Forum Infectious Diseases®2022

https://doi.org/10.1093/ofid/ofac158

cannot be fully protected against SARS-CoV-2 infection by vaccination [9, 10], how to enjoy singing activities safely is a big challenge for society.

Karaoke is a popular recreational activity in which people sing through a microphone along with melodies provided by a machine. This activity is typically performed with a group in a confined space, such as a bar. Karaoke first appeared in Japan in the 1960s but soon became popular in many other countries. Now, karaoke is quite popular among all age groups in Japan. In particular, elderly individuals enjoy karaoke while eating and drinking during the daytime. Karaoke can provide an opportunity for elderly individuals to socialize, which can help to alleviate dementia [11].

In April–June 2020, karaoke-related COVID-19 outbreaks were identified in bars in Sapporo and Otaru, Hokkaido, Japan. Sapporo is the largest city in Hokkaido, with a population of approximately 2 million, and Otaru is a neighboring city with a population of approximately 110 000. The 2 cities are located within 40 km of each other, and residents commute back and forth to work and school between these cities. At the time of the outbreak, the numbers of new cases per 100 000 population in May and June were 11.3 and 5.5, respectively, in Sapporo, and 4.4 and 32.6 in Otaru [12]. This event occurred before vaccines became available, and no karaoke-related outbreaks were identified before this event.

We herein report the descriptive epidemiology of the outbreaks, a genome analysis, and an analysis of risk factors for SARS-CoV-2 infection in individuals participating in karaoke in bars. Our hypothesis was that longer exposure at karaoke bars would facilitate SARS-CoV-2 infection and that wearing a mask, especially during singing, could prevent the transmission of COVID-19. We believe that these findings will help to prevent further outbreaks in similar settings such as indoor singing activities.

METHODS

This study involved a mixture of a cross-sectional design to describe epidemiological and virological findings of the outbreak and a case-control study to identify risk factors for SARS-CoV-2 infection among guests of karaoke bars.

Cases and Controls

A case was defined as a person who tested positive for SARS-CoV-2 by reverse-transcription polymerase chain reaction (RT-PCR) between 16 May and 3 July 2020 and who had participated in karaoke at a bar in Sapporo or Otaru within the 2 weeks before the onset of symptoms or sample collection. For the case-control study, we excluded cases lacking a detailed exposure history, including behavior in bars (Figure 1). We define "C-case" as cases in the case-control study to distinguish them from total cases. A control was defined as a person who participated in karaoke at the same bar with confirmed cases during their infectious period (between 2 days before the onset of symptoms or sample collection and isolation of the confirmed cases) and who tested negative for SARS-CoV-2 by RT-PCR.

Active Case Findings and Selection of Controls

Public health centers defined "close contacts" as people who enjoyed karaoke at the same bar with confirmed cases during their infectious period, as described above, or who were within 2 meters of the confirmed case without masks for ≥15 minutes during the infectious period. The public health centers also conducted telephone interviews with the owners of the bars about their daily operation, infection prevention and

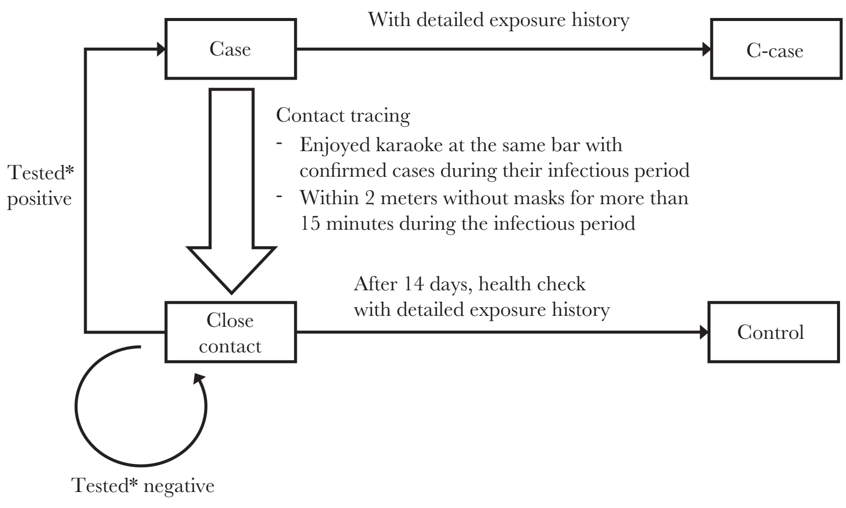

Figure 1. Selection of cases and controls. *The nasopharyngeal specimens of close contacts were tested by reverse-transcription polymerase chain reaction (RT-PCR) after identification. At that time, persons who developed fever or acute respiratory symptoms went to designated local coronavirus disease 2019 testing facilities for severe acute respiratory syndrome coronavirus 2 RT-PCR. Abbreviation: C-case, cases in the case-control study.

control measures, and behaviors of guests in their bars. Public health centers identified close contacts based on the reports from the cases, family members and their friends, and the situation of the bars. After close contacts were identified, their nasopharyngeal specimens were tested by RT-PCR. At that time, persons who developed fever or acute respiratory symptoms went to designated local COVID-19 testing facilities and underwent RT-PCR for SARS-CoV-2. Those diagnosed as having COVID-19 were hospitalized in accordance with the law at that time.

Information Sources

Public health centers created records of cases and close contacts through site visits or by phone. We extracted the information from these records for the case-control study including basic demographic information, signs/symptoms, RT-PCR test results, and possible exposure, such as the frequency of visits to a bar per month, time spent per visit, eating or drinking at the bar, and use of personal protective equipment.

Genome Sequencing

We determined the whole-genome sequence of SARS-CoV-2 using multiplex PCR–based RNA-Seq by ARTIC Network protocol2 based on PrimalSeq [13, 14] with modification of the primers and protocol [15]. For the obtained genome sequences, a haplotype network analysis using genome-wide single-nucleotide variants (SNVs) on the core regions from positions 99 to 29 796 nt in the Wuhan-Hu-1 reference genome sequence was performed.

After the outbreak, we obtained results of the genome analysis of the isolates sampled from the cases, the cycle threshold values of which were <30. On the basis of these results and the history of visits to karaoke bars, we identified the links between cases. Because of the similarity of the isolates determined by the genomic analysis, we considered these outbreaks to be part of a single outbreak, which supported the rationale of the case-control study.

Data Analysis

To compare exposures between c-case and controls, we calculated odds ratios (ORs) and 95% confidence intervals (CIs), using logistic regression. We evaluated exposure time and mask use according to our hypothesis that longer exposure at karaoke bars would facilitate SARS-CoV-2 infection and that wearing a mask, especially during singing, could prevent the transmission of COVID-19. Dancing was considered a risk factor because people usually spend a certain period of time in close proximity to each other. Also, we evaluated toilet use because that might be an opportunity for indirect contact transmission from the contaminated environment [16]. We thought that age would be a confounder because older age is reported to be a risk factor for positive SARS-CoV-2 test results [17]. Thus, adjusted for age, we assessed time spent per visit (increase per additional hour), singing, and mask wearing in the bar in our model. Age and time spent per visit were analyzed as continuous variables. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), which is a graphical user interface for R software (R Foundation for Statistical Computing, Vienna, Austria).

Ethical Considerations

This report was exempt from the requirement for institutional ethics review as the entire activity was conducted as part of public health control measures under the Japan's Infectious Disease Control Law, and no informed consent was obtained from the study population.

RESULTS

Description of COVID-19 Cases and Outbreak

During the study period, 81 cases were identified, 47 in Sapporo and 34 in Otaru. Their median age was 75 years (interquartile range [IQR], 69–80 years) and 49 cases (60%) were female (Table 1). Fifty-six cases (69%) were unemployed/retired. At the time of sample collection, 21 cases (26%) were asymptomatic, and 8 (10%) subsequently developed symptoms. Two cases required mechanical ventilation and 6 cases died (case fatality ratio, 7%). More than half of the cases (49 [60%]) had an underlying disease, and the most frequent underlying illness was hypertension (18 [22%]), followed by diabetes (17 [21%]), and heart disease (13 [16%]). Among the cases, 68 (84%) were guests and 13 (16%) were staff members. Nearly all cases were active elderly individuals who frequently enjoyed karaoke with friends. Eighteen of the guests had visited ≥2 karaoke bars. One case in Otaru City resided in Sapporo City; however, there were no apparent activities with the Sapporo cases before the diagnosis of COVID-19. The cases developed symptoms from 17 May to 30 June 2020, and the epidemic curve showed a bimodal feature, with accumulation during 5–9 June and on 27 June (Figure 2). Karaoke-related cases were identified in 13 bars (Sapporo, n = 8; Otaru, n = 5). The median number of cases per bar was 5 (IQR, 2–5). Staff members in 7 bars were infected, including owners. Among 10 bars for which information on the bar's infection control measures was available, only 5 bars encouraged users to wear a mask; however, more than half of the guests wore masks in another 4 bars. All of the bars had hand sanitizers in place. In 6 bars, owners facilitated guests to keep their distance, but spaces in 4 bars were too small to achieve this (<35 m^2). Only 5 bars well ventilated their indoor space.

Public health authorities in both cities conducted case investigations and isolation, controlled hospitalization of the cases

Table 1. Characteristics of the Coronavirus Disease 2019 Cases Associated With Karaoke, Hokkaido, May–July 2020

Characteristic	Cases (n = 81)		Guests (n = 68)		Staff Members (n = 13)	
	No.	(%)	No.	(%)	No.	(%)
Age group, y						
50–59	3	(4)	0	(0)	3	(23)
60–69	18	(22)	13	(19)	5	(38)
70–79	38	(47)	35	(51)	3	(23)
≥80	22	(27)	20	(29)	2	(15)
Sex						
Male	32	(40)	29	(43)	3	(23)
Female	49	(60)	39	(57)	10	(77)
Employment						
Staff of karaoke bar	13	(16)	…	…	13	(100)
Office worker	3	(4)	3	(4)	…	…
Self-employed	1	(1)	1	(1)	…	…
Part-time employee	4	(5)	4	(6)	…	…
Unemployed/retired	56	(69)	56	(82)	…	…
Unknown	4	(5)	4	(6)	…	…
Asymptomatic cases						
At time of detection	21	(26)	18	(26)	3	(23)
In the course of follow-up	13	(16)	11	(16)	2	(15)
Underlying disease	49	(60)	42	(62)	7	(54)
Heart disease	13	(16)	12	(18)	1	(8)
Lung disease	3	(4)	3	(4)	0	(0)
Liver disease	3	(4)	3	(4)	0	(0)
Renal disease	2	(2)	2	(3)	0	(0)
Malignancy	7	(9)	6	(9)	1	(8)
Diabetes mellitus	17	(21)	13	(19)	4	(31)
Hypertension	18	(22)	16	(23)	2	(15)
Other	11	(14)	8	(11)	4	(31)
None	24	(30)	19	(28)	5	(38)
Unknown	8	(10)	7	(10)	1	(8)
Severity						
Mechanical ventilation	2	(2)	1	(1)	1	(8)
Death	6	(7)	5	(7)	1	(8)

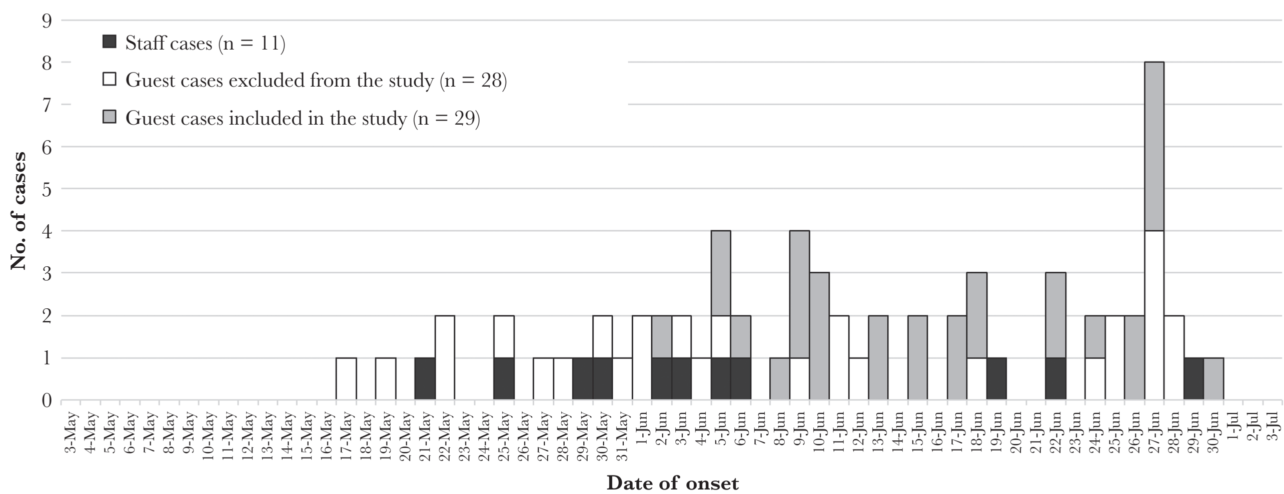

Figure 2. Epidemic curve of karaoke-associated coronavirus disease 2019 outbreak in Hokkaido, May–July 2020 (n = 81). Thirteen asymptomatic cases were excluded from this graph.

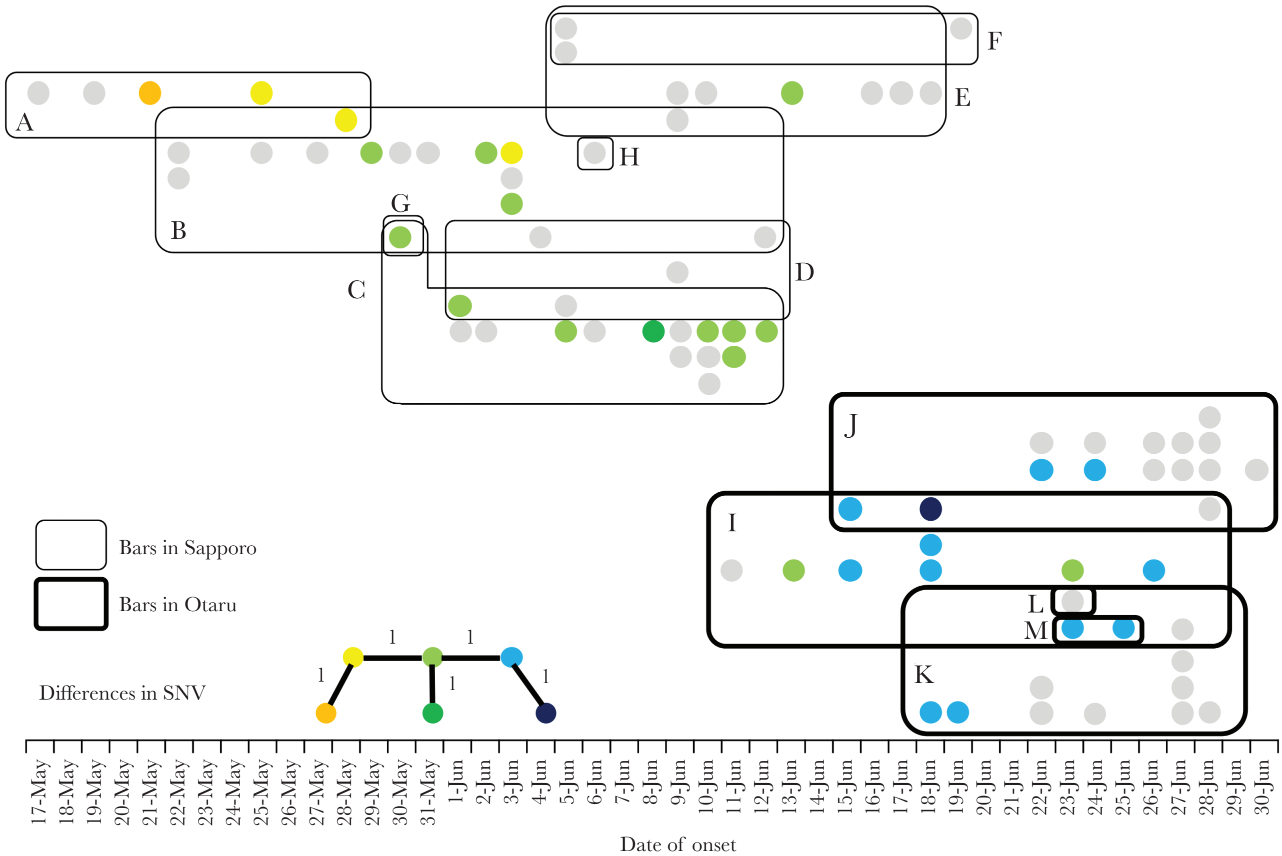

Figure 3. Chronological association between karaoke bars, cases, and results of the genome analysis of the virus isolated from cases in a karaoke-associated coronavirus disease 2019 outbreak in Hokkaido in May–July 2020 (n = 81). A to M indicates karaoke bars (A–H are located in Sapporo, I–M are located in Otaru). Cases are shown by colored circles and are placed horizontally according to their date of onset for symptomatic cases or the date of the diagnosis for asymptomatic cases. Circles of the same color indicate cases in which the isolated viruses had the same genome. Gray circles indicate cases in which the results of the virus genome analysis were not available. Cases who visited or worked at each bar are marked with rectangles. For example, bar A was visited by 5 cases, and 1 of them (onset on 28 May) also visited bar B. Abbreviation: SNV, single-nucleotide variant.

and identification and isolation of the close contacts, provided free testing opportunities, and issued public alerts about the outbreak to other bar owners and citizens. The occurrence of related cases gradually subsided in late June, approximately 6 weeks after the index case was identified.

Genome Sequence Analysis With Epidemiological Data

Figure 3 shows the chronological association between cases who visited karaoke bars and the results of the genome analysis of the virus isolated from the cases. A genome analysis was successfully conducted in 30 cases (37%), which identified 6 types of isolates within 4 SNVs of difference (accession numbers are listed in Supplementary Table 1). Three types of isolates accounted for the cases identified at 10 of the 13 bars (bars A, B, C, D, E, G, I, J, K, and M). The earliest date of onset among those sequenced cases was reported from an individual who visited bar A; this was followed by cases involving individuals who visited bars B and C. All of these bars were located in Sapporo. Cases in one of the 4 bars in Otaru (barI) had the same genome as the cases who visited the Sapporo bars.

Case-Control Study to Identify Factors Associated With COVID-19 Infection Among Karaoke Bar Guests

In total, 38 C-cases and 52 controls were included in the case-control study. The 52 controls were identified in both Sapporo (n = 36) and Otaru (n = 16). Those who were included in the case-control study (C-cases) and censored cases (cases other than C-cases) had similar sex and age distributions. The proportion of female sex was approximately 60% in both groups (Table 2). Controls were slightly younger than C-cases (mean age, 68.0 years in controls and 75.4 years in C-cases). The logistic regression analysis showed that compared to the controls, C-cases were older (OR, 1.1 [95% CI, 1.03–1.1]), stayed longer per visit (OR, 2.2 [95% CI, 1.4–3.3]), sang (OR, 13.6 [95% CI, 1.9–591.6]), and were less likely to wear a mask in the bar (OR, 4.2 [95% CI, 1.5–12.6]). Adjusted for each other, the time spent per visit (adjusted OR [aOR], 1.7 [95% CI, 1.1–2.7]), singing (aOR, 11.0 [95% CI, 1.2–101.0]), and not wearing a mask in a bar (aOR, 3.7 [95% CI, 1.2–11.2]) were significantly associated with COVID-19, even when models with various combinations of these factors were considered (Supplementary Table 2).

Table 2. Odds Ratios of Possible Exposures for Acquiring Severe Acute Respiratory Syndrome Coronavirus 2 During Karaoke

	C-Case (n = 38)		Control (n = 52)					
Characteristic	No.	(%)	No.	(%)	OR	(95% CI)	aOR[a]	(95% CI)
Female sex	23/38	(61)	32/52	(62)	1.0	(.4–2.7)	…	…
Age, y, mean (SD)	75.4	(5.9)	68.0	(12.7)	1.1	(1.0–1.1)	1.1	(1.0–1.1)
No. of visits per month, mean (SD)	3.6	(3.6)	2.7	(2.9)	1.1	(.9–1.2)	…	…
Time spent per visit, h, mean (SD)	3.1	(1.0)	2.1	(1.2)	2.2	(1.4–3.3)	1.7	(1.1–2.7)
Singing	37/38	(97)	38/52	(73)	13.6	(1.9–591.6)	11.0	(1.2–101.0)
Dancing	2/24	(8)	10/43	(23)	0.3	(<.1–1.6)	…	…
Eating or drinking	37/38	(97)	46/52	(88)	4.8	(.5–227.8)	…	…
Using the toilet	33/38	(87)	39/51	(76)	2.0	(.6–8.1)	…	…
Maintaining distance of >1 m from others	18/26	(69)	25/49	(51)	1.9	(.7–5.8)	…	…
Not wearing a mask in a bar	30/38	(79)	24/51	(47)	4.2	(1.5–12.6)	3.7	(1.2–11.2)
Not wearing a mask while singing a song	26/27	(96)	39/42	(93)	2.0	(.1–109.0)	…	…

Abbreviations: aOR, adjusted odds ratio; C-case, cases in the case-control study; CI, confidence interval; OR, odds ratio; SD, standard deviation.

[a]Adjusted for age, time spent per visit, singing, and not wearing a mask.

DISCUSSION

This study provides an overview of a karaoke-related COVID-19 outbreak that occurred in 2 different cities and was confirmed by the results of genome analysis and a case-control study that showed that singing, not wearing a mask, and staying in a bar for a long time were risk factors for SARS-CoV-2 infection during karaoke. A confined, less-ventilated indoor space that is suitable for singing may be a specific environment that could result in long-range aerosol transmission of SARS-CoV-2 if many people are inside. These findings will provide both information on how to enjoy karaoke safely and a hint on how to sing songs safely in a small, less-ventilated place in a group.

Some people continued to perform karaoke or sing songs in a group during the COVID-19 pandemic, partly because karaoke is not just a hobby but a component of therapy for schizophrenia [18], pain perception following stroke [19], and dementia [11], as well as for the rehabilitation of people with disability [20, 21]. Karaoke may also potentially alleviate depression, which was reported to have worsened among the elderly during the COVID-19 epidemic [22, 23]. Thus, it is considered beneficial to continue enjoying karaoke or singing songs in a group even during an epidemic situation. Although COVID-19 vaccines can decrease the severity of COVID-19, they cannot fully protect against infection [9], and variants with different characteristics may emerge one after another [24]. Thus, we need to determine how these activities can be conducted safely in the post–COVID-19 era, when we need to reduce the risk of infection as much as possible.

Karaoke-related cases were first detected from Sapporo City and then from Otaru City. Initially, these cases did not seem to be related to each other through a case investigation conducted by the public health centers. However, the viruses isolated from these cases were within 4 SNVs' difference, and it was reported that SARS-CoV-2 acquires approximately 2 mutations per month in the global population [25]. Our observation that the outbreaks in the 2 cities lasted for approximately 6 weeks was in line with previous reports, and several small-sized outbreaks in karaoke bars in 2 different cities were considered to be part of a larger outbreak among the elderly who enjoyed karaoke in these 2 cities. This understanding supported our combination of the cases identified in the outbreaks in the 2 cities when we conducted the case-control study. Because these cases had enjoyed karaoke before their onset of symptoms, we planned to identify the risk factors for COVID-19 infection associated with karaoke. Even though we could not analyze genomes in all cases, it is plausible that the cases may have isolates from the same origin because the overall COVID-19 levels in these 2 cities were relatively low. This is one good example of the application of a genome analysis to analytic epidemiology in the field.

We found that singing was associated with SARS-CoV-2 transmission. Previous studies reported that choirs, singing, or cheering could cause COVID-19 outbreaks in indoor and outdoor settings [7, 8]. Other reports showed that speaking loudly or singing could lead to more frequent [4, 5] or more widespread particle emission [26]. Even possible aerosol generation by singing was reported [8]. Based on these reports, it is plausible that singing facilitates SARS-CoV-2 transmission through droplets and short- and long-range aerosols. Surprisingly, our study suggested that singing also increases the risk of SARS-CoV-2 acquisition. Some possible reasons may be as follows: (1) taking deep and frequent breaths while singing might increase virus inhalation; (2) people who sing songs in karaoke usually enjoy doing so with many people, which may cause a crowded situation; (3) people usually take off masks to eat or drink during karaoke, which may cause increased viral shedding; (4) sharing microphones, if contaminated, could cause contact transmission; and (5) less-ventilated and closed spaces in karaoke bars may facilitate transmission via aerosol. People who sing songs, especially in an indoor environment, need to protect themselves. Although it is difficult to identify a single reason, people who sing songs may be able to reduce the risk of SARS-CoV-2 infection by avoiding the situations listed above.

Not wearing a mask was associated with SARS-CoV-2 infection during karaoke in a bar. This is in line with previous reports that noted that masks have a preventive effect on SARS-CoV-2 transmission because they decrease the spread of the virus from infectious individuals [27]. Because asymptomatic persons are infectious [28] and it is difficult for them to know this, it is considered good etiquette to wear a mask—even during karaoke—to avoid transmission. Based on this understanding, universal masking is now the norm in some countries or situations such as nonvaccinated settings [29]. Masks can also prevent people from inhaling infectious particles [30], although the effect varies depending on the fit of the mask [31]. It is therefore even more important for people to wear a mask to protect themselves from SARS-CoV-2 droplet transmission when participating in karaoke in bars.

Spending more time at a bar during karaoke also increased the risk of SARS-CoV-2 infection, and C-cases stayed at a bar for a median of 3.1 hours, whereas controls stayed for 2.1 hours. In Washington State, 32 confirmed cases and 20 suspected cases were confirmed among 61 people who participated in choral practice for 2.5 hours [7]. The time spent in a room that increases the risk SARS-CoV-2 infection depends on the width of the room and the number of occupants inside the room [32]. Because people usually enjoy karaoke with 3 or more people in a small room, it is reasonable that this specific room environment is associated with a very high risk of infection if an infectious individual is present. Thus, participating in singing activities such as karaoke should be limited to ≤2 hours when other people are present. The OR for eating or drinking was high even though not statistically significant. This association was decreased greatly by adjusting for time spent per visit (crude OR, 4.8; adjusted OR, 1.3), whereas not wearing a mask, singing, and age were not (Supplementary Table 2). So, the association of eating or drinking with SARS-CoV-2 infection may be confounded by time spent per visit. This is biologically plausible because spending long hours often involves taking off masks, which may increase the risk of SARS-CoV-2 acquisition.

The bars where infection spread were small, which is typical for karaoke bars that are usually confined and less-ventilated for soundproofing, and this is a suitable environment for aerosol transmission. Crowded situations with infectious individuals may result in an increased risk of SARS-CoV-2 infection. Because neither a cotton mask nor a medical mask completely prevents inhalation of infectious particles [31, 32], it is vital to ventilate the room frequently during karaoke, in addition to wearing a mask. Some bars use plastic curtains or partitions that may block droplets within a few meters; however, this can interfere with air circulation and the effect on prevention of transmission has not been determined.

Some COVID-19 outbreaks in bars with infected owners became large (data not shown). Some continued to open their bars and work while they were symptomatic. In an epidemiological study on a cruise ship, although a significant proportion of cases were asymptomatic at the time of detection, approximately half were symptomatic [33] and could be identified as sick. In the COVID-19 era, the key to continuing social activities like karaoke is to understand and manage one's own health. If each karaoke bar has a system to check the health status of staff members and guests, in addition to voluntary self-reporting, the risk of SARS-CoV-2 transmission when participating in karaoke in a bar may decrease, although the risk may never reach zero.

The interpretation of the present results is associated with at least 5 limitations. First, due to a lack of case information, only 56% of cases were included; however, the distribution of age and sex of the 38 included cases did not differ from the 30 excluded cases. Second, because public health centers made the names of specific bars public if it was difficult to obtain a guest list, the methods of case identification differed between bars, which may have caused selection bias. However, the events occurred in a relatively closed community, and the majority of asymptomatic cases reached out to public health centers through clinics or hospitals due to good healthcare accessibility and networking in Japan. Third, cases may have included primary cases, which could have led to underestimation of the OR. Fourth, information on mask wearing was self-reported, and we cannot guarantee that the individuals wore masks at all times when in the bar, which may have caused misclassification. Last, masks are known to offer different levels of protection depending on their material and structure, but no information was available on the types of masks that were worn.

In summary, karaoke or singing songs in a group is a popular social activity among the elderly in Japan, but participating in karaoke in a confined, less-ventilated room with a large number of people increases the risk of SARS-CoV-2 infection. Wearing a mask in a bar, even when singing songs, and staying in the bar for a short time (<2.5–3 hours) could reduce the risk of SARS-CoV-2 infection.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

Author contributions. T. Y., H. N., T. U., and M. N. designed the study. Y. S., Y. T., K. A., H. C., K. T., K. N., T. F., K. S., R. Y., Y. M., K. Y., H. T., T. Sa, A. K., S. T., T. Shib, Y. I., T. O., Y. H., and T. H. collected information of the cases and controls. T. Y., H. N., T. U., and M. N. analyzed the data. T. Y., M. N., and S. A. developed the draft manuscript. H. K., Y. Y., T. Shim, Y. A., M. S., T. Se, M. K., and T. Su reviewed the manuscript and provided inputs.

Acknowledgments. We thank the staff of the Public Health Office, Sapporo, Sapporo City Institute of Public Health, Public Health Office, Otaru City, Hokkaido Prefectural Government and the Hokkaido Institute of Health who were involved in the investigation.

Financial support. This work was supported by the Ministry of Health, Labour and Welfare, Japan (grant number 20HA2007).

Potential conflicts of interest. All authors: No reported conflicts.

All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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