The Effect of ROM Exercise on Pain Intensity in Osteoarthritis Patients at RSU Sundari Medan

Fajar Amanah Ariga[1*], Youlanda Sari[2], Hijrah Purnama Sari[3]
[1,2]Sekolah Tinggi Ilmu Kesehatan Flora, Medan
[3]Universitas Almuslim, Aceh
Email: fazaamanahariga@gmail.com

ABSTRACT

Osteoarthritis sufferers generally experience pain in the joint area, pain that occurs continuously can reduce the quality of life of osteoarthritis sufferers. This study aims to determine the effect of ROM exercises on the intensity of knee joint pain with osteoarthritis at RSU Sundari. The design of this study used quasi-experimental with the one group pre post test design approach. The sampling technique in this study used Probability Sampling with the Simple Random Sampling approach and obtained 26 respondents at RSU Sundari Medan. The instrument used is a sheet SOP Range of Motion, stopwatch and NRS (Numeric Rating Scale) observation sheet. Data were analyzed using the Wilcoxon Statistical Test with significance ($\rho \leq 0.05$). The results of the study showed that the average pain scale before ROM was 3.00, and the average pain scale after ROM intervention for 6 days decreased to 1.00. The results of the study show that there is influence exercise ROM vs. intensity of knee joint pain with osteoarthritis at RSU Sundari (ρ value = 0.000) with a mean ranks of 10.50 and a sum of ranks of 210.00. ROM exercises can affect the intensity of the knee joint pain scale with osteoarthritis. This is because by practicing ROM, the joints will move actively, thus affecting the blood vessel system in the extremities. That the nutrition and fluids in the joints and bones are sufficient and pain due to disease will be reduced.

Keywords: osteoarthritis, intensity painful, exercise ROM

INTRODUCTION

Osteoarthritis is a degenerative and progressive inflammatory joint disease that involves all parts of the joint. Osteoarthritis generally attacks the knee and hip joints because these joints are the joints that support the body's weight, but the most frequently attacked is the knee joint Symptoms that are often complained of by osteoarthritis sufferers are joint pain. According to (Bella et al., 2021) osteoarthritis joint pain can reduce the quality of life because if not treated immediately it will affect daily life activities.

Elderly is a period when a person has entered the age of 60 years and over. Experiencing physiological changes due to the aging process which is characterized by decreased immunity, causing the elderly body to be more susceptible to disease. The impact of the aging process on the elderly causes health problems, one of which is arthritis. The elderly often experience

osteoarthritis where this disease is a musculoskeletal disease which is one of the 10 main causes of paralysis and joint movement disorders (Fitamania et al., 2022).

World Health Organization, in 2019 explained around 528 million people in the world suffer from osteoarthritis. In the United States, 15% of total resident suffer osteoarthritis And 60% from amount the aged >75 years, and 25% of the total it is elderly sufferer >65 years, whereas Which aged <65 year only range 15% Indonesia, it is recorded that around 7.3% of people suffer from osteoarthritis and in North Sumatra, sufferers of osteoarthritis are estimated to be around 6.72%. Based on the prevalence of osteoarthritis in Medan reaches figure of 1.34%. In a preliminary study conducted by researchers in May 2023.

Limitations in joint movement and reduced joint use will worsen the condition of the musculoskeletal system due to the disease process (Aryanti et al., 2023). If not treated immediately, joint pain and disability due to osteoarthritis will result in decreased activity in the elderly and prolonged immobilization (Andriani et al., 2022). Therefore, management is needed for osteoarthritis, one of which is with Range of Motion (ROM) exercises. Nurses as providers of nursing care play a role and are tasked with providing interventions that can help the elderly improve their health. A number of intervention and management Which Can given in osteoarthritis sufferers, including pharmacological, non-pharmacological, and surgical therapies. One of the non-pharmacological therapies that can be applied is physiotherapy with Range of Motion exercises (Sudarsih & Santoso, 2022).

Range of Motion (ROM) exercises are useful for maintaining and preserving joint strength, maintaining mobility joints, stimulate blood circulation, and increase muscle mass which has an impact on preventing immobilization in the elderly who suffer from osteoarthritis so that the quality of life of the elderly will increase (Nurtanti & Ningrum, 2019). In previous research conducted by (Permadhi et al., 2022). it was found that ROM exercises can reduce pain in osteoarthritis sufferers where before doing ROM exercises the average pain quality was 3.40 and the results after doing ROM exercises the average pain quality was 2.47. ROM training can influence the intensity of the knee joint pain scale in elderly people with osteoarthritis, this is because by practicing ROM the joints will move actively, thus affecting the blood vessel system in the extremities so that nutrition and fluids in the joints and bones are sufficient and pain due to disease will be reduced. The aim of the research was to determine the effect of ROM exercise on pain intensity in sufferers of osteoarthritis.

METHODS

This study is a quantitative experimental study (quasi-experimental) with a one group pre post test design approach. Respondents who will undergo intervention on the first day before being given ROM (Range of Motion) intervention, respondents are first given a measurement of the intensity of their movements pain (pretest) and after being given ROM intervention will pain intensity measurement (posttest) was conducted on the sixth day after the intervention. The aim was for researchers to find out whether there was an effect of ROM (Range of Motion) exercises on the intensity of knee joint pain before and after the intervention was given for 6 meetings.

This research was conducted on 12 - 26 October 2024, the research location was conducted by conducting research interventions for 2 weeks, every week. There were 3 meetings, namely on Tuesday, Thursday, and Saturday. The research location supports the research because research has never been conducted by providing Range of Motion intervention with osteoarthritis.

The population in this study were patients with osteoarthritis at RSU Sundari as many as 28 patients. The sample of this study were patients suffering from Osteoarthritis at RSU Sundari who met the inclusion and exclusion criteria as follows: criteria inclusion is willing become respondent research, elderly which no have disturbance communication and hearing, able follow and do exercise range of motion. Criteria exclusions are patients who moment do intervention sick and patients who moment do intervention No present.

The demographic data questionnaire instrument in the observation sheet consists of several important items, namely age, gender, religion, marital status, last education, occupation, daily activities, duration of knee pain, actions taken when experiencing knee pain, types of medication consumed, have you ever had surgery before, have you participated in the elderly posyandu program, weight, height, factors that affect pain. The instrument for providing Range of Motion exercise intervention uses the SOP (Standard Operating Procedure) (Lathifah et al., 2020) a stopwatch from a cellphone with the aim of measuring the length of time in doing ROM (Range of Motion) exercises with a duration of 30 minutes where 10 repetitions of each movement with an intervention dose of 3x/week. The instrument for measuring the intensity of knee joint pain using the pre post test observation sheet by determining the Numeric Rating Scale (NRS) (Fitamania et al., 2022) is a tool for measuring pain intensity by sorting the level of pain being experienced by the patient.

RESULTS

Tabel 1. Respondent Characteristics of Osteoarthritis Patients

Characteristics	Frequency (f)	Percentage (%)
Age		
60-65 Year	21	80.8
66-70 Year	5	19.2
Type Sex		
Female	26	100.0
Religion		
Islam	16	61.5
Christian Catholic	6	23.1
Christian Protestant	1	3.8
Hindu	3	11.5
Occupation		
Mother House Ladder	11	42.3
Employee Private	5	19.2
Businessman	10	38.5

The table 1 above shows that from 26 respondents consisted of 21 people (80.8%) who were elderly aged 60-65 years, and 5 people (19.2%) who were elderly aged 65-70 years. The majority indicated that of the 26 respondents (100%) the respondents were women. Based on religion 16 people (61.5%) are elderly Muslims, 6 people (23.1%) are elderly Catholics, 3 people (11.5%) are elderly Hindus, and 1 person (3.8%) is an elderly Protestant. Based on occupation 11 people (42.3%) are housewives, 10 people (38.5%) are elderly entrepreneurs, and 5 people (19.2%) are elderly private employees.

Table 2. Frequency Distribution of Daily Activities in Osteoarthritis Patients

Activity Daily	Frequency (f)	Percentage (%)
Activity Light	10	38.5
Activity Heavy	12	46.1
Sitting/ only Sleeping	4	15.4
Total	26	100

The table above shows that of the 26 respondents, 12 people (46.1%) were elderly people who had heavy activities, 10 people (38.5%) were elderly with light activity, and 4 people (15.4%) elderly who have sitting and only lying activities. In this study, according to the table above, the results showed that the majority of respondents were elderly who had heavy activity.

Table 3. Frequency Distribution of the Length of Pain Experience in Osteoarthritis Patients

Length of Pain Experience	Frequency (f)	Percentage (%)
2 year - <3 year	17	65.4
>3 year	9	34.6
Total	26	100.0

The table above shows that out of 26 respondents, there were 17 elderly people (65.4%) who had experienced pain for 2-3 years, and 9 elderly people (34.6%) had experienced pain for >3 years. In this study, according to the table above, the results showed that the majority of respondents were elderly people who had experienced pain for 2 years to >3 years.

Table 4. Frequency Distribution on Actions When Experiencing Pain in Osteoarthritis Patients

Actions When Experiencing Pain	Frequency (f)	Percentage (%)
Drink Drug moment Painful	4	15.4
Massage	13	50.0
Compress	9	34.6
Total	26	100.0

The table above shows that out of 26 respondents, there were 13 elderly people (50%) who massaged to reduce pain, 9 elderly people (34.6%) who applied compresses to the painful area, and 4 elderly people (15.4%) who took medication when they were in pain. In this study, according to the table above, the results showed that the majority respondent is elderly which do massage if moment experience painful.

Table 5. Wilcoxon Test Results of Pain Scale in Elderly with Osteoarthritis Before and After ROM Exercise

Result		Mean	Negative Rank	Positive rank	Asymp.Sig 2-tailed
Day 1	Pre ROM	3.00	5	0	0.025
	Post ROM	2.00			
Day 2	Pre ROM	3.00	13	0	0.000
	Post ROM	2.00			
Day 3	Pre ROM	2.00	11	0	0.001
	Post ROM	2.00			
Day 4	Pre ROM	2.00	7	0	0.008
	Post ROM	2.00			
Day 5	Pre ROM	2.00	13	0	0.000
	Post ROM	1.00			
Day 6	Pre ROM	2.00	12	0	0.001
	Post ROM	1.00			

Describes the pain scale data on day 1 with an average value of the pain scale before and after the intervention of 3.00-2.00. The pain scale on day 2 with an average value of the pain scale before and after the intervention of 3.00-2.00. Pain scale on the 3rd day with an average value of the pain scale before and after the intervention of 2.00. Pain scale on the 4th day with an average value of the pain scale before and after the intervention of 2.00. Pain scale on the 5th day with an average value of the pain scale before and after the intervention of 2.00-1.00. Pain scale on the 6th day with an average value of the pain scale before and after the intervention of

2.00-1.00. The results of data processing with the Wilcoxon test obtained the results of the pain scale on the 1st, 2nd, 3rd, 4th, 5th, and 6th days (Asymp. Sig <0.05) which means that H0 is rejected and H1 is accepted so that there is an effect of ROM exercise on the knee pain scale in the elderly with osteoarthritis (Agusrianto & Rantesigi, 2020).

Results of pain scale test in the elderly with osteoarthritis on the 2nd day 1st and 3rd. The table above explains the results of the comparison of pain scales on day 1, before being given ROM intervention and on the 6th day after being given ROM exercise intervention, the average pain scale value on the 1st day was 3.00 and on the 6th day after being given ROM exercise intervention decreased with an average pain scale value of 1.00. The results obtained a value (Asymp. Sig = .000) <0.05, which means that the pain scale on the 1st and 6th days was different. So it can be concluded that ROM exercise can reduce the scale of knee pain with osteoarthritis (Dabadghav et al., 2019).

DISCUSSION

This study was designed to determine the effect of providing ROM exercise intervention. on the intensity of knee joint pain with Osteoarthritis at Sundari Hospital, Medan.

Knee Joint Pain Intensity before Range of Motion Exercise with Osteoarthritis

There are several factors that can affect the intensity of the pain scale in Osteoarthritis sufferers as stated by Arif et al., (2021) that Osteoarthritis (OA) is a disease that occurs due to several things, namely degradation of joint cartilage, bone remodeling, and inflammation. In the pain phase, fibriogenic activity will increase while fibrinolytic activity will decrease. The accumulation of thrombus and lipid complexes in subchondral blood vessels leads to ischemia and tissue necrosis, releasing chemical mediators like prostaglandins and interleukins, which act as pain transmitters. Kinins also play a role in pain, causing tendons, ligaments, and muscle spasms. Osteoarthritis (OA) is caused by osteophytes pressing on nerves and venous stasis during remodeling, with the exact cause unknown (Larsen et al., 2019).

The main risk factors for OA are age, female gender, obesity, physical activity, genetic factors, race, joint trauma, and chondrocalcinosis. Lack of movement, obesity and metabolic diseases such as diabetes can worsen OA. Osteoarthritis is also more common in peri-menopausal women who have low estrogen levels, are overweight, and are still actively working (Eftekharsadat et al., 2020).

This is in accordance with Herawaty's research (2022) which states that Osteoarthritis is the most common disease that causes pain and movement disabilities in the elderly population. Osteoarthritis sufferers are usually over 40 years old and increase based on increasing age. Increasing age causes decreased function of joint cartilage. The strength of collagen in the elderly also decreases, this can cause joint cartilage to become weak and easily damaged. The aging process has several changes in bones and joints. In the bones, there is a reduction in bone mass and reduced bone osteoblast formation. In the joints, there is disruption of the cartilage matrix and modification of proteoglycans and glycosaminoglycans (Mete & Sari, 2022).

Osteoarthritis is more common in women (68.67%) than in men, with menopausal women experiencing fat accumulation in lower joints, leading to increased load on joints. Women with a BMI above average are more susceptible to joint stages. Asian women have a lower BMI (24-26.9 kg/m2), with an obesity rate of 4% in America compared to 2% in men. Obesity is a risk factor for knee osteoarthritis, as the knee joint supports half a person's body weight while walking. Increased weight can cause cartilage damage, ligament failure, and other structures. The knee joint's harder work affects the durability of joint cartilage, causing joint loss, collagen tissue fractures, and proteoglycan degradation (Eftekharsadat et al., 2020).

Elderly women aged 45-59 years will be prone to OA because the beginning of menopause where there is a decrease in estrogen causes a decrease in the collagen matrix so that the cartilage becomes damaged and causes pain. In addition, obese women will have a higher risk factor for OA because the body weight supported by the joints of the feet is not comparable, causing severe pain. The study by Kurniawan (2023) state heavy activity significantly impacts osteoarthritis (OA) sufferers, increasing pain due to the use of muscle and bone mass exceeding work capacity. Improper work positions and lack of rest can cause pain in bones and joints. The elderly's heavy activities increase the risk factors for OA due to the use of large amounts of energy exceeding the load capacity of joints and bones, leading to osteoporosis or calcification, which causes pain.

Massage therapy shows a positive effect in reducing muscle pain. In addition, massage can increase endorphin hormones, increase serotonin and dopamine neurotransmitters, and increase blood flow so that pain stimuli can be stopped (Andriani et al., 2022). The scale of pain experienced by elderly people with OA can worsen if the pain felt has been felt for too long and is not treated properly, the elderly usually keep the pain or pain they suffer because of the lack of knowledge they have, besides that they are also accustomed to preferring conventional treatment to treat the disease. Massage therapy is often chosen to treat joint pain because it is

more economical and quite effective, but massage therapy must be balanced with further examination and appropriate treatment to reduce the scale of existing pain and not worsen the previous condition (Agusrianto & Rantesigi, 2020).

Knee Joint Pain Intensity after Range of Motion Exercise with Osteoarthritis at RSU Sundari

Providing ROM exercises can have a positive effect on elderly people with OA. This is in accordance with what was stated Andriani et al. (2022) that non-pharmacological therapy including physiotherapy can overcome pain problems by increasing muscle tone. Active movement exercises are one way to manage body conditions related to movement function. Active movement exercises can be interpreted as exercises that allow joints to move without feeling pain. By doing these two exercises, flexibility can be increased.

Active ROM exercises are isotonic exercises, which cause muscles to contract. In addition, there is a change in muscle length and stimulates osteoblastic activity (the activity of muscle-forming cells). Performing active ROM exercises correctly and routinely can increase muscle strength, muscle tone and mass and maintain joint flexibility, Range of Motion and circulation. Muscle strength increases depending on the type of exercise, exercise intensity, and age. The more often the exercise is done, the greater the percentage increase in muscle strength. Isotonic contractions cause muscle strength to increase throughout the range of joint motion. Providing strengthening exercises with light to moderate intensity can significantly increase muscle strength in the elderly (Nindawi et al., 2021). Researchers assume that the duration and frequency of ROM exercises are key factors in the intensity of the pain scale in elderly people with OA. OA sufferers will be able to increase muscle tone strength and can train the Range of Motion according to their abilities.

The Effect of ROM Exercises on the Intensity of Knee Joint Pain Scale with Osteoarthritis

The data shows the results of the comparison of the pain scale on day 1 before the ROM intervention and day 6 after the ROM exercise intervention. From the statement above, ROM exercises can affect the intensity of moderate knee joint pain scale in the elderly with OA. This is in accordance with the research of Kurniawan, (2023) which revealed that Actively moving joints will affect the blood vessel system in the extremities so that nutrients and fluids in the joints and bones are sufficient and pain due to disease is reduced. Active ROM is one of the effective exercises for increasing muscle strength in the elderly, especially the elderly with degenerative osteoarthritis (because it can increase and maintain Range of Motion. Not only

that, this exercise is also useful for other elderly people, with easy movements and can be done independently at home. So there needs to be an effort for the relevant parties to be able to create an active ROM exercise program both individually and in groups.

ROM exercise therapy can reduce cytokine levels in synovial fluid in the knee, inhibit cartilage degradation and improve pain symptoms. Cytokines are one of the chemical mediators of inflammation and if cytokine levels decrease, the nociceptor stimulation mechanism by noxious stimuli is inhibited so that the pain mechanism is also inhibited. Exercise therapy if done regularly will increase blood circulation so that metabolism increases and there is an increase in the diffusion of joint fluid through the bone matrix, so that the fulfillment of cartilage nutrition is very dependent on the condition of the joint fluid, this is also influenced by the contraction of the quadriceps muscles and hamstring muscles will be stronger as a result of the provision of exercise therapy, thus facilitating the pumping action mechanism, so that the local metabolism and circulation processes can take place properly. Thus, the transportation of metabolic waste of substance P produced through the inflammation process can also run well so that pain can be reduced (Pamungkas et al., 2021).

The importance of physical exercise in osteoarthritis management aims to improve joint function, protect joints from damage by reducing stress on the joints, increase joint strength, prevent disability, and improve physical fitness. Therefore, when this exercise is done routinely, the level of pain experienced by the respondents will decrease. The positive impact of ROM exercises occurs because it is based on the basic principles of implementation, namely: ROM is repeated 8 times and is done at least 2 times a day. ROM is done slowly and carefully so as not to tire the patient. ROM exercises, don't forget to always pay attention to the patient's age and vital signs (Nurtanti & Ningrum, 2019).

According to the results obtained, there is an effect of ROM exercises on the pain intensity scale in the elderly with Osteoarthritis at RSU Sundari which states that the most pain intensity scale is moderate pain. with routine and consistent ROM exercises will reduce the scale of pain felt.

CONCLUSION

Based on the research findings and test results in the discussion that has been carried out that intensity of the pain scale with Osteoarthritis at Sundari Hospital during the pre-test, it was found that the majority experienced moderate pain. Pain scale intensity with Osteoarthritis at

Sundari Hospital during the post-test, it was found that most of them experienced mild pain. There is a significant influence or improvement between the provisions of ROM exercise intervention on knee joint pain scale intensity with osteoarthritis at Sundari Hospital.

LIMITATION

Limitations are weaknesses and obstacles in research. The limitations faced by researchers in this study were time constraints in implementing ROM exercises and time constraints in monitoring possible contraindications or side effects that may arise after intervention.

REFERENCES

Agusrianto, A., & Rantesigi, N. (2020). Penerapan latihan range of motion (ROM) pasif terhadap peningkatan kekuatan otot ekstremitas pada pasien dengan kasus stroke. *Jurnal Ilmiah Kesehatan (JIKA)*, *2*(2), 61–66. https://doi.org/10.36590/jika.v2i2.48

Aji, K. B., Inayati, A., & Sari, S. A. (2023). *Penerapan teknik ROM (Range of Motion) untuk meningkatkan kekuatan otot pada pasien post op. fraktur*. *3*(1), 138–143. https://jurnal.akperdharmawacana.ac.id/index.php/JWC/article/view/449

Andriani, D., Fitria Nigusyanti, A., Nalaratih, A., Yuliawati, D., Afifah, F., Fauzanillah, F., Amatilah, F., Supriadi, D., & Firmansyah, A. (2022). Pengaruh range of motion (ROM) terhadap peningkatan kekuatan otot pada pasien stroke. *INDOGENIUS*, *1*(1), 34–41. https://doi.org/10.56359/igj.v1i1.59

Aryanti, A. D., Rohmah, M., A, S. F., & Saputra, R. (2023). Studi kasus: Pasien stroke non hemoragik dengan intervensi rom pasif untuk meningkatkan kekuatan otot. *Jurnal Keperawatan*, *1*(1), 23–27. https://www.risji.com/index.php/jurkep/article/view/12

Bella, C., Inayati, A., & Immawati, I. (2021). Penerapan range of motion (ROM) pasif untuk mengatasi masalah keperawatan hambatan mobilitas fisik pada pasien stroke non hemoragik di Kota Metro. *Jurnal Cendikia Muda*, *1*(2). https://jurnal.akperdharmawacana.ac.id/index.php/JWC/article/view/203

Dabadghav, R., Potdar, A., Patil, V., Sancheti, P., & Shyam, A. (2019). Additional effect of neuromuscular electrical stimulation on knee extension lag, pain and knee range of motion in immediate postsurgical phase (0–2 weeks) in primary total knee arthroplasty patient. *Annals of Translational Medicine*, *7*(Suppl 7), S253. https://doi.org/10.21037/atm.2019.09.79

Eftekharsadat, B., Jahanjoo, F., Toopchizadeh, V., Heidari, F., Ahmadi, R., & Babaei-Ghazani, A. (2020). Extracorporeal shockwave therapy and physiotherapy in patients with moderate knee osteoarthritis. *Crescent Journal of Medical and Biological Sciences*, *7*(4), 518–526. https://www.cjmb.org/uploads/pdf/pdf_CJMB_459.pdf

Fitamania, J., Astuti, D., & Puspasari, F. D. (2022). Literature review efektifitas latihan range ofmotion (ROM) terhadap gangguan mobilitas fisik pada pasien post operasi fraktur ekstremitas bawah. *Journal of Nursing & Health*, *7*(2), 159–168. https://jurnal.politeknikyakpermas.ac.id/index.php/jnh/article/view/182

Larsen, J. B., Mogensen, L., Arendt-Nielsen, L., & Madeleine, P. (2019). Multimodal rehabilitation in patients with persistent pain and functional disability after primary or revision total knee arthroplasty. *Osteoarthritis and Cartilage*, *27*(Supplement 1), S444. https://doi.org/10.1016/j.joca.2019.02.476

Lathifah, W., Winarni, & Leni, A. S. M. (2020). Latihan jalan kaki meningkatan kualitas hidup pada lansia. *Physio Journal*, *1*(1), 1–10. https://doi.org/10.30787/phyjou.v1i1.656

Mete, E., & Sari, Z. (2022). The efficacy of exergaming in patients with knee osteoarthritis: A randomized controlled clinical trial. *Physiotherapy Research International*, *27*(3), e1952. https://doi.org/10.1002/pri.1952

Nurtanti, S., & Ningrum, W. (2019). Efektiffitas range of motion (ROM) aktif terhadap peningkatan kekuatan otot pada penderita stroke hemoragik. *Jurnal Keperawatan GSH*, *7*(1), 14–18. https://jurnal.akpergshwng.ac.id/index.php/kep/article/view/58

Pamungkas, S. P., Munawwarah, W., Dewi, N. K., & Nurdesia, M. (2021). Latihan aerobik untuk meningkatkan kualitas hidup pada lansia. *FISIO MU: Physiotherapy Evidences*, *2*(3), 175–188. https://doi.org/10.23917/fisiomu.v2i3.15203

Permadhi, B. A., Ludiana, & Ayubbana, S. (2022). Penerapan ROM pasif terhadap peningkatan kekuatan otot pasien dengan stroke non hemoragik. *Jurnal Cendekia Muda*, *2*(4), 443–446. https://www.jurnal.akperdharmawacana.ac.id/index.php/JWC/article/view/370

Sudarsih, S., & Santoso, W. (2022). Pendampingan latihan range of motion (ROM) pada penderita stroke. *Jurnal Pengabdian Pada Masyarakat*, *7*(2), 318–325. https://doi.org/10.30653/002.202272.82

World Health Organization. (2019). Ten threats to global health in 2019. In *World Health Organisation* (Issue March).