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AUFATMEN – Arts for Long Covid

The artists perform/record the arrangements for string quartet and voices.
(Vienna: Theater an der Wien, June 2021). Picture by Gabriele Schacherl.

Abstract

This pilot project *Aufatmen – Singen gegen Long Covid* is an art-based intervention strategy and offers the possibility of singing as well as overall artistic experience for people affected by Long Covid. The six-week sing-training consists of active parts ("do it/sing yourself" with one one-hour training session per week) and receptive, specially tailored and artistically implemented components (videos, audio files, …). Due to the outstanding legal situation in

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Austria, with a music therapy law, the project represents a novel fusion of the art-based concept Singing for Lung Health (SLH), professional music therapy and the knowledge support by pulmonary specialists. The program is also characterized by its high artistic quality, as its standards are set by (a) internationally acclaimed artists partaking in this project and (b) acoustically as well as visually outstanding venues in Vienna, where the videos and recordings were produced. Of the participants, no previous musical knowledge was assumed or needed. The pilot project was accompanied by a clinical study in the form of a case report. It includes listings of the participants' health status, their overall wellbeing and their musical preferences (revealed via questionnaires), all collected once at the beginning and once at the end. Included as further variables were lung function measurements of volunteers recruited from the pool of participants.

Results

The pilot project was predominantly accepted by women; among 45 participants, there were only two men. Participants showed a significant increase in subjective wellbeing from before to after the musical training; reporting more joy, feeling less depressed, sad or lonely, and experiencing less symptoms of exhaustion, and more energy and focus after the training period.

The entire cohort showed a reduction in their lungs' one-second capacities and respiratory muscle strength in the cohort, with the latter relating on the documented severity of the Covid-19 disease and the type and duration of hospitalization (not analyzed here).

Though no significant changes in lung functions from pre to post training were found in those 14 participants taking part in the clinical assessment, a trend towards significant improvements were seen regarding diffusion capacity of the lung (KCO: $p = 0.102$; DLCO: $p = 0.132$) with younger participants showing greater improvements in DLCO from pre to post ($r = - 0.56$, $p = 0.045$).

KEYWORDS: LONG COVID, Singing for Lung Health (SLH), Arts for Health, Music Therapy

Background

In the course of the Covid-19 pandemic, a further massive new challenge arose in the form of Long Covid[i]. We were aware of decades of practice with Singing for Lung Health (SLH) in several countries in general as well as numerous studies[ii,iii,iv] thereof. As our team members had decades of experience in the field of music therapy and clinical expertise, it was evident to us that the arts-based concept of SLH would be very suitable for combatting this new scourge. Interrelatedness of singing, medicine and (music-)therapy has been reported since the beginnings of human history[v]; in the course of further development from the pre-Socratics[vi] to the music theory of the 19th Century[vii], this practice has been repeatedly described in textbooks. During the 20th century evidence-based science also became involved[viii] and current findings derived from (functional) imaging techniques have contributed further insights.[ix] In the wake of the pandemic, several projects have emerged, such as those of the English National Opera[x] and initial studies of SLH in action against Long Covid, which have claimed to have achieved positive effects[xi][xii, xiii, xiv] and also describe innovative technological solutions[xv]. Not only Long Covid affected persons but also the nursing staff could benefit from appropriate singing training[xvi] as well as movement-correlated breath regulation[xvii].

In Long Covid, psychologically manifest symptoms (such as "brain fog" or fatigue syndrome as well as general anxiety and stress) and organic ones ("lung complaints" — often described as shortness of breath, lung pain, reduced physical efficiency and so on) have been observed to occur in combination,[xviii, xix, xx, xxi, xxii] independent of the severity of the COVID-19 disease[xxiii]. These combinations make singing, dancing and music performance particularly meaningful because they are able to strengthen the potential of the lungs as well as the whole breathing process[xxiv, xxv] (including related neural plasticity[xxvi]). Concurrently, they putatively contribute to relaxation and wellbeing[xxvii], to stress and anxiety reduction[xxviii]. In summary: singing should be able to positively influence both the physique and psyche together, as — against the background of millennia-old traditions already described — has also been repeatedly emphasized in the recent past.[xxix]

The arts & health project

Our association *Arts for Health Austria* (an associated member of the UNESCO Cultural Diversity Working Group; www.artsforhealthaustria.eu) used these aforementioned claimed insights as a starting point. Based on the growing scientific knowledge about Long Covid, and our cooperation with the two startups (in the pre-foundation phase) *Art Wave* and *Ludwig Med*, we created and implemented the initiative "AUFATMEN – SINGEN GEGEN LONG COVID"

(www.aufatmen-austria.eu). The pilot project that took place in Vienna/Austria during November/December 2021 has received funding and support from Stadt Wien; Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz; Selbsthilfegruppe Long Covid Austria; IMC FH Krems; Therme Wien Med; Porticus; Theater an der Wien; Wiener Konzerthaus; Porgy&Bess; Cape 10 and Musikverein Wien and was met with a high level of response from politicians, the media and the public.

Based upon this wide cooperation from the world of culture as well as the world of science, we were able to implement the following essential characteristics:

1) Both receptive (in the form of online content that was specially selected, arranged, edited, performed, recorded and produced by artists at Theater an der Wien, Wiener Konzerthaus and Porgy&Bess, Vienna) and active (in the form of sing-training provided by professional voice coaches and singers) musical interventions/stimuli were available.

2.) A specially adapted online program that has been arranged/edited and compiled for the appropriate functional use inducing relaxing, stimulating and balancing stimuli. The program on one hand incorporates the Austrian music tradition but also contains a wide variety of musical styles including, but not limited to, arias and songs by Marianna Martines, Wolfgang Amadeus Mozart, Gioachino Rossini, Engelbert Humperdinck and Johannes Brahms. All were specifically arranged for string quartet and voices by a member of our team (Oliver Peter Graber, composer). Folk and children's songs for guitar and voices and popular canons a capella (*Frère Jacques*, *I like the flowers* and others) are included. All works were performed in the original language (German, English, French, Italian and Turkish) and thereby also addressed a broad cultural language background.

3.) The sing-training, lasting six weeks, constitutes the central and active component of the program; it was created specifically for the project by professional staff (voice coaches and international vocal soloists). Their artistic expertise was transferred from the stage into their highly participatory and mindful, personal work with the participants, who were not required to have any prior musical knowledge. The musical repertoire is stylistically open and adaptable by taking into account the musical taste, preferences and specific abilities of each participating person. Musical improvisation also forms a central concept of the program. Group sessions of 60 minutes (live and online) were held weekly. The participants were given exercise instructions and music suggestions for independent work between the sessions and were encouraged to take advantage of the contents that were made available online weekly.

4.) Taking into account the very special legal situation in Austria — where a specific music therapy law has been in force since 2009[xxx] — the art-based approach is interwoven with professional music therapy and guided by professional, registered music-therapists. Vocal coaches supervise the group sessions and online training of the participants together with the music therapists, who also accompanied the entire project as general supervisors. Additional offers in music therapy could be taken up by the participants according to their personal needs.

Arts for Health & Music-therapy — A combined concept of two related worlds

While music therapy in its approach to Long Covid is largely oriented towards psychotherapeutic concepts, arts for health in its light-hearted encounter with artistic activity offers the spontaneous experience of positive impulses emanating from art (in our case: music and musical performance = singing) itself. The goal to combine these two approaches is also reflected in the personnel composition of our team:

Two professional vocal coaches (Johanna von der Deken and Monica Theiss-Eröd), two professional vocal soloists (Jennifer Davison, soprano and Bea Robein, mezzosoprano) and two professional music therapists (Marlies Sobotka and Iris Zoderer) were responsible for five singing groups with a maximum of twelve people each. One group met in person and four groups used the platform ZOOM for online-meetings. All five groups met weekly, for 60 minutes. "Breakout-rooms" for music-therapy interventions were available online and could be (virtually) visited during the weekly group meetings as well as on some other day whenever requested by a participant. There was no general time limit for these breakout-rooms.

The coaching sessions began with a short introductory session and ended with a feedback session led by the music therapists. The content of these sessions was mostly about how the participants felt on the respective day, how they had fared over the course of the previous week and what they could take away from the respectively last session.

After the introductory round, the group performed basic breathing exercises and the voice coaches usually continued with body awareness exercises which eventually led to humming and singing (starting with vocalises and gradually turning into the singing of simple songs).

At the very beginning of the project, participants repeatedly expressed concern about not being able to sing properly or about not being musical enough. However, since singing ability was never the focus, this initial shyness was overcome in the first two weeks.

The main task of the vocal coaches was, on the one hand, to strengthen the participants' breathing levels and singing abilities, but, furthermore, to accompany them emotionally — to convey joy, optimism and fun. Since many participants reported to permanently have a subjective feeling of pressure on their sternum and a feeling of tightness due to their Long Covid, the training sessions focused on inducing a feeling of wideness and lightness (supported by freely inhaling and exhaling).

On the emotional level, humor also played an important role. Through fun exercises, in which grimacing was allowed, or singing songs in which different roles were adopted by the participants, the training program succeeded in distracting them from their symptoms of illness and making them again aware of their personal resources.

In the first course unit, some participants were recognizably exhausted after only short exercises and a few bars of music; consequently, one hour of concentration and musical activity was already the maximum. Within the six weeks, the resilience and vocal endurance had increased noticeably. The participants were by then able to perform longer basic exercises and full pieces, reported about their subjectively improved breathing ability and they had little trouble singing up to ten songs in one session. Confidence in their own vocal abilities grew — a difference that was audible even to outsiders. Overall, all vocal coaches, music therapists and singers agreed that the vocal and musical abilities of all participants increased during the training period of six weeks. The participants themselves reported a self-perceived improvement as well[xxxi].

After the first pilot project in the winter of 2021, a four-week continuation program called *Weiteratmen* took place twice. This was requested by twelve participants in order to continue singing with their trainers. We see this demand for a continuation as a significant sign of success, all the more so since the follow-up offer could not be offered free of charge.

Participants' spontaneous reactions and personal comments were documented during pre- and post-training interviews; further evaluations by the vocal coaches took place after all sessions.

Among the most frequently mentioned topics were:

- ✓ Being part of a group with similar problems and symptoms.
- ✓ Mutual exchange regarding problems, symptoms and "Long Covid" overall.
- ✓ Being taken seriously, since they perceived Long Covid is not yet a concept for most people.
- ✓ Community sense that is strongly supported by singing and music.

- ✓ Discovering and expanding one's own abilities in the physical as well as in the singing regimen.
- ✓ Bringing singing into everyday life; using the new musical tools during moments of great fatigue and exhaustion.
- ✓ Finding new matters in life, such as regularly performing music or subsequently taking music lessons.
- ✓ Improved self-awareness and self-help abilities.
- ✓ Humor and a return of *joie de vivre.*
- ✓ New hope, despite still fearing to fail.

Following the so-called *Kremser Modell* of music therapy, as practiced at the IMC FH Krems, all sessions were videotaped for the purpose of quality assurance as well as post-evaluation of individual participants' responses.

Among the musical material offered during the sessions, the canon *I like the Flowers* became the favorite piece of all five groups and thus became not only an *earworm* during the six weeks of the program but also some sort of *signation* of the entire program.

Material and Methods

1. Assessment of Lung Performance

To assess changes in lung performance, clinical assessement of pulmologic functions were performed at the pulmological rehabilitation center Therme Wien Med GmbH in 14 participants before and after the training. All 28 tests were performed by the same health care worker in order to minimize inaccuracies as they can easily arise in the intra-individual interaction between medical-technical personnel and the persons to be tested [xxxii, xxxiii, xxxiv].

The following parameters were surveyed during one week before the first singing training started and during one week after the last training:

- ✓ Forced vital capacity (FVC)
- ✓ Forced expiratory volume in one second (FEV1)
- ✓ Diffusion lung capacity for carbon monoxide (DLCO)[xxxv]
- ✓ Carbon monoxide transfer coefficient (KCO)
- ✓ Maximal inspiratory pressure (MIP)
- ✓ Maximal expiratory pressure (MEP)

A value of 80% can be interpreted as sufficient (with regard to an age-standardized control group). Applicable reference values for these parameters can be taken directly from the *Leitlinie 020-017 Spirometrie[xxxvi]* following this link https://www.awmf.org/uploads/tx_szleitlinien/020-017l_S2k_Spirometrie-2015-05-abgelaufen.pdf which is currently under revision.

2. Assessment of Well Being via Questionnaire

Prior to and after completion of the singing-training, participants completed the "Aufatmen"-Wellbeing questionnaire (the queries for both prior and post are listed in **Appendix A**). Not all queries in the prior questionnaire were repeated in the post questionnaire; only 14 were. For each query, participants were given a 4 or 5-step Likert scale. There were 3 different scale types:

1. The 4 step Likert scale with step 1 = never, step 2 = occasionally, now and then, step 3 = most of the time; step 4 = almost always.
2. The inverted 4 step Likert scale with step 1 = almost always, step 2 = most of the time occasionally, every now and then, step 3 = occasionally, most of the time, step 4 = never.
3. The step Likert scale with step 1 = not at all, step 2 = hardly, 3 = tolerable, step 4 = noticeable, step 5 = strongly.

According to each step (1 – 4 / 5) numerical values (1 – 4 / 5) were attributed for data analyses.

45 participants filled out the questionnaire before and after the training period. Two did not follow the instructions correctly, resulting in 43 patients to be analyzed.

Statistical Analyses:

Continuous variables, as e.g. the lung performance tests, were tested for normality using the Kolmogorov-Smirnov test and each variables histogram and QQ-Plot. In case of normal distribution variables were presented as mean ± 1 standard deviation. If normal distribution was not given, the median and the 25. / 75. percentile were presented. Ordinally scaled variables, as e.g. items from the questionnaire, were presented as median and the 25. / 75. Percentile, nominal variables, as e.g. gender, were presented as absolute and relative frequencies (N / %).

To compare changes from pre to post training in continuous variables, that were normally distributed, paired t-tests were calculated. Changes over time in continuous variables, that were not normally distributed or ordinally scaled were tested with the Wilcoxon test.

For better interpretation of significant changes in the questionnaire from pre to post training, the mean ± 1 standard deviation was presented in addition to median and percentiles.

For each statistical test the effect size r was presented, with r = 0.1 representing a small effect, 0.3 a medium effect and 0.5 a strong effect.

To investigate relations between age and changes in lung performance from pre to post training, Pearson correlation tests with 1000 sample bootstrapping were calculated and the correlation coefficient r and its 95%-confidence interval were reported. Changes in lung performance were derived from the difference of post minus premeasurements.

Data analyses was performed in SPSS 28 (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp).

Results:

Changes in lung-performance:

14 Patients, who took part in the lung performance test were on average 40.45 ± 10.99 years old and female. From a clinical point of view, the entire cohort showed a reduction in their lungs' one-second capacities (FEV1, FEV1/FVC) and respiratory muscle strength in the cohort (MEP / MIP), with the latter relating on the documented severity of the Covid-19 disease and the type and duration of hospitalization (not analyzed here).

Statistical comparison revealed no significant changes in lung performance from pre to post training (see Table a). Still, it must be emphasized, that group size was very low. Therefore, the possibility to detect significant changes was reduced. If the effect size r is considered, though, it can be concluded, that especially KCO and DLCO show medium sized statistical effects, indicating the existence of systematic improvements in lung performance over time. Based on an alpha of 0.05, a power of 0.8, a correlation of pre and post measurements of 0.9, sample size calculations reveal, that at least a study population of $N = 20$ patients would have been needed to detect significant changes in lung performance from pre to post training. Therefore, there seems to be some improvement in lung performance, which very likely can be detected if further patients are added to the analyses.

(N = 14)	Pre	Post	Statistics
	Median [25.; 75. Percentile] %	Median [25.; 75. Percentile] %	
FVC	89.00 [80.75; 100.00]	90.00 [84.50; 98.50]	p = 0.172, r = 0.259
FEV1	93.00 [77.50; 98.25]	89.50 [77.50; 98.50]	p = 0.675, r = 0.079
FEV1/ FVC	80.00 [77.00; 84.25]	79.00 [76.00; 85.25]	p = 0.506, r = 0.126
DLCO	90.50 [77.50; 97.00]	93.00 [79.00; 100.00]	p = 0.132, r = 0.284
KCO	95.00 [81.75; 97.50]	98.50 [78.50; 100.00]	p = 0.102, r = 0.309
MIP	73.00 [38.75; 100.00]	81.00 [54.75; 100.00]	p = 0.413, r = 0.155
MEP	63.00 [46.00; 93.75]	60.50 [44.75; 100.00]	p = 0.485, r = 0.132

Table a: Lung performance presented as medians [25.; 75. percentil]. Everything above 80% can be interpreted as appropriate performance with regard to each patients age group.

Correlation analyses revealed, that changes in DLCO from pre to post training increase significantly with younger age (r = - 0.56, 95%-KI[-0.87 - -0.043], p = 0.045, see Figure x), with age explaining 31.7% of variance within changes in DCLO. No other significant correlation between age and changes in lung performance were found ($\mid$ r $\mid$ <0.445, p > 0.127).
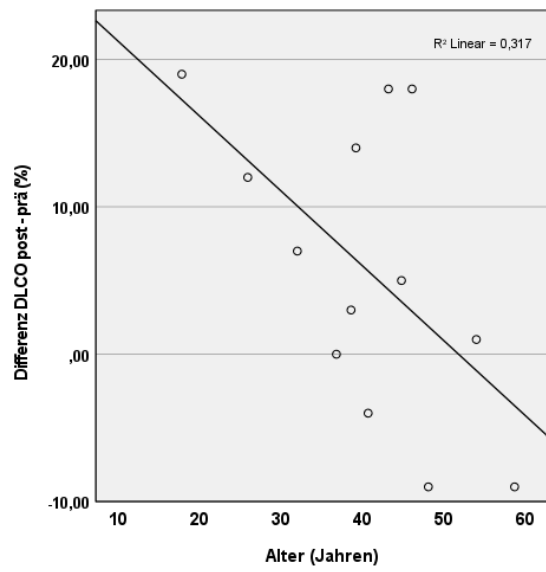
Figure 1 Difference DLCO pre-post (%) related to age

Changes in Well Being - Questionnaires

Those 43 patients who answered the questionnaires before and after the training were on average 4.80 ± 10.60 years old and in 95.3% (N = 41) female.

Significant improvements from pre to post training were found in 10 out of 14 questions (see Table x), showing that patients felt well more often during the last week (F1), experiencing more often enjoyment of life (F2) and felt less often depressed (F3), or sad (F5) after the training.

Patients felt less often that anything they undertook was a great exertion (F6) and felt less often exhausted right after waking up (F10). The felt more often full of energy (F9) and they were more often able to stay focused while completing a task.

Finally, they felt less often lonely during the last week and Long Covid did less often hamper their professional undertakings. See Appendix x for the detailed wording of each question and for better interpretation of descriptive statistics in Table b.

(N = 43)	Pre		Post		Statistics
	Median [25. – 75. Perc]	Mean ± 1 SD	Median [25. – 75. Perc]	Mean ± 1 SD	
F 1	2 [2 - 3]	2.37 ± 0.58	2 [2 - 3]	2.56 ± 0.67	**p = 0.046*, r = 0.216**
F 2	2 [2 - 3]	2.37 ± 0.79	3 [2 - 3]	2.60 ± 0.85	**p = 0.033*, r = 0.230**
F 3	3 [2 - 3]	2.58 ± 0.66	3 [3 - 3]	2.93 ± 0.59	**p = 0.003, r = 0.321**
F 4	3 [3 - 3]	2.95 ± 0.62	3 [3 - 4]	3.16 ± 0.65	**p = 0.007*, r = 0.289**
F 5	2 [1 - 2]	1.95 ± 0.75	2 [2 - 3]	2.35 ± 0.69	p = 0.077, r = 0.191
F 6	2 [2 - 3]	2.14 ± 0.83	3 [2 - 3]	2.53 ± 0.67	**p = 0.007*, r = 0.289**
F 7	2 [2 - 3]	2.42 ± 0.85	3 [2 - 3]	2.70 ± 0.77	p = 0.139, r = 0.160
F 8	2 [1 - 3]	2.33 ± 1.06	3 [2 - 3]	2.56 ± 0.96	p = 0.159, r = 0.152
F 9	1 [1 - 2]	1.49 ± 0.51	2 [1 - 2]	2.00 ± 0.82	**p < 0.001, r = 0.399**
F 10	3 [2 - 4]	2.79 ± 0.94	2 [2 - 3]	2.44 ± 0.94	**p = 0.038*, r = 0.223**
F 11	2 [2 - 3]	2.23 ± 0.53	2 [2 - 3]	2.49 ± 0.67	**p < 0.001, r = 0.358**
F 14	3 [2 – 4]	2.70 ± 1.04	2 [1 - 2]	1.63 ± 0.66	**p < 0.001, r = 0.454**
F 15	5 [4 - 5]	4.64 ± 0.66	5 [4 - 5]	4.35 ± 0.78	**p = 0.022*, r = 0.250**
F 16	3 [1 - 5]	2.86 ± 1.68	3 [2 - 3]	2.76 ± 0.58	p = 0.932, r = 0.009

Table b: Ratings given by participants, displayed for each question (F 1 – F 16). Ratings are presented as medians [25.; 75. percentile] and means ± 1SD, separately before and after the training. The meaning of each rating number can be interpreted by comparing the presented rating and the corresponding wording of each answer as displayed in Appendix X. For question 1 e.g. 1 = never, 2 = occasionally, every now and then, 3 = most of the time, 4 = almost always. Therefore, the average rating changed from 2.37 (2 = occasionally, every now and then) to 2.56 (2 = „occasionally, every now and then" with a strong bias towards 3 = „most of the time").

Discussion

The mix of Arts for Health, music therapy and pulmonology represents an integrative and interdisciplinary approach that distinguishes the project in terms of its innovation. From the point of view of those responsible for the project (physicians, artists, therapists), the interaction of the different disciplines has provided enrichment to their work.

Both those responsible for the project, and the participants found singing together in the group and the accompanying feeling of community particularly joyful.

The statistical analysis of the questionnaires revealed a significant improvement in subjectively perceived Long Covid symptoms and thus an increase in wellbeing, although there were no statistically significant changes in lung function values *per se*. This was due though to the fact, that the assessed sample size was too low. Based on the effects found in this study, a sample size calculation revealed, that at least 20 participants would have been needed to detect significant changes in the KCO and DCLO – both showing improvements from pre to post training on a descriptive level (see table a). Therefore, to detect objective improvements as well, a study population of at least 20 participants should assessed in future studies.

Most interestingly, a strong relation between age and the amount of improvement of diffusion capacity (DLCO) from pre to post training was found, indicating that younger participants profited most from training (see Figure 1).

Also, in general respiratory muscle strength in the cohort (tested via MEP / MIP) was pathologically shifted. From a clinical point of view, the pathological data explain themselves from the severity of the previous Covid-19 disease and possible hospitalization, as expected, although this was not an explicit question of the present study and therefore is not discussed and analyzed here.

Strengths and limitations of the project

In the combination of music therapy and Arts for Health, the special qualities of both approaches can be optimally exploited. The inclusive strategy of *Aufatmen* is non-invasive and, as long as Covid-19 relevant safety regulations are observed (which can be easily implemented in the form of online training), is safe and free of side effects, cost-effective and conveys a high fun factor for all concerned. The experience of group-singing creates positive emphases and impulses which not only raise the mood but also stimulate the daily life of the participants. The

combination of receptive and active musical stimuli as well as the wide variety of musical styles and epochs also contributes essentially to effects of these kind. The receptive part, however, also represents a limitation in that it is left up to the participants to decide to what extent they want to use these offers for themselves. The intensity of a participant's involvement cannot be monitored. Another limiting factor is that not every Long Covid affected person is willing or interested in taking part in a music-related program and that the step towards music — even though *Aufatmen* deliberately offers a low-threshold access — often has to be risked for the first time.

It also must be mentioned that it cannot fully be excluded, that the improvement in subjective wellbeing could have been a random effect of time, as no control group without training or with treatment as usual was assessed. Still, as all patients being classified as Long Covid patients, further spontaneous improvement due to time passing on, was not likely. Still, in future studies, a control group or a waiting list design should be established.

Last, but not least, the lack of financing options (such as the assumption of costs by health insurance companies) forms the biggest hurdle for our program, as the costs outside the pilot project have to be borne by the participants themselves.

Conclusion

Aufatmen offers a cost-effective, non-invasive and joyful additive intervention that combines Arts for Health and music therapy and has its focus on a high artistic standard. Follow-up studies with a greater study population should be performed to further investigate changes in subjective wellbeing and lung function due to music therapy.

Appendix A

Queries[xxxvii]

The options for the responses to the queries are:

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

The options for the responses to the queries are:

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F1 Since last week, how often have you felt well?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F2 Since last week, how often have you experienced exuberance?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F3 Since last week, how often have you felt depressed?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F4 Since last week, how often have you felt sad?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

15

A4 never (4)

F5 Since last week, how often have you felt tired?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F6 Since last week, how often have you felt that everything you undertook was a great exertion?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F7 Since last week, how often have you felt you have made no progress?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F8 Since last week, how often have you had irregular sleep?

A1 almost always (1)

A2 most of the time occasionally; every now and then (2)

A3 occasionally; every now and then (3)

A4 never (4)

F9 Since last week, how often have you felt full of energy?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F10 Since last week, how often have you felt exhausted right after waking up?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F11 Since last week, how often have you been able to stay focused while completing a task?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F14 Since last week, how often have you felt lonely?

A1 never (1)

A2 occasionally; every now and then (2)

A3 most of the time (3)

A4 almost always (4)

F15 To what extent do your current Long-Covid symptoms hamper your professional undertakings?

A1 not at all (1)

A2 hardly (2)

A3 tolerable (3)

A4 noticeable (4)

A5 strongly (5)

F16 To what extent has your current Long-Covid affected your income?

A1 not at all (1)

A2 hardly (2)

A3 tolerable (3)

A4 noticeable (4)

A5 strongly (5)

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[xxxvii] The questionnaires are exploratory and do not represent a standard questionnaire on quality of life, for example.