The applicability of music coaching on different stages of dementia: a literature review

Marloes Breij
S1847791
University of Twente
Faculty of BMS
Department of Psychology, Health & Technology
1st supervisor: dr. L.M.A. Braakman-Jansen
2nd supervisor: C. Wrede

Abstract

An ever-increasing number of people are diagnosed with dementia each year, leading to cognitive, psychological and behavioral impairment, which become worse as the disease progresses. Currently no treatment options are available to cure dementia, however, there are treatments that influence and reduce the symptoms which accompany the disease. The treatments can be divided into pharmacological and non-pharmacological treatments. Non-pharmacological treatments such as music therapy are preferred as they have less harmful side effects and are less costly than pharmacological treatments. As of yet, there is no overview provided in current reviews to what extent different forms of music coaching are applicable to the different stages of dementia. Therefore, the aim of the current study is "*to identify the current literature on music coaching for people with different stages of dementia that target cognitive, psychological and/or behavioral symptoms, and/or enhance quality of life*", thereby contributing to the current scientific body of knowledge on dementia care. More specifically, the currently existing music coaching interventions, the effects of music coaching interventions, the effects of passive and active music coaching interventions and the effects of personalized and non-personalized music coaching interventions were explored.

A literature review was conducted in an attempt to provide a clear overview of the literature. Studies were selected based on the PICOC method, by establishing inclusion and exclusion criteria, and additionally, following the steps of screening for titles, abstract, full text and lastly the reference list of reviews. Three tables were created for the data extraction, covering a description of the technical details, the intervention procedure used and the practical details of the included studies.

N=31 studies were included in this study. The most common elements of music therapy are "listening to music", "singing", "playing instruments", "movement", "musical activities", "interaction" and "warm-up". Limited evidence was found for improvement in psychological, behavioral and cognitive symptoms of dementia through music coaching interventions in general. Overall, active music coaching interventions and non-personalized music coaching interventions have better evidence of effectiveness than passive, blended and personalized music coaching. With regard to the different stages of dementia, the results imply overall that there are no differences in effectiveness between applying passive, active or blended music coaching interventions and personalized or non-personalized music coaching interventions, but currently, active music coaching, especially in the early stages of dementia, and non-personalized music coaching overall, are slightly preferred.

As most studies had their limitations, it was difficult to draw strong conclusions. Moreover, some forms of music coaching were underrepresented in the current study, such as personalized music coaching, of which some authors claim, is the key for effective music coaching interventions. Therefore, it is encouraged that research into the effectiveness of music coaching, especially personalized music coaching interventions in reducing symptoms of dementia is continued, specifically studies with a RCT design.

Introduction

The yearly incidence of dementia is around 10 million new cases, which means that every three seconds, a person is diagnosed with dementia (Alzheimer's Disease International, n.d.). The World Health Organization [WHO] (2017) reported a total of 50 million people worldwide who experience some form of dementia. According to WHO (2018), worldwide "deaths due to dementia" has doubled since 2000, rising from number fourteen to the number five of causes of death in 2016. In some parts of the world, such as the UK, it has become the number one leading cause of death for women and second leading cause for men in 2017 (Alzheimer's research UK, n.d.). Alarmingly, according to Alzheimer's research UK (n.d.), it is currently the only condition in the UK top ten that does not have a treatment in order to prevent, cure or slow down its progression. Moreover, the care for dementia gets increasingly difficult to manage, as WHO (2013) claimed an increase in the shortage of healthcare workers, reaching 12.9 million by 2035. This development of a shortage of healthcare workers, is alarming for the increasing demand for a high quality of life for people with dementia. Because, as Bökberg, Ahlström and Karlsson (2017) state, the quality of life of people with dementia is largely dependent upon the quality of the care they receive from healthcare workers. Thus, when there is an increasing shortage of healthcare workers, the experienced quality of life for people with dementia may be negatively affected.

The WHO (2017) states that dementia can be regarded as a syndrome, whereby chronic or progressive cognitive decline is inevitable, for example in language, memory, learning capacity and thinking. According to Cerejeira, Lagarto and Mukaetova-Landinska (2012), behavioral and psychological symptoms are equally as important as cognitive symptoms, because they correspond with the degree of functional and cognitive impairment. Those symptoms mostly affect the emotional experience (depression, apathy), thought content (delusions), perception (hallucination) and motor function (agitation). In general, it is associated with forgetfulness, becoming lost (either at home or familiar places), experiencing behavior changes, increasing need for care and becoming unaware and not able to recognize time, places, relatives and friends.

How dementia is expressed exactly, is dependent upon the person and the type and stage of dementia (WHO, 2017), because, as dementia progresses from one stage to the next, the symptoms become worse and more evident (WHO, 2017). Reisberg, Ferris, de Leon and Crook (1982) developed a seven-stages model. The first three stages of this model are regarded as pre-dementia stages, while the last four stages are officially recognized as having dementia,

whereby clear symptoms are present which gradually become worse. Stage 1 is described as "no cognitive decline", no symptoms are present. Stage 2, "Very mild cognitive decline", is when a person experiences little memory problems. In stage 3 "Mild cognitive decline", cognitive problems can be detected; the person has problems with planning, organization and remembering names. In stage 4 "Moderate cognitive decline" clear symptoms of dementia are present and the person is in denial. In stage 5 "Moderately severe cognitive decline", people with dementia need assistance in daily life and memory loss increases. Disorientation of time and place is present. In stage 6 "Severe cognitive decline" people require professional care and assistance in daily life. In addition, they experience symptoms as confusion and personality and behavioral changes. Details of their history are forgotten and they often wander. In stage 7 "Very severe cognitive decline", the person requires help with all aspects of daily life. Verbal abilities are lost and often speech is absent. Additionally, the person experiences loss of psychomotor skills and will inevitably pass away.

Currently, there are no treatment options that cure dementia or alter its progression, but rather, the treatments influence and reduce the symptoms which accompany the disease, such as wandering or aggression (WHO, 2017). Those treatments can be divided into pharmacological (e.g., medicine) and non-pharmacological (e.g., therapy). However, the pharmacological treatment options have a major drawback as they come with side effects, for example, headaches, nausea and loss of appetite, and the effectiveness is often limited, as the medicine only help temporary (NHS, n.d.). Hence, it is of importance to focus on other treatment options, specifically in the area of non-pharmacological possibilities, as they are safer and have no side-effects.

One particular type of non-pharmacological treatment is music coaching (Alzheimer's society, n.d. -a). According to Spiro (2010), examples of music coaching are musical activities, listening to music and music therapy. Musical activities consist of rhythmic use of instruments, singing and movement associated to music. Listening to music can be individual or in group form and includes classical or favorite music. In music therapy, a musical therapist works with individuals with dementia or in programs for groups. Music coaching can be provided in the home-based or professional care setting. Music coaching might be especially helpful for the mental consequences of dementia, as these consequences negatively impact quality of life. People with dementia often have difficulties managing their emotions, which is affected by the disease itself. However, the diagnosis of dementia can also have an enormous mental impact, influencing a person's feelings, thoughts and responses (Alzheimer's Society, n.d. -b). A diagnosis can lead to emotions of grief, loss, anger, shock, fear, disbelief and relief. The

confirmation of the diagnosis may trigger depression as some people struggle to deal with a range of emotions and a decline in confidence and self-esteem. Not only the persons with a diagnosis are affected, the informal caregivers may need to cope with their own emotional reactions as well (Alzheimer's Society, n.d. -b). The reason why music coaching would be suitable is that, according to Devere (2017), music can evoke emotions and memories, thereby aid in providing a connection to a person's history and enhance interconnection with caregivers and others with dementia. In addition, music coaching has the capability to enhance mood and behavior, and reduce mood symptoms, such as depression and anxiety, and, as mentioned above, these are common mental consequences of dementia. Moreover, Devere (2017) stated that the aim of MT is to address emotions, cognitive powers, thoughts and memories in order to stimulate and relax people with dementia and thereby enrich and contribute to freedom, stability and focus.

In sum, music coaching has qualities that potentially could help alleviate psychological symptoms that people with dementia experience, thereby increase their quality of life, while also addressing cognition and thoughts. Music coaching can stimulate or relax people with dementia, which contributes to their freedom, stability and focus.

As of yet, there is no overview provided in current reviews to what extent different forms of music coaching are applicable to the different stages of dementia. Many previous studies have delved into the topic of music and its effects on dementia and its symptoms, however, the findings so far are controversial. Moreover, some studies were conducted in the home-based setting as opposed to the professional-care setting. In addition, no distinction is made between the phases of dementia, and the interventions used in these studies differ as well, for example, some focused on listening to music, whereas others focused on MT. Both Svansdottir and Snaedal (2006) and Sung, Lee, Li and Watson (2012) performed studies researching the effects of music on the reduction of dementia symptoms.

However, as mentioned above, when dementia progresses from one stage to the next, the symptoms gradually become worse and hence, people in different stages of dementia may respond differently to forms of music coaching. Some studies did include a particular stage of dementia into the inclusion criteria, such as early, mild/moderate and/or severe dementia. One example is a study by Svansdottir and Snaedal (2006) who researched MT in moderate and severe dementia. Concluding, the aforementioned studies do not provide an overview of the applicability of music coaching on the different stages of dementia. Therefore, the aim of the study is "*to identify the current literature on music coaching for people with different stages of dementia that target cognitive, psychological and/or behavioral symptoms, and/or enhance*

quality of life", thereby contributing to the current scientific body of knowledge on dementia care. The focus of this research is limited to all forms of music coaching, such as singing, playing an instrument, listening to music and its elements (rhythm, melody) and MT. The following research questions are of interest

1) "*What existing music coaching interventions are currently applied for elderly with different stages of dementia*?",

2) *"What are the effects (cognitive, psychological, behavior) of music coaching for elderly with different stages of dementia?"*,

3)*"What are the effects of music coaching for respectively active and passive music coaching regarding elderly with different stages of dementia?",*

4)*"What are the effects of music coaching for respectively personalized and non-personalized music coaching regarding elderly with different stages of dementia?".*

Method

PICOC

The PICOC method (cebma, n.d.) was applied in order to provide clarity with regard to the research objective and establish inclusion and exclusion criteria to select studies. PICOC stands for population, intervention, comparison, outcome and context. Firstly, the **population** under investigation was "people with any type of dementia". Secondly, the **intervention** used in studies were "all interventions that use a form of music coaching". Thirdly, the intervention used can be **compared**, "to other types of non-pharmacological therapies", or "a different form of music coaching", or compared to "usual care". The **outcome** of the studies should be focused on "symptom reduction (cognitive, psychological, behavioral) and/or quality of life improvement". Lastly, the **context** of studies is either "home-based or professional-care setting".

Search strategy

The keywords used in the search string were derived from the definitions of the two main concepts of this research, namely "music coaching" and "dementia". Spiro (2010) defined music coaching as consisting of three categories: musical activities, listening to music and music therapy. Musical activities encompass rhythmic use of instruments, singing and movement associated with music. Listening to music included classical or favorite music, and is provided in either individual or group form. Music therapy consists of a musical therapist who works with individuals with dementia or in programs for groups, which is either provided in the home-based or professional care setting. Furthermore, according to WHO (2017), dementia is a syndrome, encompassing several different forms of dementia, whereby a decline is experienced in memory, thinking, and behavior and an interference in the ability to perform everyday activities.

The first set of variables consisted of: "dementia", "alzheimer", and "neurocognitive disorder". "Dementia" is a syndrome, and thus all types of dementia were included in this keyword. In addition, "alzheimer" is the most common form of dementia, and therefore, included in the keywords. Moreover, "neurocognitive disorder" is an umbrella term that includes dementia, and thus, was included in the keywords. The objective was to investigate the applicability of music coaching on the different stages of dementia. However, it was decided not to include the different stages of dementia in keywords, because many studies do not report

the severity of dementia under investigation. It was thought that the other keywords, such as "dementia" were more general, and therefore, would automatically include studies that do report the stage of dementia.

The second set of variables consisted of: "music coaching", "music therapy", "music" and "nonpharmacological therapy". "Music coaching" consists of many forms, and therefore, one of the most common forms, "music therapy", was included as keyword. Additionally, "music" was added to the keywords to include all other forms of music coaching. Lastly, "nonpharmacological therapy" was included as it encompasses all types of treatment that do not involve drugs, including music coaching.

The following search string was created on the basis of the keywords: TITLE-ABS-KEY ((dementia OR alzheimer OR neurocognitive AND disorder) AND (music OR music AND coaching OR music AND therapy OR non-pharmacological AND therapy)). Scopus was used as database. To identify literature of interest, a selection strategy was applied and inclusion and exclusion criteria were established on the basis of the PICOC method.

Selection of studies

Selection of studies was done using the following steps and by using the inclusion and exclusion criteria (see figure 1, flowchart). Firstly, articles were filtered on the basis of their title. Secondly, the remaining articles were screened based on their abstract. Thirdly, articles were selected based on their full text. If the full text was not available, ResearchGate and Google Scholar were used to potentially find a full text version. Lastly, the reference list during full text reviews were screened to search for articles that did not appear in the Scopus, but were potentially of interest to the study's objective.

Inclusion criteria

- Type of studies: reviews, RCT, empirical study
-Year of publication: all publication years
- Type of population: people with (all types of) dementia (accepted terms used were: "cognitive impairment", "brain impairment" or "Alzheimer")
- Setting: home-based and professional care setting
- Type of intervention: all interventions that use a form of music coaching (accepted terms used were: "treatment", "approach" or "non-pharmacological therapy/treatment")

- Type of outcome measures: psychological (depression, delusions) and/or cognitive (decline in memory, thinking, learning and or behavioral (agitation, behavioral disturbance) symptoms of dementia and/or quality of life.

Exclusion criteria

- Full text not available
- Duplicates
- Non-English
- Non-empirical data
- Intervention: all combined interventions that use a form of music coaching together with another type of treatment in the same condition.

Data extraction

Three tables were created for the data extraction. The first table (see table 2) covered the description of the included studies regarding their technical details. The second table (see table 3) covered the description of the intervention procedure used. The third table (see table 4) provided a description of the practical details regarding the included studies. See table 1 for an overview of the characteristics per table.

Table 1

Data extraction form

Description technical details	Description of intervention procedure	Description practical details
First author	Name therapy	Type of music coaching Personalized music coaching Active music coaching
Year of publication	Intervention Study arm 1 Study arm 2 Study arm 3	Measures and instruments Mental state Cognition Behavior
Study location	Measures	Findings Mental state Cognition Behavior

Setting	Type of technology/tool
Study design	
Study participants Intervention group(s) (IG) Control group(s) (CG)	
Study population Diagnosis	

Criteria were set up to distinguish between interventions of studies that were personalized or non-personalized, active or passive, and of high or low quality. Firstly, an intervention was personalized if the intervention was tailored to a person's needs or preferences. An intervention was non-personalized if the intervention was exactly the same for everyone. Furthermore, taking into account preferred music was only viewed as personalized when only the preferred music of that person was played. Taking into consideration preferred music of all people together, for example to create a common playlist, was not regarded as personalized. In the table, non-personalized interventions were labelled as "NA". Personalized interventions were check marked and the personalized component was shortly described.

Secondly, an intervention was active if it was required to be actively engaged or actively participate, such as singing, playing an instrument, or rhythmic movement in combination with music was used or even guessing songs, for most of the time during the intervention. An intervention was passive if there was no active engagement or active participation required, such as listening to music. In the table, passive interventions were labelled as "NA". Active interventions were check marked and the active component was shortly described. If active and passive elements were equally as much used or unclear how the elements are distributed, the intervention was labelled as "blended".

Thirdly, the quality of an instrument was regarded as high when a Cronbach's alpha, or a test-retest reliability, or an internal consistency reliability was reported of 0.7 or higher (UCLA: Statistical Consulting Group, n.d.). The quality of an instrument was regarded as low when a Cronbach's alpha, test-retest reliability, or internal consistency reliability was reported below 0.7. In the table, an instrument of high reliability was labelled as "+" and an instrument of low reliability was labelled as "-". If the quality of an instrument was not mentioned in a study, it was labelled as "NA".

Results

Flowchart

A flowchart (see figure 1) was created to visualize the process of the study selection, including the used inclusion and exclusion criteria for each step of the selection. 31 studies were selected for the analysis.

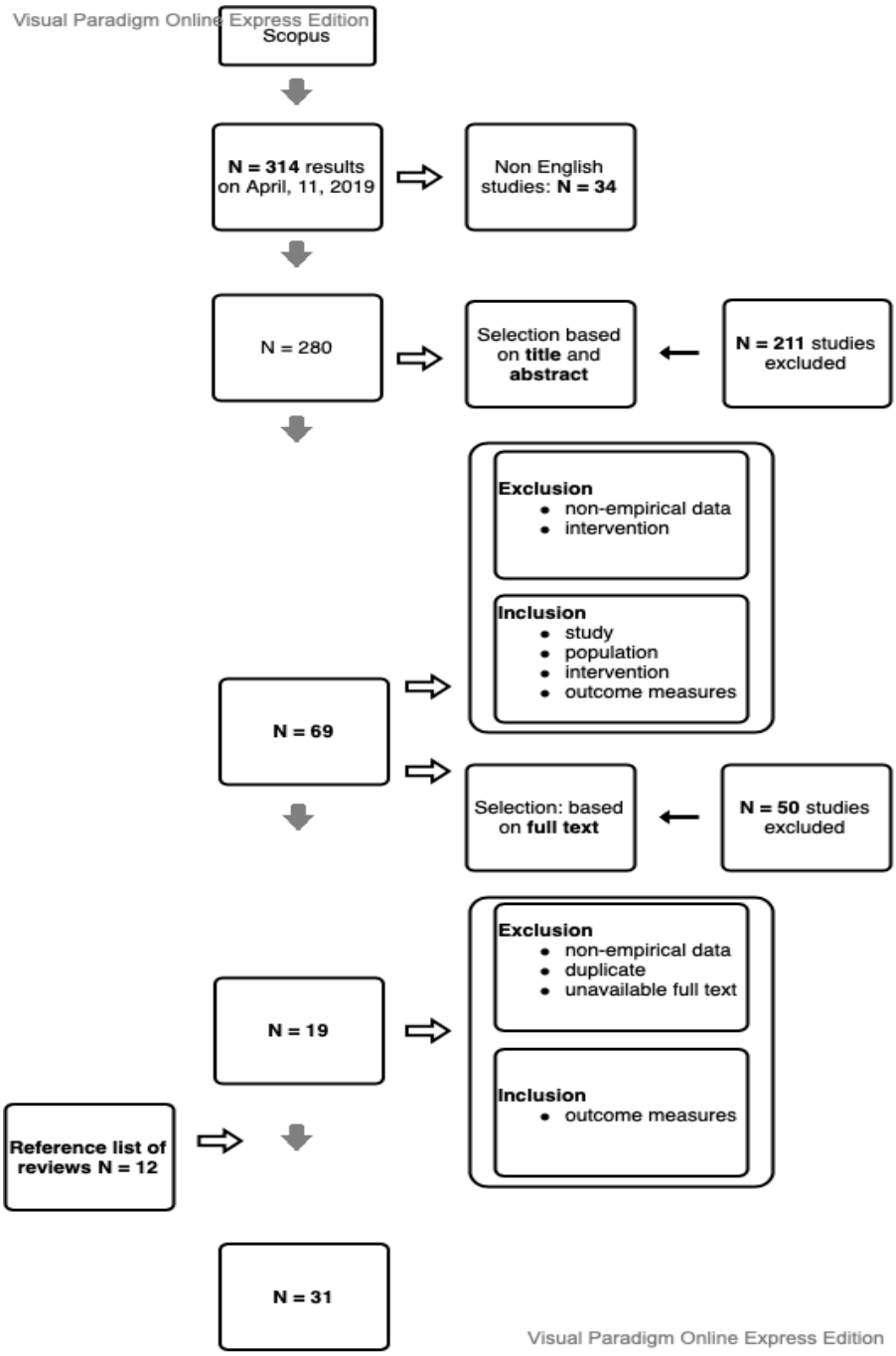

Figure 1 flowchart for study selection based on the taken steps and the inclusion and exclusion criteria.

As can be seen in the flowchart, the third step in the process of selecting studies was elimination based on the abstract of articles. However, seven articles had no abstract available

and therefore, could not be excluded yet on the basis of their abstract. The fourth step included screening the full text of articles. 2 full text versions of articles were found via ResearchGate. Full text versions were requested from the authors via ResearchGate of the other remaining eleven articles, but no response was given.

The categorization of selected studies

In total, 31 studies were found (see table 2). The following study designs were used N=13 RCT designs [1-3, 6, 8, 10, 12, 15, 18-21, 25], N=5 quasi-experimental designs [4, 9, 11, 23, 24], N=7 experimental repeated measures designs [5, 17, 22, 26, 27, 29, 31] N=2 prospective designs [14, 30] N=1 experimental study design [7], N=1 pragmatic controlled trial [13], N=1 pilot trial design [28], and N=1 case control design [16].

The studies were categorized according to the severity of dementia of the patients. There were N=4 studies included in the mild dementia category [1-4], of which N=3 were RCT designs [1-3] and N=1 a quasi-experimental design [4]. The mild/moderate dementia category comprised N=5 studies [5-9] and had the following designs: N=2 studies used a RCT [6, 8], N=2 studies used an experimental repeated measures design [5, 7] and N=1 had a quasi-experimental design [9]. Furthermore, the moderate dementia category only encompassed N=1 study [10], which employed a RCT design. The moderate/severe dementia category included most studies, N=9 [11-19], and used N=4 RCT's [12, 15, 18, 19], N=1 quasi-experimental [11], N=1 pragmatic controlled trial [13], N=1 prospective study [14], N=1 case control study [16] and N=1 repeated measures study [17] as designs. Moreover, the severe dementia category comprised N=6 studies [20-25], of which N=3 were RCT designs [20, 21, 25], N=2 quasi experimental designs [23, 24] and N=1 repeated measures study design [22]. Lastly, N=6 studies were included in the mild/moderate/severe dementia category [26-31] of which N=4 studies adopted a repeated measures designs [26, 27, 29, 31], N=1 study applied a pilot-controlled trial design [28] and N=1 study used a prospective study design [30].

Table 2

Description of the included studies regarding technical details: first author, year of publication, study location, setting, study design, study participants: intervention group(s) and control group(s); and study population: diagnosis. Studies were first ordered according to the stage of dementia (mild; mild-moderate; moderate; moderate-severe; severe; mild-moderate-severe). Then, within the stage of dementia category, studies were ordered from personalized interventions to non-personalized interventions to interventions that used both, and lastly, those were ordered according to year of publication.

						Study participants		Study population
	First author	Year of publication	Study location	Setting	Study design	Intervention group(s) (IG)	Control group(s) (CG)	Diagnosis
1	Cooke, M.	2010a	Australia	Two care facilities	RCT cross-over	N = 38	N = 37	Mild Alzheimer's disease (AD)/dementia
2	Cooke, M. L.	2010b	Australia	Two care facilities	RCT cross-over	N = 38	N = 37	Mild AD/dementia
3	Pongan, E.	2017	France	Three memory clinics	Multicenter RCT	N = 24	N = 26	Mild AD
4	de la Rubia Ortí, J. E.	2018	Spain	Valencia's Alzheimer's Association Institute	Quasi-experimental	N = 25	NA[1]	Mild AD
5	Hicks-Moore, S. L.	2008	Canada	3 special care units in nursing homes	Experimental 3x3 repeated measures design	N = 32	N = 9	Mild-moderate dementia
6	Guétin, S.	2009	France	Nursing home	RCT	N = 15	N = 15	Mild-moderate AD
7	Sung, H. C.	2012	Taiwan	Residential care facility	Experimental study	N = 27	N = 28	Mild-moderate dementia
8	Särkämö, T.	2014	Finland	5 day activity centers and inpatient centers	RCT	IG1: N = 30 IG2: N = 29	N = 30	Mild-moderate dementia
9	Gómez Gallego, M.	2017	Spain	2 geriatric residences	Quasi-experimental	N =42	NA	Mild-moderate AD
10	Cheung, D. S. K.	2018	Hong Kong	Residential care facilities	Multi-center RCT	IG1: N = 58 IG2: N = 54	CG: N = 53	Moderate dementia

11	Sung, H. C.	2010	Taiwan	Long-term care facility	Quasi-experimental design	N = 29	N = 23	Moderate-severe dementia
12	Vink, A. C.	2013	The Netherlands	6 nursing homes	RCT	N = 43	N = 34	Moderate-severe dementia
13	Ridder, H. M. O.	2013	Denmark and Norway	14 nursing homes	PCT (pragmatic)	N = 38	N = 38	Moderate-severe dementia
14	Shiltz, D. L.	2018	USA	Memory care facility	Prospective, naturalistic, single-center study	N = 47	N = 45	Moderate-severe dementia
15	Sung, H.C.	2006	Taiwan	Residential care facility	RCT	N = 18	N = 18	Moderate-severe dementia
16	Svansdottir, H. B.	2006	Iceland	Two nursing homes, two psychogeriatric wards	Case-control study	N = 20	N = 18	Moderate-severe AD
17	Ledger, A. J.	2007	Australia	13 Nursing homes	Longitudinal repeated measures non-randomized, experimental design	N = 26	N = 19	Moderate-severe AD
18	Narme, P.	2014	France	Nursing home	RCT	N = 18	N = 19	Moderate-severe AD/mixed dementia
19	Raglio, A.	2015	Italy	9 institutions: nursing home and day-care centers	Multicenter RCT	IG1: N = 40 IG2: N = 40	CG: N = 40	Moderate-severe dementia
20	Sakamoto, M.	2013	Japan	4 group homes, 1 dementia hospital	RCT	IG1: N = 13 IG2: N = 13	N = 13	Severe dementia
21	Sánchez, A.	2016	Spain	Specialized dementia elderly center	RCT	IG1: N = 9 IG2: N = 9	NA	Severe dementia
22	Maseda, A.	2018	Spain	Specialized dementia Gerontological Complex	Randomized longitudinal trial	IG1: N = 11 IG2: N = 10	NA	Severe dementia

23	Goddaer, J.	1994	Belgium	2 nursing homes	Quasi-experimental study ABAB (A = no music, B = music) repeated measures design	N = 29	NA	Severe dementia
24	Raglio, A	2008	Italy	3 nursing homes	Quasi-experimental design	N = 30	N = 29	Severe dementia
25	Raglio, A.	2010	Italy	5 nursing homes	RCT	N = 30	N = 30	Severe dementia
26	Brotons, M.	2000	USA	Specialized Alzheimer's care facility	Within-subjects, crossover design	N = 20	NA	Mild-moderate-severe-profound AD
27	Lin, Y.	2011	Taiwan	3 nursing home facilities	Experimental, repeated measures design	N = 49	N = 51	Mild-moderate-severe dementia
28	Choi, A. N.	2009	South Korea	Special dementia day care unit	Pilot-controlled trial	N = 10	N = 10	Mild-moderate-severe dementia
29	Nair, B. K.	2011	Australia	Dementia-specific care facility	Cross-over study	N = 38	N = 37	Mild-moderate-severe dementia
30	Chu, H.	2014	Taiwan	3 nursing homes	Prospective, randomized parallel-group design	N = 49	N = 51	Mild-moderate-severe dementia
31	Gerdner, L.A.	2000	USA	6 long-term-care facilities	Experimental repeated measures crossover design	N = 39	N = 39	Mild-moderate- severe AD or related dementias

Note: Most of the included studies excluded patients with comorbidity, except for 8 (Cooke, Moyle, Shum, Harrison, & Murfield, 2010a; Cooke, Moyle, Shum, Harrison, & Murfield, 2010b; Gómez Gallego & Gómez García, 2017; Ledger & Baker 2007; Lin et al. 2011; Nair et al. 2011; Pongan et al. 2017; Sung, Chang, Lee, & Lee, 2006).
[1]NA = not applicable

Existing music coaching interventions

"*What existing music coaching interventions are currently applied for elderly with different stages of dementia*?"

The music coaching interventions were roughly divided into 7 elements, namely "listening to music", "singing", "playing instruments", "movement (to music)", "musical activities (song guessing, games related to music, song writing, clapping)", "interaction (discussions, chatting)" and "warm-up (body, voice)" (see table 3). Most studies used for the analysis adopted a combination of those elements, for example, the intervention consisted of singing, playing instruments, and engagement with others in between. N=21 studies used listening to music as element [1, 2, 5, 6, 8, 10-14, 17-23, 27, 29-31], N=18 studies used the element of singing [1-4, 8-10, 12, 13, 16-20, 26-28, 30], N=16 studies adopted the element of playing instruments [1, 2, 7, 9, 10, 12, 13, 16-19, 24, 25, 27, 28, 30], N=10 studies applied the element of movement [1, 2, 8-10, 12, 13, 15, 17, 20], N=7 studies applied musical activities as element [9, 10, 17, 20, 27, 28, 30] N=6 studies adopted the element of interaction [8, 16, 17, 24-26] and N=3 studies used the warm up element [3, 7, 8]. Noteworthy is that half of interventions that used the element of listening to music, did not use any other elements [5, 6, 10, 11, 14, 19, 21-23, 29, 31].

Remarkably, the elements that required active engagement in terms of their body, such as "warm-up" and "movement", were predominantly applied in early dementia stages. In contrast, the one passive element, "listening to music", was mostly adopted during later stages of dementia. Most of the elements were used throughout the different stages of dementia. No other outstanding differences were found with respect to the different stages of dementia.

Table 3

Description of the included studies regarding the intervention procedure: therapy name; intervention: study arms and frequency; measures (with week number); and type of technology/tool used. Studies were first ordered according to the stage of dementia (mild; mild-moderate; moderate; moderate-severe; severe; mild-moderate-severe). Then, within the stage of dementia category, studies were ordered from personalized interventions to non-personalized interventions to interventions that used both, and lastly, those were ordered according to year of publication. For clarification, the number of the study was added.

	Name therapy	Intervention				Measures	Type of tool
		Study arm 1	Study arm 2	Study arm 3	Frequency		
1	Live group music programme	30 min. familiar song singing; 10 min. pre-recorded instrumental music for active listening involving singing, playing instruments and movement	CG: reading local news stories, telling jokes, undertaking quizzes	NA[1]	40 min, 3x a week, 8 weeks total. Five-week washout period, then crossover	Pre-measure (0), mid-point (8) and post- measure (21)	Guitar; musical instruments
2	Live group music programme	30 min. familiar song singing; 10 min. pre-recorded instrumental music for active listening involving singing, playing instruments and movement	CG: reading local news stories, telling jokes, undertaking quizzes	NA	40 min, 3x a week, 8 weeks total. Five-week washout period, then crossover	Pre-measure (0), mid-point (8) and post- measure (21)	Guitar; musical instruments
3	Musical intervention (SI)	SI: 1. personalized welcome. 2. body and voice warm-up. 3. song learning. Each session four songs were practiced	CG: 1. Personalized welcome. 2. Discuss paintings 3. Realizing painting according to a predetermined theme	NA	120 min, 1x a week, for a total of 3 months	Pre-measure (0), post-measure (12), follow-up (16)	Piano
4	Short music therapy (MT) protocol	1. Welcome song. 2. Theme song related to flowers	NA	NA	1 time only, 2 activities of each 30 min; 60 min in total	Pre-measure (0), post-measure (0)	NA
5	Favorite music (FM), hand massage (HM), combined HMFM	FM = listening to favorite music HM = receiving 5 min. massage on each hand HMFM = combination, simultaneously	Usual care (UC)	NA	10 min. per treatment, 30 min total. Unknown how long treatment lasted	Pre-measure 10 min before treatment; immediate post-measure; 1 hr post-measure	Portable compact disc player; compact discs
6	Individual receptive MT	Listening to favorite music in phases, according to the U-sequence method	CG: Resting and reading	NA	20 min. 1x a week, total of 24 weeks	Pre-measure (0), midpoint (4,8), post-measure	Computer program; headphones; a mask

		from enlivening to relaxation to re-enlivening				(16), follow up (24)	
7	Group music intervention	1. 5 min warm-up of major muscle groups, breathing. 2. 20 min playing percussion instruments. 3. 5 min cool down stretching with music	UC: tv watching, some social activities, basic nursing care	NA	30 min, 2x a week, total of 6 weeks	Pre-measure (0), midpoint (4), post-measure (6)	Percussion instruments
8	Music coaching program (either singing (SG) or music listening (MLG))	SG: Singing songs, vocal exercises, rhythmical movement; based on theme. Musical homework was given to integrate into everyday life	MLG: listening to songs and discuss emotions, thoughts, memories evoked. Visual cues present to stimulate reminiscence	UC: physical or social activity	SG/MLG: 90 min, 1x a week, 10 weeks total UC: A couple of times a week	Pre-measure (0), midpoint (10) post-measure (34)	Piano, guitar, kantele; CD, CD-player, song books, compiled CDs
9	Musical activities therapy	1. Welcome song 2. Rhythmic accompaniment (instruments or hands) 3. Moving to background music 4. Guessing songs and interpreters 5. Farewell song	NA	NA	45 min. 2x a week, total of 6 weeks	Pre-measure (0), midpoint (3), post-measure (6)	High-quality stereo; music instruments; hoops and balls; music bingo; drawings
10	Music-with-movement (MM) intervention versus listening to music (ML)	MM: 1. 5 min greeting song. 2. 20 min. MM activities, e.g. foot tapping, playing musical instruments; batting balloons 3. Closing song	ML: listened to their preferred music	Social activity: chatted casually	30 min., 2x a week for 6 weeks total	Pre-measure (0), post-measure (6), follow up (12)	Musical instruments (e.g. drums, triangles), balloons, ribbons
11	Preferred music listening intervention	Listening to preferred music	UC	NA	30 min. 2x a week, total of 6 weeks	Pre-measure (0), post-measure (6)	CD-player, CD
12	MT sessions	1. Welcome song. 2. Listening to music sung or played by therapist. 3. Music activities: singing, dancing, playing an instrument	Participation in general daily recreational activities: handwork, cooking, puzzle games.	NA	40 min., 2x a week, a max. of 34 sessions, in total 4 months.	Pre-measure (0), measures at 4 intervals each day of intervention: 1h before, 1h, 2h, 4h after session	Musical instruments
13	Individual MT sessions	The session included opportunities to vocally/instrumentally improvise, sing, dance, listen to music, or do another activity (walk)	UC which could include a sing-along session as usual	NA	30 min. 2x a week, total of 6 weeks. 1-week washout period, then crossover	Pre-measure (0), mid-point (7), post-measure (14)	Musical instruments

14	Personalized music listening	Individually listening to personalized music playlist	UC	NA	30 min. 3x a week, 3 months	Pre-measure (0), mid-point (4, 8, 12), post-measure (13-16)	Headphones, iPod shuffle
15	Group music with movement intervention	Familiar music played with pleasant moderate rhythm and tempo to move the body and extremities	UC	NA	30 min. (3:00 pm to 3:30 pm) 2x a week, 4 weeks total	Pre-measure (0), midpoint (2), post-measure (4)	CD and CD-player;
16	MT sessions	Familiar songs were selected, sung twice, accompanied by playing an instrument. Those who did not sing held the songbook, listening. In between, patients chatted	UC	NA	30 min, 3x a week, 6 weeks total	Pre-measure (0), post-measure (6), follow up (10)	Guitar, musical instruments
17	Group MT sessions	Structure: greetings, main section, song requests, farewells. Listening to music, requesting songs, guessing song-titles from clues, sing, playing instruments, moving, and discussing	UC	NA	30-45 min 1x a week, for at least 42 weeks within a year	Pre-measure (0), measure at (12,26, 38) post-measure (52)	Musical instruments
18	MT sessions	Listening to different styles of music, calming/slow and arousing. Participation by singing and/or using instruments.	Game about ingredients to prepare a recipe. Cook a different recipe for each session. Roles for cooking: cutting, mixing, cooking	NA	60 min., 2x a week, 4 weeks total.	Pre-measure (-1,0) midpoint (2), post-measure (4) follow up (6, 8).	CD, CD-player; percussion instruments
19	Active MT and listening to music	Interaction with instruments, and singing to facilitate non-verbal communication, expression of emotions	Listen to preferred playlist without any interaction	UC: occupational and physical activities	30 min. 2x a week, 10 weeks total	Pre-measure (0), post-measure (10, 18)	Musical instruments
20	Individualized, passive or active music interventions	Active group: listen to selected music while participating in interactive activities: clapping, singing, dancing	Passive group: listen to the selected music	UC	30 min. 1x a week, 10 weeks total	Pre-measure (-2), post-measure (10), follow up (13), 5 min. before and after every session	CD-player, CD
21	individualized music	Patients listened to their preferred music	MSSE: Patients were offered visual, auditory, tactile and	NA	30 min, 2x a week, total of 16 weeks.	Pre-measure (0), midpoint (8),	Computer

			olfactory stimulation to engage with in a Snoezelen room			post-measure (16).	
22	Individualized music	Patients listened to their preferred music	MMSE: patients were offered visual, auditory, tactile and olfactory stimulation to engage with in a Snoezelen room	NA	30 min. 2x a week, total of 12 weeks.	Pre-measure (0), midpoint (6), post-measure (12). 10 min before, during and after sessions	Computer
23	Relaxing music during meals	Relaxing music (slow tempo, slow, irregular, unpredictable rhythm) was played during lunch time	NA	NA	Every weekday for 4 weeks total during lunch time	Pre-measure (1), each weekday	Recorder and "new age" compact discs
24	Nonverbal MT approach	Through nonverbal behavior and sound-music performances, the use of rhythmical and melodic instruments, emotions and feelings were conveyed	UC: educational and entertainment activities	NA	3 cycles of 10 MT sessions of 30 min., 16 weeks of treatment in total	Pre-measure (0) midpoint (8), post-measure (16), Follow up (20)	Rhythmical and melodic instruments
25	Non-verbal MT treatment	Sound-music improvisation: Through non-verbal behavior and musical instruments patients interact and express feelings and emotions	UC: educational and entertainment activities	NA	3 cycles of 12 MT sessions, 30 min, 3x a week, total of 6 months. 1-month washout period each cycle	Pre-measure (0), post-measure (24) follow up (28)	Musical instruments
26	MT	Song themes were animals, flowers, spring, St. Patrick or the USA with guitar accompaniment to introduce discussion. 1. Introduction song. 2. first topic song, then a discussion, and so on. Each song was sung twice, accompanied by pictures of items named in the song. 3. Goodbye song	Topics for the conversation group were the same. The structured followed the same as the music condition, including pictures and photographs, used to stimulate discussion and reminiscence, but without music	NA	20-30 min, 2 x a week, 2 weeks per condition, 4 weeks total.	Cognition: Pre-measure (0), post-measure (6) Language functioning: pre-measure (-1), midpoint (2), post-measure (4)	Pictures, photographs, guitar
27	Group music intervention	Themes of sessions: 2x Rhythmical music and slow-tempo instrumental activities; 2x singing; 2x listening to specially selected music; 2x	UC	NA	30 min., 2x a week, total of 6 weeks.	Pre-measure (0), midpoint (3), post-measure (6), follow up (10)	Instruments, glockenspiel

		glockenspiel; 2x musical activities and traditional holidays; 2x music creator					
28	Music intervention program	Singing songs, analysis of libretto making musical instruments, playing instruments, song drawing, song writing	UC	NA	50 min. 3x a week, 5 weeks,	Pre-measure (0), post-measure (5)	Material to make instruments, instruments, paper, pen
29	Baroque music intervention	Listening to Baroque music	UC	NA	4 weeks 3pm-7 pm. 2-week washout period (7,8) the other unit crossed over	Pre-measure (1,2), midpoint (3-11), post-measure (12)	CD-player
30	Group MT intervention	Themes of sessions: 2 x musical instrument activity; 2x therapeutic singing; 2x music listening; 2x color sound bell, hand function, attention; 2x music activity, traditional festival; 2x music creators	UC: watching television, afternoon tea, taking walks	NA	30 min, 2x a week, total of 6 weeks	Pre-measure (-1), midpoint (3), post-measure (6), follow up (10)	Instruments, color sound bell
31	Individualized music intervention versus classical "relaxation" music intervention	Listening to preferred music	Listening to classical, relaxation music	NA	30 min, 2x a week, for 6 weeks. 2-week washout period, then crossover	Pre-measure (1-4), Midpoint (washout period), and during sessions	RCA portable audio cassette player; Meditation – classical relaxation vol.3

[1]NA = not applicable

The effects of music coaching

"What are the effects (psychological, cognitive, behavioral) of music coaching for elderly with different stages of dementia?"

With regard to the effectiveness of music coaching for psychological, cognitive and behavioral symptoms of dementia, limited evidence was found (see table 4). The studies were categorized according to the severity of dementia of the patients and the distribution of psychological, cognitive and behavioral effects per dementia severity category were analyzed.

With respect to the psychological effects, it is noteworthy that those aspects were mostly measured during the early and mid-stages of dementia, particularly depression (N=10 studies) and anxiety (N=12 studies). However, concerning depression, the non-significant studies adopted higher quality designs compared to the significant studies. Due this difference in the quality of designs, the studies that did not find any significance are more valued. With respect to anxiety, neither the significant nor the insignificant studies are preferred as both have weaknesses with regard to the quality of designs used, as well as issues, such as lack of a standardized randomization procedure, or the results were not compared with a control group. In conclusion, the results imply depression is difficult to improve by applying music coaching, whereas it is uncertain whether anxiety can be improved through music coaching.

No remarkable findings were found with respect to cognition (N=12 studies). Surprisingly, most studies reporting significant improvement, refer to a part of cognition that improved such as verbal memory, but not general cognition. In terms of quality of the design of the studies, both the significant studies and insignificant studies used similar designs and had similar issues concerning a lack of a control group and a standardized randomization procedure. Therefore, neither the significant nor the insignificant studies are preferred as both have similar strengths and weaknesses. Thus, it remains uncertain whether music coaching interventions are able to improve cognition.

Furthermore, behavioral effects (N=22 studies) were predominantly measured during the later stages of dementia, while the frequency of psychological outcome parameters decreased as dementia progresses further. Interestingly, more studies found significance with regard to behavioral effects at later dementia stages than during early and mid-dementia stages. However, most significant studies were of low quality as opposed to the non-significant studies. Hence, even though measures of behavioral effects become more prevalent and significant during later stages of dementia, considering the quality of studies, preference is given to the non-significant studies. Therefore, it seems that behavior cannot be improved through music coaching interventions such as those used by the included studies.

Active and passive music coaching interventions and their effects

"What are the effects of music coaching for respectively active and passive music coaching regarding elderly with different stages of dementia?"

Active music coaching was used in N=15 studies [1-4, 7, 9, 12, 15, 17, 24-28, 30], while passive music coaching was employed in N=9 studies [5, 6, 11, 14, 21-23, 29, 31] (see table 4). Some studies applied an intervention that was blended, meaning that both active and passive elements were equally as much adopted in the intervention, N=3 [13, 16, 18]. Additionally, N=4 studies conducted two music coaching interventions within their study, of which one intervention included active music coaching, whereas the other intervention included passive music coaching [8, 10, 19, 20]. As these four studies included two different interventions, they were excluded for analysis.

Furthermore, of the N=15 active music coaching interventions, N=11 studies found significant improvements in verbal memory, depression, anxiety, orientation, memory, language, delusions, hallucinations, irritability, agitation, apathy, aberrant motor activity, nighttime behavior disturbances, speech content, speech fluency and deterioration of cognition functions [3, 4, 7, 9, 15, 24-28, 30], while N=4 studies did not find any significant improvements in depression, QoL, anxiety and agitation [1, 2, 12, 17]. However, remarkably, two of four insignificant active music coaching studies had issues with low baseline scores, hence, an attempt to improve low scores is difficult. Additionally, one insignificant study did not use a standardized randomization procedure to allocate patients to groups. Nevertheless, in terms of study design, significant studies were not of the best quality, as quasi-experimental, prospective and pilot designs were used, of which some lacked a control group and did not apply a standardized randomization procedure. Yet, preference is given to the significant studies as they included more sound studies due to encompassing a greater number of studies. In sum, it seems that active music coaching produces overall significant improvements in symptoms of dementia. However, looking more closely at the outcome parameters, active music coaching is not able to improve specific outcome measures such as depression, anxiety and QoL, and it remains uncertain whether agitation and cognition can be improved through active music coaching interventions as both significant and insignificant studies either used low quality designs or had issues, such as lack of a control group.

Moreover, of the N=9 passive music coaching interventions, N=6 studies found significant improvements in anxiety, depression, relaxation, agitation and behavioral disturbances [6, 11, 22, 23, 29, 31], while N=3 studies did not find any significant

improvements in agitation, affect, cognition, behavior, depression, anxiety [5, 14, 21]. Both significant and insignificant studies are similar in terms of designs used and encountered similar issues such as lack of a standardized randomization procedure and control group. Therefore, neither the significant nor the insignificant studies are preferred as both have similar strengths and weaknesses, implying that the effects on symptoms of dementia of passive music coaching remain unclear. In addition to these results, considering the specific outcome parameters, it remains uncertain whether passive music coaching could possibly improve agitation, anxiety, depression, affect/mood and cognition, as both significant and insignificant studies show similar study designs for a specific outcome parameter and similar strengths and weaknesses. Moreover, too little studies measure certain outcome parameters.

Comparing the previous results with regard to active and passive music coaching interventions, it is remarkable that passive music coaching interventions did not report any significant with respect to the cognitive domain, while active music coaching interventions did find significant improvement concerning cognition. However, taking a closer look at the cognition domain previously declared significantly improved by active music coaching, the study designs chosen mostly were of lower quality (one pilot, one prospective, one repeated measures and two quasi-experimental designs, with one RCT) compared to passive music coaching that reported no improvement in cognition (two RCT, one prospective). Additionally, the active music coaching studies reporting significance regarding cognition, exhibited more issues such as lack of a control group and a standardized randomization procedure. Accordingly, preference is given to the non-significant passive music coaching studies in that, regardless of whether a study applies a passive or active music coaching intervention, it seems unlikely music coaching is able to improve cognition.

Additionally, of the N=3 blended music coaching interventions, N=2 found significant improvements in anxiety, agitation disruptiveness, aggressiveness and activity disturbances [13, 16], while N=1 study did not find any significant improvements in emotional state, cognition, agitation and behavior [18]. Notably, the significant studies applied a study design of lower quality than the study that reported no significance, which was a RCT design. Hence, it is thought that blended music coaching interventions do not lead to improvement in cognition, psychological or behavioral symptoms of dementia, also concerning specific outcome parameters such as QoL, emotional state, cognition and agitation. However, it must be noted that the blended music coaching category only consisted of three studies, which is too little to be able to draw strong conclusions.

Comparing the active, passive and blended music coaching, active music coaching is most preferred as the studies indicate that overall, symptoms of dementia could be improved through this type of music coaching. With respect to passive music coaching, more research is necessary as it remains unclear whether passive music coaching could potentially improve symptoms of dementia. Lastly, blended music coaching interventions cannot improve symptoms of dementia.

Next, the distribution of active, passive and blended music coaching interventions per dementia severity category were analyzed. The first category, mild dementia, only comprised active music coaching interventions. Interestingly, blended music coaching interventions were only applied in the moderate/severe dementia category, but as concluded above, blended music coaching does not lead to improvement in symptoms of dementia. The last dementia category which comprises mild, moderate and severe dementia, used passive and active music coaching interventions. All resulted in significantly improved symptoms of dementia, however, it must be noted that the quality of the adopted study designs was low, and involved only one RCT design. These findings are in accordance with the overall conclusion that the results imply there are no differences between applying passive, active or blended music coaching interventions for the different stages of dementia.

Personalized and non-personalized music coaching interventions and their effects

"What are the effects of music coaching for respectively personalized and non-personalized music coaching regarding elderly with different stages of dementia?

Personalized music coaching was employed in N=9 studies [5, 6, 11-14, 20-22] (see table 4). Most personalized music coaching interventions considered the patient's personal music taste to create a playlist, such as their favorite genre, artist, specific songs or related to special memories [5, 6, 11, 12, 14, 20-22]. One personalized study adjusted the intervention level to each individual's capacities [12]. Moreover, one personalized study let the patient's decide what sort of musical activity they wanted to do, for example singing, dancing, vocal/instrumental improvising, listening to music or another activity [13]. Furthermore, non-personalized music coaching was applied in N=20 studies [1-4, 7-10, 15-18, 23-30]. There were N=2 studies that conducted two music interventions of which one intervention was personalized and the other intervention was non-personalized, which were not included in the analysis [19, 31].

Furthermore, of the N=9 personalized music coaching intervention studies, both significant and insignificant studies were similar in terms of study designs and showed similar

issues concerning the lack of applying a standardized randomization procedure. Accordingly, neither the significant nor the insignificant studies are preferred as both have similar weaknesses and study designs of which half are of high quality and half of low quality. This also applies to the specific outcome parameter of agitation, therefore, whether personalized music coaching can improve agitation remains unclear. Furthermore, the significant studies concerning anxiety are slightly preferred due to the quality of designs. However, too little studies measured anxiety to come to a strong conclusion. Moreover, the effectiveness of personalized music coaching interventions with respect to depression, cognition, quality of life and affect/mood/emotional state, remain unclear as too little studies measured the specific outcome parameters.

Contrastingly, most of the N=20 non-personalized music coaching intervention studies reported significant improvement with regard to the psychological, cognitive and behavioral symptoms of dementia. Only a few non-personalized studies reported insignificant improvements. Both significant and insignificant studies used RCT designs, yet, some issues remained such as low baseline scores and a lack of applying a standardized randomization procedure. In addition, other designs involved were of low quality. Yet, preference is given to the significant studies, as they included more sound studies due to encompassing a greater number of studies. Concerning the specific outcome parameters, non-personalized music coaching is not able to improve QoL. Furthermore, mood/emotional state was measured by too little studies to make a statement. It remains unclear whether depression can be improved by non-personalized music coaching. Moreover, regarding anxiety, agitation and cognition, the significant studies are slightly preferred as overall, they are of higher quality, have the majority, and have slightly less issues than the non-significant studies. Therefore, it is thought that non-personalized studies might improve anxiety, agitation and cognition.

In sum, it seems that non-personalized music coaching produces significant improvements in different domains of symptoms of dementia, compared to personalized music coaching. However, personalized music coaching consisted of less studies than non-personalized music coaching.

Subsequently, the distribution of personalized and non-personalized music coaching interventions per dementia severity category were analyzed. Noteworthy is that in the category that comprised mild, moderate and severe dementia, all studies were personalized except for one, and all but one of those studies reported significant improvements. The other study stated significance, but this concerned an increase in agitation instead of a decrease. Nevertheless, most of the significant studies adopted a low-quality design, such as a pilot-controlled trial and

a prospective study design. These findings are in line with the previously mentioned conclusion regarding personalized studies in general, namely that the effectiveness of personalized music coaching interventions remain unclear.

Table 4

Description of the included studies regarding practical details: type of music coaching: personalized music coaching and active music coaching; measures and instruments: mental state, cognition, behavior; findings: mental state, cognition, behavior. Studies were first ordered according to the stage of dementia (mild; mild-moderate; moderate; moderate-severe; severe; mild-moderate-severe). Then, within the stage of dementia category, studies were ordered from personalized interventions to non-personalized interventions to interventions that used both, and lastly, those were ordered according to year of publication. For clarification, the number of the study was added.

	Type of music coaching		Measures and instruments			Findings		
	Personalized music coaching	Active music coaching	Mental state	Cognition	Behavior	Mental state	Cognition	Behavior
1	NA[1]	√ active: singing, playing instruments, movement	Depression: GDS +[1] QoL: DQOL +	NA	NA	NS[3]	NA	NA
2	NA	√ active: singing, playing instruments, movement	Anxiety: RAID +	NA	Agitation: CMAI-SF +	NS	NA	NS
3	NA	√ active: body and voice warm-up, singing	Anxiety: STAI "NA"[4] Depression: GDS "NA" QoL: EQ-5D "NA" –	Neuropsychological performance: battery of neuropsychological tests "NA"	NA	NS	* verbal memory	NA
4	NA	√ active: singing	Depression, anxiety: HADS "NA"	NA	NA	**depression **anxiety	NA	NA
5	√ personalized: musical selection based on favorite artists, songs type of music	NA	NA	NA	Agitation: CMAI +	NA	NA	NS

6	√ personalized: musical selection based on patients' personal taste	NA	Anxiety: Hamilton Scale "NA" Depression: GDS "NA"	Cognition: MMSE "NA"	NA	**anxiety **depression	NS	NA
7	NA	√ active: playing instruments and movement	Anxiety: RAID +	NA	Agitation: CMAI +	** anxiety	NA	NS
8	NA	IG1: √ active: singing IG2: NA	Mood: CBS "NA" QoL: QOL-AD "NA"	Cognition: neuropsychological battery "NA"	NA	IG1 and IG2 **mood, **QoL	IG1 and IG2 *cognition, *attention, *executive function, **orientation level; IG1 **short-term working memory, **working memory performance	NA
9	NA	√ active: singing, moving, playing instruments	Anxiety, depression: HADS "NA"	Cognition: MMSE "NA"	Behavior: NPI "NA"	**anxiety **depression	**orientation, **memory, *language	*delusions, *hallucinations, *irritability, **agitation
10	NA	IG1: √ active: singing, playing instruments, movement IG2: NA	Anxiety: RAID (Chinese) + Depression: GDS +	Cognitive function: MMSE + Short-term Memory: FOME + Verbal fluency: MVFT + Attention and immediate recall: DST of WAIS "NA"	NA	IG1 and IG2 *anxiety; IG1 *depression	IG1 and IG2 *delayed memory. IG1 *verbal fluency	NA
11	√ personalized: musical selection based on patient's personal taste	NA	Anxiety: RAID +	NA	NA	**anxiety	NA	NA

12	√ personalized: level of each session was adjusted to each individual's capacities	√ active: playing instruments, singing, dancing	NA	NA	Agitation: CMAI +	NA	NA	NS
13	√ personalized: a patient could choose to improvise, sing, dance, listen to music or another activity	Blended	QoL: ADRQL +	NA	Agitation: CMAI nursing home form +	NS	NA	*agitation disruptiveness
14	√ personalized: musical selection based on patient's personal taste	NA	Affect: POMS-B "NA"	Cognition: MMSE "NA"	Behavior: CMAI "NA"	NS	NS	NS
15	NA	√ active: moving body/extremities to familiar music	NA	NA	Agitation: modified CMAI +	NA	NA	**agitation
16	NA	Blended	BPSD: BEHAVE-AD "NA"	NA	BPSD: BEHAVE-AD "NA"	**anxiety	NA	*activity disturbances, **aggressiveness
17	NA	√ active: singing, playing instruments, moving to music, guessing songs	NA	NA	Agitation: CMAI-long form +	NA	NA	NS
18	NA	Blended	Emotional state (discourse content, EFE, mood): interview "NA", Ekman's criteria "NA", STAI-A "NA"	General cognitive abilities: SIB "NA"	Agitation: CMAI "NA" Behavioral disorders: NPI "NA"	NS	NS	NS
19	IG1: NA IG2: √ personalized: musical selection	IG1: √ active: playing instruments IG2: NA	QoL: CBS-QoL "NA" Depression: CSDD "NA"	NA	Behavior: NPI "NA"	NS	NA	NS

	based on patient's personal taste							
20	IG1 and IG2: √ personalized: musical selection based on patient's personal taste	IG1:√ active: singing, dancing. IG2: NA	Emotional state: Faces Scale "NA" BPSD: BEHAVE-AD "NA"	NA	BPSD: BEHAVE-AD "NA"	IG1 and IG2 **relaxation, **pleasant emotional states, *anxiety	NA	IG1 and IG2 *affective disturbance; Only IG1 *paranoia, *delusion, *aggressiveness and *activity disturbances
21	√ personalized: musical selection based on patient's personal taste	NA	Depression: CSDD + Anxiety: RAID +	Cognition: MMSE +	Agitation: CMAI +	NS	NS	NS
22	√ personalized: musical selection based on patient's personal taste	NA	Mood: Interact scale short +	NA	Behavior: interact scale short +	NS	NA	IG1 **relaxation
23	NA	NA	NA	NA	Agitation: CMAI +	NA	NA	**general agitation
24	NA	√ active: playing instruments	BPSD: NPI "NA"	Cognition: MMSE "NA"	BPSD: NPI "NA"	**anxiety	NS	*delusions, **agitation, *apathy, **irritability, **aberrant motor activity, **nighttime behavior disturbances
25	NA	√ active: playing instruments	BPSD: NPI "NA"	NA	BPSD: NPI "NA"	NS	NA	**disturbances, **delusions, **agitation, **apathy
26	NA	√ active: singing	NA	Language functioning: WAB "NA"	NA	NA	**speech content **speech fluency	NA

				Cognitive functioning: MMSE "NA"				
27	NA	√ active: singing, musical activities	NA	NA	Agitation: Chinese version – CMAI +	NA	NA	**agitation
28	NA	√ active: playing instruments, singing	Depression: GDS + QoL: GQoL "NA" BPSD: NPI-Q "NA"	Cognition: MMSE "NA"	BPSD: NPI-Q "NA"	NS	NS	*agitation
29	NA	NA	NA	NA	Behavioral disturbances: behavior chart "NA"	NA	NA	**increased behavioral disturbances
30	NA	√ active: playing instruments; singing	Depression: Chinese version – CSDD +	Cognition: MMSE +	NA	**depression	**delay in deterioration of cognition functions	NA
31	CG1: √ personalized: musical selection based on patient's personal taste. IG2: NA	NA	NA	NA	Agitation: modified CMAI +	NA	NA	IG1 **frequency of agitation

[1]NA = not applicable
[2]an instrument of high reliability was labelled as "+".
[3] NS = not significant
[4] "NA" = quality of instrument was not mentioned in the study
* = p= <0.05
** = p <0.01

Discussion

The aim of the study was to identify the current literature on music coaching for people with different stages of dementia that target cognitive, psychological and /or behavioral symptoms, and/or enhance quality of life. With regard to the research question "what existing music coaching interventions are currently applied for elderly with different stages of dementia" the following predominantly applied elements were identified: "listening to music", "singing", "playing instruments", "movement", "musical activities", "interaction" and "warm-up". The findings indicate that active elements, which require active participation of the body (warm-up, movement), were applied more often during the beginning stages of dementia, and while dementia progresses to later stages, other active elements (singing, playing instruments, musical activities, interaction) were used in addition to the passive element of listening to music. Furthermore, concerning the research question "What are the effects (cognitive, psychological, behavioral) of music coaching for elderly with different stages of dementia" it was found that the ability of music coaching interventions to improve psychological, behavioral and cognitive symptoms of dementia in general, is meager. There is limited evidence for anxiety and cognition, while depression and agitation seem to remain unimproved through music coaching. Moreover, with respect to the research question "What are the effects of music coching for respectively active and passive music coaching regarding elderly with different stages of dementia" results indicated that, contrasting to blended and passive music coaching, active music coaching interventions result in significant improvements in general regarding psychological and behavioral symptoms of dementia, but not for cognitive symptoms or specific outcome parameters, such as attention. Additionally, with reference to the different stages of dementia, the results imply overall that there are no differences in effectiveness between applying passive, active or blended music coaching interventions. Furthermore, with regard to the research question "What are the effects of music coaching for respectively personalized and non-personalized music coaching regarding elderly with different stages of dementia", the results imply that overall, non-personalized music coaching should be first choice for interventions, rather than personalized music coaching interventions. However, both interventions present mixed evidence concerning their effectiveness in improving symptoms for different stages of dementia.

The finding that active music coaching elements are more applied during early dementia stages rather than the later dementia stages is in line with previous studies that confirm dementia is a process of gradual deterioration (Volicer, 1987; Wang, Larson, Bowen, & van Belle, 2006; Zidan, 2012), meaning that symptoms, including motor activity, worsen as dementia

progresses. Therefore, motor function decline becomes more apparent during the later stages of dementia. Hence, it is plausible that the active elements of music coaching that require active participation of the body are employed mostly during the early stages, rather than the later stages, of dementia. Moreover, the uncertainty of the findings is in line with previous studies. This uncertainty of the findings is demonstrated through comparing the results of studies, as some obtained significant improvement in symptoms of dementia, while others reported insignificant improvement. For example, Pongan et al. (2017) found no significant improvement regarding the outcome parameter of anxiety, while Cheung, Lai, Wong and Leung (2018) attained significant improvement with respect to anxiety. In addition, the findings are in accordance with previous studies. For example, Ebberts (1994), Rio, 2002, and Pollack and Namazi (1992) reported group music interventions to be preferred over individual interventions, due to the effectiveness in providing interaction and feelings of belonging for patients with dementia. The only passive element, "listening to music", is often done individually, whereas active elements are often performed in group form, such as "singing", "playing instruments", or "musical activities". Hence, it is thought that the active music coaching, provided in group form, derives its effectiveness also from the finding that interaction and feelings of belonging are improved in patients as well, while this is not the case for patients that were assigned to passive music coaching, in individual form. Lastly, these findings are contradicting to previous research, as Dileo and Bradt (2005), Gerdner (1997; 1999) and Sung and Chang (2005) reported in their studies that personal music preferences of patients is what makes music interventions most effective. The explanation for this finding is that musical memory is persevered even in the severe stages of dementia, but this applies only to music familiar to the specific person (Gerdner, 1997). Hence, music that is familiar to a person, they claim, will be more effective in activating and potentially elicit certain brain areas such as verbal language and memory. An alternative explanation for the findings is that in the current study, too little personalized studies were included and, moreover, studies with low quality designs were involved, both making it complicated to draw any strong conclusions regarding the effectiveness of music interventions in general and for specific outcome parameters.

Limitations and strengths of the study

A limitation of the current study is that only one database was used for the selection of studies, thus the study missed out on about 25% of the available studies. Nevertheless, the study included 31 studies in total, which is quite a number of studies.

Another limitation is that some studies did not report the quality of an instrument for an

outcome measure, making it more difficult to assess the quality of the findings and the study itself.

One major drawback of the current study is the quality of the studies. Often, studies lack a control group and a standardized randomization procedure, thereby influencing the results as groups may have significant differences in outcome measures of interest, or the results cannot be compared to a group that did not get the intervention, allowing for potential intervening third variables. A source of intervening third variables stems from the diagnosis of patients with dementia. Most studies group patients with different stages of dementia together, or do not define the particular stage of dementia. This can potentially distort the results, as the severity of the symptoms of dementia differ between stages, for example, it is thought that agitation worsens as people progress through dementia stages.

On another note, the current study had strengths as well. This is the first study to provide an overview of the applicability of music coaching interventions focused on different stages of dementia. Additionally, one of the goals was to add to the knowledge of dementia care, which is achieved through the type of study conducted, as it provides rich information with regard to dementia and music coaching. Lastly, the study selected relatively speaking, many studies for the analysis. This ensured that the different stages of dementia would all be covered, as the aim was to differentiate between those stages.

Recommendation for future research

It is recommended to conduct more in-depth research with higher quality study designs, more specifically, a RCT design is advised. Moreover, the studies should include a waiting list control group and apply a standardized randomization procedure, to ensure a high-quality design and exclude the possibility of alternative explanations for the significant or insignificant findings. In addition, it would be important to carefully screen participants for the specific stage of dementia as well as an actual diagnosis of the outcome parameter(s) of interest. Currently, some of the included studies involved low-quality designs and due to the aforementioned weaknesses, it was complicated to draw any (strong) conclusions at times. Perhaps, stronger conclusions can be drawn with regard to the effectiveness of music coaching interventions in general, and more specifically the effects of personalized, non-personalized, active, passive and blended music coaching interventions. Additionally, it is of importance to conduct more research with respect to specific outcome parameters such as anxiety, cognition or agitation. As of yet, no (strong) conclusions could be drawn as too little studies were included that measured a specific outcome

parameter. This may provide clarity regarding what form of music coaching is effective for a specific symptom of dementia.

Practical implications and consequences for new research

Overall, it is encouraged that research into the effectiveness of music coaching interventions in reducing psychological, cognitive, and behavioral symptoms of dementia, is continued. As more people are diagnosed with dementia now and in the future, the costs of providing care for people with dementia becomes a more important topic. Music coaching interventions, as well as other non-pharmacological interventions, are significantly of lower cost than pharmacological interventions. Currently, evidence is limited regarding the effectiveness of music coaching interventions in reducing psychological, cognitive and behavioral symptoms of dementia. Therefore, music coaching interventions need more research before implementing it to reduce particular symptoms of dementia. Specifically, it would be of interest to conduct more research into personalized music coaching interventions. The current study included too little studies regarding personalized music coaching, but as Dileo and Bradt (2005), Gerdner (1997;1999) and Sung and Chang (2005) claim, a personalized approach to music coaching is what makes it effective. A challenge to this user-centred approach is the possibility of low involvement of users. Researchers have to rely on family members or caregivers to provide them with musical preferences of patients with dementia, which potentially may not be fully accurate. Additionally, privacy could be an issue, as not everyone is inclined to share personal information necessary to personalize the intervention. Nevertheless, there may be other arguments why music coaching interventions may be of interest to provide to people with dementia. For example, Gerdner (2000) provided anecdotal notes in addition to quantitative data regarding user experience, whereby they mentioned the joy experienced by a patient. In addition, Maseda et al. (2018) reported that patients enjoyed themselves, were less bored and more content during the interventions. Moreover, Särkämö et al. (2014) asserted that quality of life of caregivers improved significantly, as well as the emotional wellbeing of the family members. Hence, it may be of interest to implement music coaching interventions to improve wellbeing of people with dementia, caregivers and family members.

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