



## Effects of dance activities on patients with chronic pathologies: scoping review



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### ABSTRACT

**Introduction:** Physical inactivity often accompanies chronic pathologies. This induces a sedentariness that favors complications and patient isolation. There is a growing scientific interest in the practice of art, for such activities leave the usual healthcare framework and include the World Health Organization (WHO)'s three dimensions of health. Dance is a universal activity that has been identified as healthy. This scoping review's aim is to study the benefits, modalities and risks of dance for persons with a chronic pathology.

**Method:** The literature research was conducted in English and French, using PubMed and Kinedoc's databases, and keywords related to dance and chronic pathologies. Dance activities that did not involve a dance instructor or a trained health professional were excluded. Studies' location and design, the chosen type of dance, pathologies, the number of subjects, modalities, intended effects and adverse effects were then studied.

**Results:** 51 studies were included in this work. 47.5% were RCTs and 47% originate from North America. The number of published studies is strongly increasing. Sixteen different pathologies were studied, with a large predominance of neurology diseases. Targeted effects were the impacts on mental health, quality of life, physical and motor capacities and pathology-specific symptoms. Dance activities are deemed feasible, and no adverse effects were identified.

**Discussion:** In the event of chronic pathologies, practicing dance is possible; it is stimulating and effective against sedentariness and its adverse effects. Patient adherence is good, and dance seems to respond to the multidimensional component of chronic diseases, while offering unlimited adaptation to patients' physical and cognitive impairments. There are few studies yet, and their methodological quality is moderate, which is why further research work must confirm dance's interest regarding chronic pathologies.

### 1. Introduction

There is a growing interest in the practice of art as a means of helping patients, for such activities leave the usual healthcare framework and effectively include physical, mental and social well-being – which are the three key dimensions of health as described by the World Health Organization (WHO) [1]. Indeed, singing shows improvements in relaxation, breathing, posture, social interaction and emotional strain [2]. However, music shows limited physical effects, which is why some authors studied circus and dance – which involve balance, endurance, mobility, muscular strength and coordination [3, 4].

Patient motivation is very much related to the way they feel about the activity, as well as to how they self-assess their level. Motivation is instrumental to successfully fighting sedentariness [6]. A survey identified 6 categories of benefits perceived by dancers: emotional benefits

(e.g.: better mood, joy, feeling calmer), physical benefits (e.g.: fitness, balance, body awareness, less pain, less tensions), self-esteem (e.g.: self-confidence, creativity), social benefits (e.g.: new acquaintances, better communication), coping strategy (e.g.: soothes the mind, helps to fight stress) and spiritual benefits (e.g.: food for the soul) [5]. Perceiving these positive effects induces an inner drive that stimulates patient adherence to dance, especially patients with motor impairments [7].

According to the WHO, chronic pathologies are the leading cause of death in the world [8]. Due to the negative evolution of many environmental, social and lifestyle-related factors, chronic pathologies are increasing [9]. They are usually associated with cognitive (e.g.: attention, memory) and physical disorders (e.g.: motor deficits) that reduce social interactions and social inclusion [10].

Overcoming sedentariness is essential to managing chronic pathologies (in primary prevention in order to limit risk factors, but also in

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tertiary prevention [11, 12]). Patients showing chronic pathologies with motor impairments are little aware of the complication and isolation risks related to sedentariness [13]. However, when the rehabilitation is over, the diminishing motor stimulation gradually limits autonomy in daily tasks. The factors of sedentariness are mainly motor impairments, fatigue, cognitive disorders and lack of motivation [13]. Moreover, it is often difficult to continue the treatment because of the patients' decreasing adherence and increasing weariness of treatment. Thus, it is interesting for health professionals to guide the patients towards non-therapeutic physical activities that foster social interaction and well-being in order to tackle sedentariness.

In 1987, Van Deusen et al. published a first study on using dance on patients [14]. Their aim was to find an activity that favors physical exercise adherence of patients who suffer from rheumatoid arthritis, in order to maintain physical activity and improve mobility. Results showed good patient adherence and satisfaction, as well as improved mobility of upper limbs. The benefits of dance have been confirmed for Parkinson's disease, especially since music is an external reference point that facilitates movement, and that repeated tasks foster balance, flexibility and endurance [15, 16]. These studies have highlighted the accessible, social and attractive aspect of dance, associated with quantifiable benefits on physical abilities [14, 15, 16]. Parkinson's disease was the most studied pathology [16]; dance has been tested with other pathologies, but no syntheses of these studies were made. Yet the scoping review is a relatively new approach that offers an overview based on a rigorous methodology for a broad research question [17].

This scoping review's aim is to study the benefits, modalities and adverse effects of dance for patients/persons with a chronic pathology. Its hypothesis is that dance offers many benefits, is very adaptable and fosters patient adherence while presenting very limited risk.

## 2. Materials and methods

This scoping review is based on recommendations from the Joanna Briggs Institute (JBI) – using five steps [18] – recently supported by PRISMA [19].

### 2.1. Step 1: Identifying the research question

The intention was to study scientific data on dance in order to answer the following overall question: what is the current state of scientific knowledge on the effects of dance on chronic pathologies? Following the initial research, several sub-questions were identified:

- Which chronic pathologies have been studied in their relation to dance?
- What are the characteristics of these studies (location, design, type of dance)?
- Is dance well adapted to patients, and what are the risks (adverse effects)?
- What are the studied parameters (e.g. motor and cognitive skills, quality of life, fitness) and effects?

### 2.2. Step 2: Identifying the relevant studies

#### 2.2.1. Eligibility criteria

**2.2.1.1. Inclusion criteria.** No geographic restrictions were imposed, but articles had to be written in English or French. The clinical studies had to assess the effectiveness of a dance program on chronic pathologies. All types of dance were included, but sessions had to be delivered by a dance teacher or a therapist. This scoping review was not limited to randomized controlled trials in order to answer the question in a thorough and broad manner.

**2.2.1.2. Exclusion criteria.** All articles on dance-related pathologies were excluded, as well as studies on understanding dance as movement. Articles aimed at sensitizing healthy individuals were not included; neither were studies on dance that did not include feedback from a therapist or dance instructor (e.g.: dance video games using motion sensors). Finally, literature reviews, meta-analyses, protocols and authors' points of view were also not included.

#### 2.2.2. Databases and keywords

The literature research was conducted between October 15<sup>th</sup> and December 15<sup>th</sup>, 2018 on PubMed/Medline and Kinedoc databases. Articles were initially searched using the keyword: "dance". After this first step, this word was associated – using Boolean operators "AND" and "OR" – with keywords "balance", "gait", "motor", "cognitive", "quality of life", "adherence", "risk", "chronic", "obesity", "cardiac", "diabetes", "parkinson", "stroke", "spinal cord injury", "multiple sclerosis", "cerebral palsy", "low back pain", "alzheimer", "arthritis rheumatoid", "cancer", "fibromyalgia", "mental retardation", "fall", "older", "elderly", "middle-age" and "schizophrenia".

### 2.3. Step 3: study selection

The first selection was made using the following additional filters: "clinical trial" and "human". Then, a second selection was made from reading the titles and abstracts to assess if the content seemed to fit the inclusion criteria. Full text availability and criteria were verified before considering including the articles. The detailed research method was presented according to the PRISMA flow diagram.

### 2.4. Step 4: data extraction

The complete reading of articles allowed to extract data on: authors, years of publication, study locations, aims, designs, participants' characteristics, types of dance, duration of interventions and main results.

### 2.5. Step 5: Collating, summarizing and reporting the results

Methods used in the protocol allowed to collate and summarize existing data, then graphically represent it to identify:

- The different chronic pathologies targeted by the dance program;
- The evolution of the number of publications;
- The parameters studied by the authors.

Tables were made to summarize the studies' characteristics and results regarding the benefits of dance for each pathology.

## 3. Results

### 3.1. Article selection

The flow diagram (Fig. 1) presents the results for each step. The literature research identified 2,320 articles on PubMed/Medline and 60 articles on Kinedoc. Removing duplicates decreased the number of articles to 352. After reading the title, abstract and full text, 51 studies were included in the final step.

### 3.2. Study characteristics

#### 3.2.1. Geographic location

The studies were from 18 different countries, on all continents. North America (47.05%) was the first continent followed by Europe (29.41%) (Table 1). Only one study came from Africa (Nigeria) [20], and one from Oceania (Australia) [21].

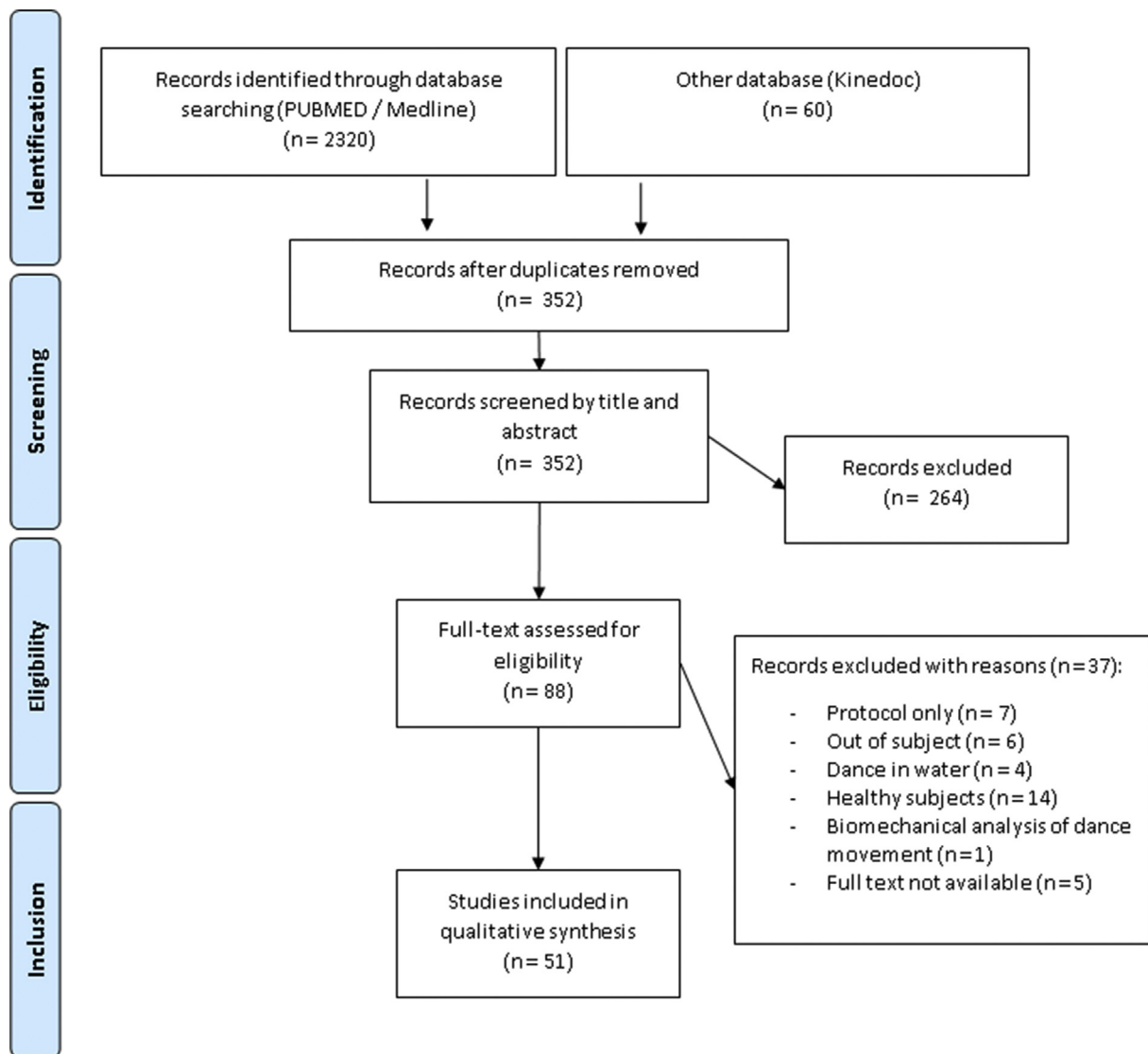


Fig. 1. Scoping review flow chart.

### 3.2.2. Study design

24 studies were randomized controlled trials (RCTs), 14 were case studies, 12 were controlled studies and 1 was quasi-RCT (Table 1).

### 3.2.3. Year of publication

The first 1950s studies that were associated with dance aimed at understanding the pathologies that are consubstantial with intensive practice. Then, around 1980, the number of publications associated with the keyword “dance” rose sharply (Fig. 2). The oldest study on the benefits of dance is from 1987, before an increase of such work was observed around 2008 (Fig. 2).

### 3.2.4. Type of dance

The following types of dance were tested with patients: classical dance (N = 3), contemporary dance (N = 6), ballroom dance (N = 19), traditional dance (N = 8), dance fitness (N = 3), mixed various dances (N = 3) and dance therapy (N = 9) (Table 1).

### 3.2.5. Target population

2,545 participants with a chronic pathology participated in the dance programs, including all ages from 7 to 89.

### 3.3. Key results by pathology

#### 3.3.1. Parkinson's disease

Sixteen studies [22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37] on 584 subjects (age: 48 to 89) were conducted. Ballroom dance was first (N = 12). Mean duration of interventions was 19 weeks (2 weeks – 2 years) with a frequency of 1–3 sessions a week. Good adherence was observed, with no adverse effects. Positive effects are visible on mental health, social relationship, cognition, balance and motor capacities. Results on Parkinson's symptoms are less clear.

#### 3.3.2. Hemiparesis after a stroke

A study on 20 subjects (mean age:  $62 \pm 10$ ) showed the feasibility of a dance program, an improvement in balance, but no effect on walking after 10 weeks of various dance types, once a week [3].

#### 3.3.3. Multiple sclerosis

After 4 weeks of ballroom dance once a week, a study on 8 subjects (age: 32 to 63) showed improvements in balance, walking and physical activity, with no adverse effects on fatigue [38].

#### 3.3.4. Spinal cord injury

A study on 1 subject showed the feasibility of a dance program, using

**Table 1**  
 Geography, method and dance type information of included studies. The proportion is indicated by the percentage and the number of studies in brackets.

Item	Characteristics	Percentage
Localisation	Asia	11.76% (6/51)
	Europa	29.41% (15/51)
	Africa	1.97% (1/51)
	North America	47.05% (24/51)
	South America	7.84% (4/51)
	Australia-Oceania	1.97% (1/51)
Method	Case study	27.46% (14/51)
	Control study	23.53% (12/51)
	Quasi-Randomized Controlled Trial	1.97% (1/51)
	Randomized Controlled Trial	47.05% (24/51)
	Ballet dance	5.88% (3/51)
Dance type	Contemporary dance	11.76% (6/51)
	Ballroom dance	37.25% (19/51)
	Traditional dance	15.69% (8/51)
	Fitness dance	5.88% (3/51)
	Danse therapy	17.66% (9/51)
	Various dance	5.88% (3/51)

two different types of wheelchairs [39].

**3.3.5. Cerebral palsy**

Five studies observed overall satisfaction of 56 children during dance lessons [40, 41, 42, 43, 44]. Either classical dance (N = 3) or contemporary dance (N = 2) was tested for a mean duration of 9 weeks (4–16). Improvements in balance, motor skills, cognition and symptoms were observed. One study showed no effects on upper limbs [42].

**3.3.6. Falls among aging people**

After 12 weeks, ballroom dance improves walking speed and balance for 589 subjects at risks of falling, while the effect on the risk of falls seems limited [21, 45].

**3.3.7. Schizophrenia**

Two RCTs [46, 47] conducted on 85 subjects (mean age: 51.8 years old) observed, after 8 weeks and 8 months, an improvement in balance, walking, muscular strength, quality of life and body mass index, while endurance does not seem to be modified.

**3.3.8. Mental retardation**

For 10 subjects (mean age: 18.1 ± 2), traditional Greek dance improves balance after 16 weeks, 3 times a week [48].

**3.3.9. Fibromyalgia**

Two studies evaluated 139 subjects (age: 16 to 65) [49,50]. After 12 weeks, no adverse effects were observed, but a decrease in pain and improvements in walking, mental health and quality of life were observed.

**3.3.10. Cancer**

Couple dance (patient and partner) or individual dance were tested with 616 subjects [51, 52, 53, 54, 55, 56, 57], either using dance therapy (N = 4), ballroom dance (N = 2) or contemporary dance (N = 1). Durations varied from 3 weeks to 1 year. A decrease in stress, pain, fatigue and depression was observed, as well as an improvement in functional activities. One study found little benefits, but it was conducted over the course of 3 weeks [55].

**3.3.11. Rheumatoid arthritis**

The three studies, comprising 78 subjects, tested dance over a period of 8–16 weeks [14, 58, 59]. Adherence was good, with no adverse effects; there were positive effects on aerobic capacity, walking, depression and fatigue.

**3.3.12. Alzheimer's disease**

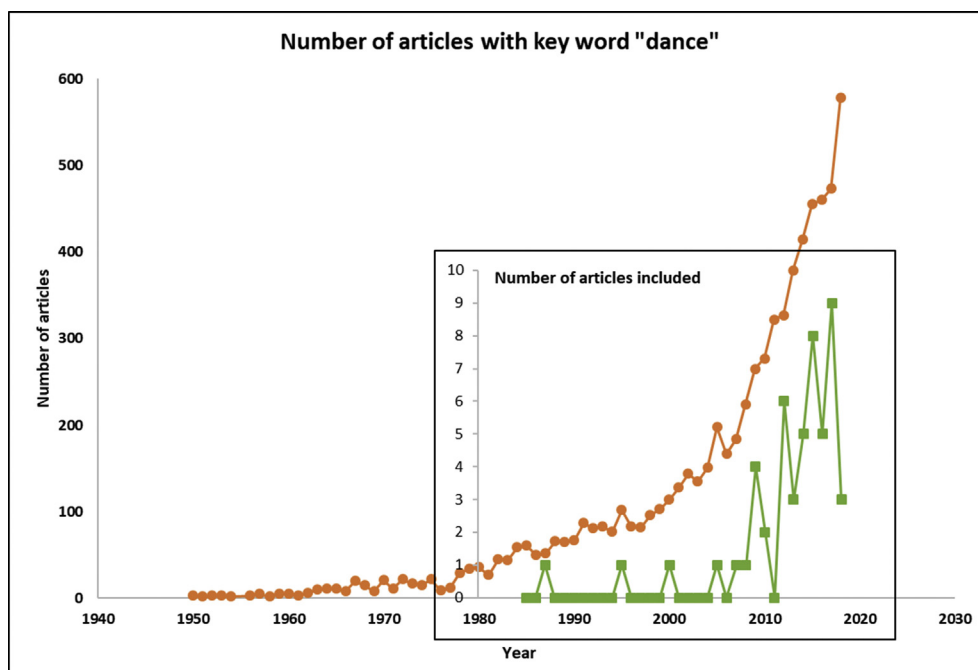
One study on an 84-year-old patient showed improvements in mobility, balance and functionality after 12 weeks of Salsa, twice a week [60].

**3.3.13. Lumbago**

Belly dance once a week for 6 weeks eased pain and improved functional mobility and work activities for 2 participants [61].

**3.3.14. Cardiac pathologies**

Heart failure [62, 63, 64] and high blood pressure [20] were evaluated for 171 subjects. No adverse event was observed over periods of 4 weeks–8 months. Dance improved VO<sub>2</sub> max (the maximum rate of oxygen consumption during an incremental exercise), walking, strength,



**Fig. 2.** Number of articles with keyword « dance » (in orange). In green, included studies by year of publication.

jumping, balance, quality of life and motivation, while cardiac frequency was only modified after 8 weeks [62].

### 3.3.15. Obesity and diabetes

A study on 95 obese subjects showed an improvement in quality of life and self-esteem [65]. Dance fitness, for 28 overweight subjects with diabetes, reduced weight and improved physical condition and motivation [66]. For 61 overweight children, dance reduced the body mass index after 16 weeks [67].

## 3.4. Results synthesis

Fig. 3 shows all categories of outcomes used in the studies on dance as a rehabilitation approach for chronic pathologies (Fig. 3). The most studied parameters are motor capacities and balance, followed by pathology-specific symptoms. Risks and adverse effects were not systematically taken into account in the studies.

The effects of dance were studied for 16 different pathologies; more than 50% of studies concern neurology (Fig. 4).

Tables 2 and 3 show results observed for each parameter studied during a dance program (Tables 2 and 3). A vast majority of studies show positive effects of dance on patients/persons with chronic diseases.

## 3.5. The limits of dance

For many pathologies, a pilot study tested the feasibility of dance with patients and included an assessment of adverse effects [3, 22, 23, 38, 44, 58, 62]. Studies showed good feasibility and no adverse effects with ballroom dance [22, 38], traditional dance [23, 62], dance therapy [58], mixed various dances [3], and classical dance [44].

## 4. Discussion

### 4.1. Principal findings

This scoping review showed the growing interest in dance as a rehabilitation approach for chronic pathologies. Benefits in terms of physical, mental and social well-being were identified in 51 articles. No adverse effect was reported, and patient adherence seems excellent.

These positive effects of dance were observed for different ages and chronic pathologies, including neuromusculoskeletal, psychiatric, cardiovascular, metabolic and oncological pathologies. However, the number of studies is low and they are often of moderate methodological quality; hence these results will have to be confirmed by better work, which should include more subjects with the same pathology.

### 4.2. Dance, a practice that is suitable for chronic diseases

Dance seems to develop cognitive and physical abilities as well as quality of life, all the while fostering well-being and social interaction [5], while chronic pathologies disrupt all of these aspects [10, 13]. This artistic physical activity is thus particularly suitable for the multidimensional component of chronic pathologies. Moreover, joy [44], satisfaction [57] and the benefits – which are genuinely perceived by participants [5] – increase intrinsic motivation, which fosters patient adherence. Unlimited adaptability of dance makes it an easy practice, for it can cover very broad motor and cognitive aspects. All these elements may explain the success of dance programs applied to patients with chronic diseases.

### 4.3. Adherence

One recent literature review showed that dance induces greater adherence than guided exercises, while having undeniable success [6]. The results of this scoping review highlight that, for patients suffering from chronic pathologies, dance increases participation, motivation and adherence. Health professionals must consider these elements when advising physical activity, for tackling sedentariness requires a context that is favorable to lasting patient engagement. Indeed, with chronic diseases, patients who have an active lifestyle decrease the motor and cognitive consequences of their pathology, and the risk of complications such as lower quality of life, increased fatigue, loss of autonomy, depression and gradual isolation [11, 12, 13].

However, too many patients remain inactive when they fall ill. Hence, after a stroke, patients are inactive for 5–12.5 hours a day (excluding sleeping time). The reasons given are lack of motivation and cognitive-motor disorders resulting from the pathology [13]. In oncology, main obstacles to activity include fatigue, pain, low self-esteem and family and

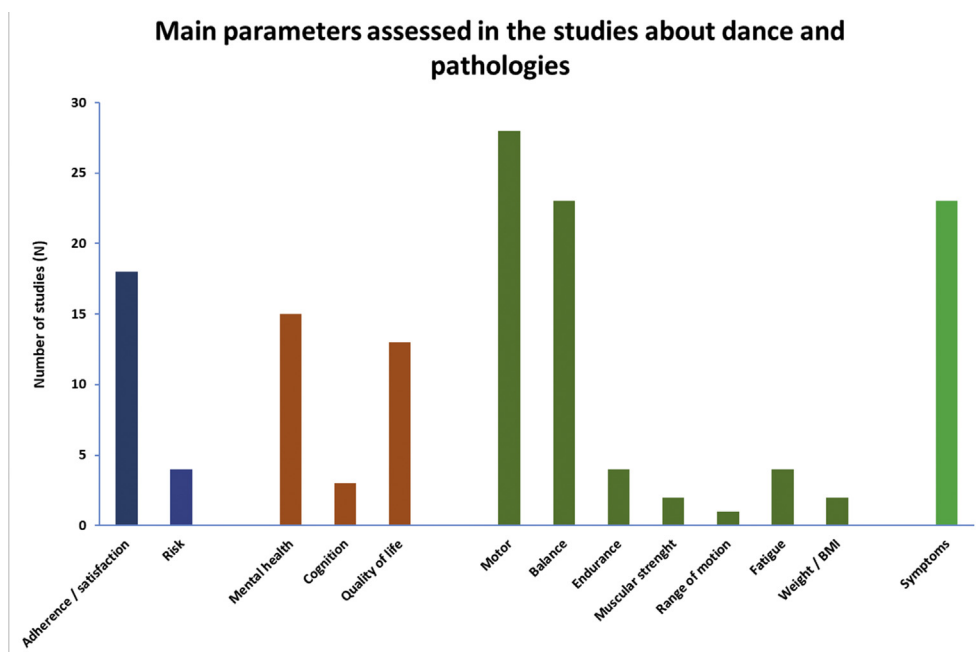


Fig. 3. Main parameters assessed in the studies about dance and chronic diseases.

## Distribution of studies about dance program and chronic pathologies

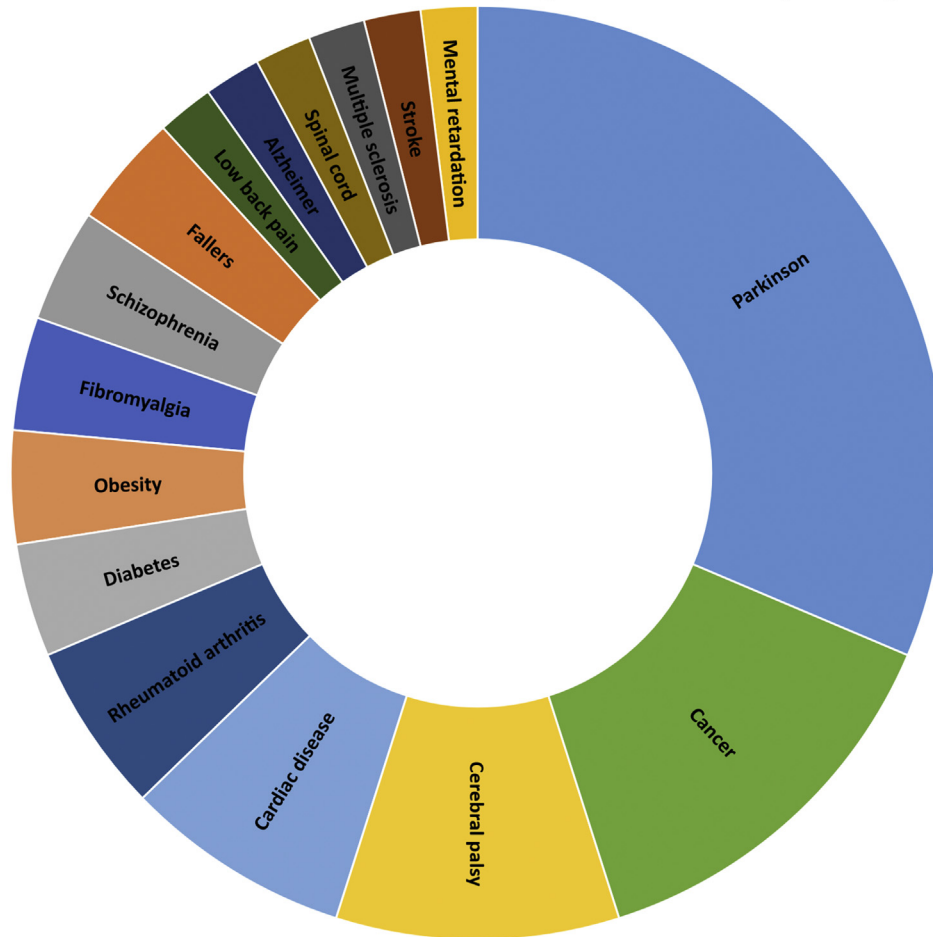


Fig. 4. Distribution of articles about dance program and pathologies.

professional constraints [68]. Yet dance increases motivation, decreases fatigue and pain [54, 56], and can be practiced with family members, with positive effects on them too [53]. Besides, well-being, self-esteem and physical abilities are improved – factors that are believed to foster physical exercise and adherence [68].

Dance seems like a suitable physical activity; it is stimulating and has perceived benefits that strengthen the will to participate, which in turn enhances adherence and helps fight sedentariness. Moreover, all types of dance seem to have positive effects. Patients can therefore be offered a wide selection of dance activities according to their preferences.

#### 4.4. Beneficial effects of dance

In cases of chronic pathologies, this scoping review shows that dance may induce physical and motor but also cognitive benefits for patients. However, only systematic reviews and meta-analyses allow to establish the real benefits of an intervention. Two systematic reviews have observed the positive impact of dance on physical and motor parameters of healthy aging people [69, 70], while no review has focused on children. Regarding Parkinson's disease, 2 reviews showed improvements in symptoms and speed of the Timed Up and Go test when compared to other exercises, as well as improved motor scores when the object of the comparison is the absence of intervention [16, 71]. Tango may also positively impact participation and quality of life [71]. Only the review on Tango targeted balance as a parameter, while 7 studies on other types of dance also studied it – of which 6 out of 7 showed positive effects. Regarding fibromyalgia, a review included 7 articles [72], while this

scoping review only points to 2 accessible articles. Dance seems to be appropriate for such patients, for it improves symptoms, as well as motor functions and quality of life. Regarding other pathologies, the number of studies is low, and reviews are nonexistent. The observed positive effects will thus need to be confirmed by new research. The motor function, balance and symptoms are the most studied factors in their relation to dance, while there seems to be a particularly positive impact on strength, flexibility and agility [69].

#### 4.5. Modalities of dance practice

The modalities of dance activities vary widely, from 1 to 5 sessions a week (mean: 2.5), but some authors did not include this parameter. As with healthy aging subjects [70], positive results can be observed with 1 session a week. According to Fong and al., minimum duration for a positive impact is 4 weeks [6]. We observed that the duration of the study that was the least successful with pathologies was 3 weeks.

#### 4.6. Adverse effects related to dance practice

Dance shows good feasibility and no adverse effects were detected in the studies, regardless of the type of dance [3, 22, 23, 38, 44, 58, 62]. Safety may be linked to dance's superior adaptability compared with other sport activities [6], and also to the self-regulation of movements by patients. Indeed, even if all movements are structured, patients are free regarding their self-imposed constraints (amplitude, muscular strength, imbalance...). Thus, they are in a situation of self-control regarding their

**Table 2**

Synthesis of main effects studied and main results for neurological pathologies. The « N » corresponds to the number of studies. In the results part, the figure corresponds to the number of studies according with the beneficial effects or absence of effects.

Pathologies	Parameters	Results (number of studies)	
		Beneficial effect	No effect
Parkinson (N=16)	Adherence/satisfaction	4	0
	Adverse effect	0	1
	Mental health (depression)	4	0
	Psycho-social aspects	1	0
	Cognition	2	0
	Quality of life	2	1
	Balance	12	1
	Gait and/or functional mobility	8	2
	Endurance	1	0
	Fatigue	1	0
	Spatio-temporal parameters of movement	2	0
	Symptoms	5	2
	Stroke (N=1)	Adherence/satisfaction	1
Balance		1	0
Multiple sclerosis (N=1)	Gait	0	1
	Balance	1	0
Spinal cord (N=1)	Gait and/or functional mobility	1	0
	Fatigue	1	0
Cerebral palsy (N=5)	Energetic demand	1	0
	Adherence/satisfaction	1	0
Cerebral palsy (N=5)	Psycho-social aspects	1	0
	Cognition	1	0
	Balance	3	0
	Spatio-temporal parameters of movement	2	0
	Symptoms (mobility and function)	2	1

movements, in a stable environment (a dance studio) that gives them control over their own safety throughout the activity. Dance thus seems to be one of the safe, effective alternatives to other sports and guided exercises for the prevention of health problems among patients with a chronic pathology.

**4.7. Critical appraisals of the studies**

In scoping reviews, the risk is that the conclusions drawn may overestimate the benefits of an intervention because there are no quantitative critical appraisals of the articles. In the articles included, 24 studies were RCTs. So, the majority were case studies or controlled studies. The most frequently identified methodological weaknesses were: the absence of sample size calculation, the blinding of assessors and an age with a high standard deviation. It is therefore difficult to understand whether the observed beneficial effects are influenced by age. Nevertheless, studies that are better targeted by age group have shown beneficial effects for children, adults and older persons. One of the pivotal aspects of planning a clinical study is the calculation of sample size. Indeed, if we include few subjects in a study, the results cannot be generalized to the population, as the sample will not represent the target population. In view of these methodological limits, it is necessary to be cautious when drawing conclusions about the beneficial effects of dance in the case of chronic pathologies.

**4.8. Limitations**

The scoping review gives a broader, more contextual overview than systematic reviews [17]. Systematic reviews can only be conducted if there are enough studies with similar aims and methods; yet this was not the case, except for Parkinson's disease [15, 16]. The scoping review is thus used to identify knowledge gaps, determine the scope of results,

**Table 3**

Synthesis of main effects studied and main results for other pathologies than neurological conditions. The « N » corresponds to the number of studies. In the results part, the figure corresponds to the number of studies according with the beneficial effects or absence of effects.

Pathologies	Parameters	Results	
		Beneficial effects	No effect
Fall (N = 2)	Balance	1	0
	Gait	1	0
Schizophrenia (N = 2)	Symptoms (fall risk)	1	1
	Quality of life	1	0
	Balance	1	0
	Gait and/or functional mobility	1	1
Mental retardation (N = 1)	Muscular strenght	1	0
	Endurance	0	1
	Body mass index	1	0
Fibromyalgia (N = 2)	Balance	1	0
	Adverse effect	0	1
Cancer (N = 7)	Mental health	2	0
	Quality of life	2	0
	Gait	1	1
	Body mass index	0	1
	Symptoms (pain)	2	0
	Adherence/satisfaction	3	0
	Mental health (stress, anxiety, depression)	3	1
Rhumatoïd arthritis (N = 3)	Quality of life	3	1
	Gait and/or functional mobility	2	0
	Fatigue	1	0
	Symptoms (pain, shoulder function)	2	1
	Adherence/satisfaction	1	0
	Adverse effect	0	1
	Mental health (depression)	1	0
	Gait and/or functional mobility	1	0
	Fatigue	1	0
	Symptoms (range of motion)	1	1
Alzheimer (N = 1)	Balance	1	0
	Gait and/or functional mobility	1	0
Low back pain (N = 1)	Range of motion	1	0
	Work activities	1	0
	Gait and/or functional mobility	1	0
Cardiac (N = 4)	Symptoms (pain)	1	0
	Adherence/satisfaction	1	0
	Adverse effect	0	1
	Mental health (motivation)	1	0
	Quality of life	1	0
	Balance	1	0
	Gait and/or functional mobility	2	0
	Muscular strenght	1	0
	Symptoms (CF, VO2, tension)	2	1
	Obesity (N = 2)	Adherence/satisfaction	2
Mental health (self esteem)		1	0
Quality of life		1	0
Gait and/or functional mobility		0	1
Endurance/physical condition		1	0
Diabetes (N = 2)	Symptoms (weight)	2	0
	Adherence/satisfaction	1	0
	Endurance/physical condition	1	0

clarify concepts or develop further research [17]. This type of review can be a preliminary work to delineating systematic reviews. These two types of reviews are similar in the demanded rigor vis-à-vis the method, transparency and result reporting. However, with the scoping review, no quantitative analysis of the methodological quality of studies is proposed.

Hence results do not include the risks of these studies being biased. Research was limited to PubMed and Kinedoc databases, which mainly target articles on physical health. Researchers who wish to examine the results of dance on mental health should extend the research to psychology-related databases such as PsycNET. Even if research was thoroughly done, it is difficult to assert that no study was left out of the final choice. Besides, five studies were excluded because the full text was not available.

## 5. Conclusion

Dance seems to be a well-adapted physical activity; it is safe and, in this context, has positive impacts on the consequences of chronic pathologies and on the detrimental effects of sedentariness. Many studies raise the interest of dance for patients; but the targeted effects and modalities are very different, which complicates syntheses.

In the case of neurological pathologies, dance is deemed feasible and seems beneficial to adherence, mental health, the psychosocial aspect, cognitive, balance and motor skills, while effects on pathology-specific symptoms seem more limited. It is only possible to affirm that there is a beneficial effect of dance practice for Parkinson's disease, because the number of studies and their quality are sufficient. Future studies on other diseases will therefore have to be carried out to improve the understanding of the effects of dance on these patients' neurological impairments.

Studies on metabolic pathologies show that dance improves adherence, mental health, quality of life, endurance, physical fitness and reduces weight. However, few studies have been conducted. Better methodological quality should be achieved as well as a longer follow-up period in order to assess the persistence of positive effects.

For other types of diseases, the highest number of studies and the best methodological quality were found for patients with cancer and cardiac diseases. Physical activity, mental health and quality of life are improved for dancing patients in an oncology context. However, the follow-up is too short, which makes it impossible to assess the persistence of effects and the efficiency against sedentariness. In the case of cardiac pathologies, the beneficial effects of dance were found on the same parameters as well as on VO<sub>2</sub>max.

With other diseases, even if the effects found are very positive, it is necessary to qualify the conclusions, because the number of studies and their quality remain rather low. All these studies show the very beneficial effects of dance, but it is necessary to strengthen the number of studies to better understand if dance can be considered as an option to fight sedentariness of people with chronic pathologies.

This overview shows that dance is an activity with various styles; it includes the whole body in movements with variable constraints, and seems to have positive impacts on physical, motor, cognitive and relational disorders. This makes dance particularly adapted to chronic pathologies. Hence, patients should be encouraged to practice dance, even if the results must be confirmed by further research, which should also highlight best modalities and compare the various dance types. It is very difficult to know the number of people who dance in the world, for this activity is often informal, especially street dances and traditional dances. Therefore, studies have first and foremost targeted institutionalized styles of dance, although a recent study evaluated the benefits of hip-hop on health. In the future, it will be interesting to evaluate the perceived impacts of dance styles such as breaking, popping and locking or new school on patients with chronic pathologies.

## Declarations

### Author contribution statement

Anne-Violette Bruyneel: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Additional information

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