How can critical care nurses improve patients' pain perception by delivering non-pharmacological treatments?

Det helsevitenskapelige fakultet

Master i spesialsykepleie, spesialisering i: Intensivsykepleie

Masteroppgave (30 studiepoeng)

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Forord

Bakgrunn: Smerte er et vanlig problem hos pasienter som er innlagt i et sykehus. Akutt smerte resulterer ofte i kroniske smerter. Smerter bidra til en økning av økonomiske kostnader for samfunnet. Samtidig betyr smerte og mindre livskvalitet for pasienter som opplever smerte og er ofte kombineres med opioidmisbruk. Intensivsykepleier kan bidra til å redusere pasientens smerte og forbedre behandlingsutfall gjennom god kommunikasjon.

Utfall: Hensikten med denne systematiske kunnskapsoppsummeringen er å evaluere effekten av alternative behandlingsmetoder på akutt og kronisk smerte. Disse tiltakene inkluderer psykologiske intervensjoner, manipulasjon av kommunikasjon og pedagogiske intervensjoner.

Metode: Denne kunnskapsoppsummeringen inkluderer randomiserte kontrollerte studier som ble hentet fra de tre databaser: Cinahl, PubMed og Embase ble screenet og kvalitetssikret ved Mixed Method Tool MMAT (MMAT). Studien inkluderer pasienter over 18 år uten kognitiv svikt.

Resultater: Tolv randomisert kontrollerte studier ble identifisert (n=1878). Studiene ble publisert mellom 2013 og 2023. Ti av disse studiene (83%) inkluderte psykologiske intervensjoner, to av disse studiene (17%) testet effekten av manipulering av kommunikasjon på smerte, og to studier (17%) inkluderte pedagogiske tiltak. Resultatene fra den statistiske analysen har vist ulike utfall på tiltakene.

Konklusjon: I denne studien kommer fram, at intensivsykepleier bør bruke positiv kommunikasjonsstil med kroniske og akutte smertepasienter og unngå å bruke negative og smerterelaterte ord og kunne sette ikke farmakologiske, alternative tiltak i gang på en intensivavdeling eller postoperativ avdeling.

Nøkkelord: smerte; smerteopplevelsen; psykologiske, pedagogiske intervensjoner, manipulasjon av kommunikasjon, smertelindring; kunnskapsoppsummering

Abstract

Background: Pain is a common problem in any clinical hospital setting. Sever acute pain often results in chronic pain. Consequences of chronic pain are seen in the increase of economical cost for society and the impairment of the patients' daily living which is often combined with opioid abuse. If critical care nurses improve their communication with patients suffering from acute or chronic pain it may lessen personal impairment and improve patients outcome.

Objective: The purpose of this systematic restricted is to evaluate the effectiveness of alternative treatments to pain medications. These interventions can be psychological treatments, like cognitive-behavioural therapy, manipulation of communication, or educational intervention, on the outcome of pain and pain perception in a clinical hospital setting. The treatments were categorised into three main groups: Psychological, Educational, and manipulation interventions groups.

Methods: A systematic restricted review of randomized controlled trials was conducted (RCT). The four databases Cinhal, Medline, Embase were scanned to collect RCT studies. The selected studies were limited to patients aged 18 or older, without cognitive disabilities. The author screening and extracted the data base to assess bias. The quality of evidence was assessed using the Mixed Method Tool MMAT approach.

Results: Twelve eligible RCT studies were identified (n=1878). The studies were published between 2013 and 2023. Ten of these trials (83%) included psychological interventions, two of these trials (17%) tested the effect of manipulation of communication on pain, and two trials (17%) included educational interventions. The results of the statistically analysis have shown different outcomes on the interventions.

Conclusion: This review suggests that ICU nurses should use a positive communication style with chronic and acute pain patients and avoid using nocebo language. Furthermore, the option to receive psychological, nonpharmacological interventions should be given on ICU or PACU.

Keywords: Pain; pain perception; psychological, educational intervention, manipulation of communication, pain reduction; review

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Abbreviation

ACC	anterior cingulate cortex
dACC	dorsal anterior cingulum
sACC	subgenual ventral anterior cingulum
ANOVA	Analysis of variance
ANCOVA	Analysis of covariance
ANEW	Affective Norms for English Words
Anterior IC	anterior insular cortex
BPI	Brief Pain Inventory
CABG	Coronary artery bypass surgery
CBT	Cognitive Behavioral Therapy
CG	Control group
CNS	Central nervous system
CSEA	Center for Emotion and Attention
CT	Cognitive therapy
DLPFC	dorsolateral prefrontal cortex
ED	Education Intervention
EEG	Electroencephalogram
ES	Effect size
fMRI	functional magnetic resonance imaging
FHI	Folke Helse Institutt
HYP	Hypnosis
HYP-CT	Hypnosis-Cognitive Therapy
IADS	International Affective Digitized Sound system
IASP	International Association
IADS	International Affective Digitized Sound system
IAPS	International Affective Picture System
ICD	International Classification of Diseases
ICU	Intensive care unite
IG	Intervention group
IPG	inferior patietal gyri
LOE	Level of evidence
MMAT	Mixed Methods Appraisal Tool
MI	primary motor cortex

mPFC	medial prefrontal cortex
NLP	Neuro-linguistic programming
NRS	Numeric Rating Scale
NSFLIS	Norwegian Association of Critical Care Nurses
NVR	Non virtual reality
PACU	Post Anaesthesia care unit
PET	Positron Emission Tomography
PICO	Population, Intervention, Comparison, Outcome
RCT	Randomize Controlled Trial
SAC	Somatosensory association cortex
SAM	Self-Assessment Manikin
SHSS	Stanford Hypnotic Susceptibility Scale
SI	Primary somatosensory cortex
SII	secondary somatosensory cortex
TNN	Theory of neural networks
VAS	Visual analogue rating scale
VR	Virtual Reality
WHO	World Health Organisation

1. Introduction

Approximately 20% of the adult population in Europe are already affected by chronic pain (Breivik, 2017). New pain develops after surgical operations and injuries. Often pain persists longer than the time of the healing process of the operation wound, and some of them are developing disabling pain. As a result, chronic pain is an economic burden, it costs 2-10% of the national products of European countries (Breivik, 2017). Moreover, any pain also represents a strong burden to the individuals affected. Appropriate preventive measures are needed, to prevent this effect on individuals and society (Henschke et al., 2015).

A cornerstone in the treatment of patients with pain is communication. During the communication we are learning a lot about the patient's expectations and where the attention is focused and this by showing empathy and listening. This communication happens in a verbal and non-verbal way. Critical care nurses' behaviour may have impact on patient's pain perception, pain relief, or contribute to worsen the experience of pain (Almarzouki et al., 2017). The efficacy of a treatment depends on patients and providers expectations on treatment outcomes, but also on conditioning of the patient. In case of negative expectations on treatment effect and conditioning the outcome will be negative, that is called the nocebo effect. It is well known that nocebo language, using negative pain-related terms can have a damping effect on pain treatment (Almarzouki et al., 2017). Pain transmitted by words is called semantic pain, and words or phrases which have impact on patient's pain outcome are called primes. The opposite of the nocebo effect is the placebo effect. When a health care provider suggests a positive outcome, and the patient believes in therapy and has trust to the provider, then the effect is leading to better treatment outcomes (Häuser et al., 2012). Treatment with placebos have already found the way into everyday medical life and research. Summarized, priming can happen in a positive or negative manner. Placebo and nocebo effect are resulting in treatment outcomes.

From a neuroscientist view is the modulation of pain perception not only influenced by sensory dimensions, that means by extern stimulation, but also by aspects at the behavioral level (Lena et al., 2022). Pain processing and the perception of pain can be affected through cognitive, social, and emotional factors. These factors don't hurt by themselves but activating subcortical nociceptive circuits in the brain. Cognitive, social, and emotional factors can

interact with each other on both the neural level and on the behavioral level (Swanell et al., 2016).

Nurses may need appropriate strategies such as different communication skills in order to prevent or buffer the patients pain perception. Critical care nurses caring for patients with pain on Intensive care units (ICU), Post Anaesthesia care units (PACU), and general wards may need to learn more about these preventive strategies. To reach this knowledge it is important that healthcare providers understand the neurobiological mechanisms of pain perception. It is also necessary to have knowledge about how words become to be noxiously and why nurses should avoid using negative primes and improve their communication.

The effect of communication on pain is still an object in research. In the past, several neuroscientists have conducted randomized controlled trials or quasi-experimental studies, which examined the effect of pain-related words on the different brain areas in healthy participants. In a clinical context, prospective studies, or randomized controlled trials are applied. Several types of interventions which includes communication have been applied in the clinical setting in order to examine the effect on pain. Randomized controlled trials as well as clinic trials are showing varying effects on outcome after treatment interventions.

So far as we know, since 2015 no systematic review or meta-analysis which includes psychological, educational and placebo- or nocebo communication interventions in a clinical setting, has been conducted to determine the effect of these treatments on pain. The aim of the master thesis was therefore to systematically review the effects of recent clinical communication intervention on the patient's pain, building on the study of Mistiaen and colleagues conducted in 2015.

1. 1 Structure of the master thesis

This master thesis comprises six chapters. The introductory chapters describe aspects of the research questions about the different communication styles and strategies to prevent and decrease pain. as well as presenting previous research followed by the aims of the thesis. Chapter 2 explain the theoretical framework of the review which begins with a neurobiological view and explanations on pain perception, followed by the definition of the psychological variables expectancy, catastrophizing, and attention. The next subchapter gives

linguistic approaches as definitions about nocebo and placebo language, semantic priming, and setting them in a neurobiological context. In the next step, psychological and educational strategies to improve or prevent pain perception are explained. Chapter 2 will finish with two neurobiological theories followed by the psychological approaches. The first theory is Bandura's theory of self-efficacy (1959), and the second ones is the cognitive behaviour therapy developed by Lang (1977). Chapter 3 describes methodological approaches employed in the review and chapter 4 presents the results of the controlled trials. In chapter 5 the findings are discussed in the light of earlier research and relevant theories which is followed by a methodological consideration related to the review. Finally, chapter 6 provides the conclusion, including implications for the clinical practice and suggestions for further research.

2. Background

Pain is considered as a major public health burden worldwide. The International Association for the Study of Pain (IASP) estimated that twenty percent of people worldwide are affected of chronic pain. In 2019, the Norwegian Institute of Public Health reported that chronic pain affects about thirty percent of the adult Norwegian population (www.fhi.no).

Chronic pain conditions have enormous consequences for patients, interferences considerably activities in daily life, poor sleep quality, and increased consumptions of analgesics and opioids. It will affect personal relationships and patients' families, often leading to depressions and at least to isolation. (Henschke et al., 2015). Reasons listed above, increases costs on national health economics, and will also have an effect on patient's economic situation. Leading to impairments in working life due to pain related failures. Of this reason it is important to develop strategies to avoid unnecessarily pain, which otherwise could lead to chronic pain states.

Therefore, it is important to get more knowledge about pain and to understand the mechanisms behind pain, in addition to develop communication skills and find a better way to interact with patients. This is especially important to patients in the ICU because critical ill patients are already strong affected of the critical illness and isolation which is due to the stay on an ICU and because of this are they more vulnerable to pain. Increased pain leads to stress, have impact on vital signs, and promotes delirium (Jin et al., 2020).

According to the Norwegian Association of Critical Care Nurses (NSFLIS), are critical care nurses required to promote health and to work preventively (NSFLIS 2017). This raises the question how critical care nurses can improve patients pain perception with non-pharmacological strategies. Already in the 1950ths the American psychologist Peter Lang described that well-being and resilience plays a role to hold the balance between health and disease (Lang, 1959). Hypnosis, guided imagery, and mindfulness are strategies to reduce stress, getting relaxed, and hold attention on oneself (Rousseaux et al., 2020). This happens by positive suggestions, relaxing techniques and having focus on breathing (Jensen, 2009). Another prevention tool which has impact on patient's pain perception is the use of positive words and manipulating expectancies (i. e. neurophysiological) (Finset, 2018). The next chapter will show prior research results of neurophysiological randomised clinical trials (RCTs) with healthy participants and patients with chronic pain.

2. 1 Prior research

A lot of neurophysiological and psychological studies have been conducted, to access the impact of verbal or visual cues, enhanced empathy, and other psychological primes on pain (Bingel et al., 2004; Dillmann et al., 2000; Richter et al., 2009). Some of the studies were carried out with healthy participants under experimental conditions. Partly trials have been conducted with patients suffering from chronic diseases like, migraine patients, multiple sclerosis, peripheral diabetic polyneuropathy, tension headache, prevention of cardiovascular diseases, and lower back pain (Eck et al., 2011; Weiss et al., 2003). As an example, the study conducted by Eck and colleagues (2011) has been shown greater activations in pain related brain areas in migraine patients in contrast to healthy participants in the control group Nikendei et al. (2005) came to the same results in a trial with depressive participants. They found an increased cortical activation in this patient group. There are few clinical trials examining the effect of semantic priming on pain (Chooi, et al. 2013; Chooi, et al. 2011; Wang et al., 2008; Varelman, et al. 2010).

Research on hypnosis is an intervention strategy interdisciplinary, both physicians, psychologist, nurses, and physical therapists are involved in conducting studies and hypnosis may have an impact on pain (Jensen, 2009). Mistiaen et al. (2015) did not include hypnosis in their systematic review. They pointed to the studies comparing hypnosis with emotional care. Therefore, hypnosis is included as an intervention strategy in this review. Jensen (2009)

reported 17 studies conducted from 2006 to 2009 which analysed the effect of hypnosis on pain.

The effect of Virtual reality (VR) on pain has been shown in several previous systematic review studies. Virtual reality was applied on different types of diseases, such as medical procedures, urological endoscopies (Moon et al., 2018) dental procedures (Atzori et al., 2018). In the past years virtual reality was also applied in cancer patients with chronic pain (Pittara et al., 2020) and on pain perception in rehabilitation (Wittkopf et al., 2020). These studies were taken account because of the limitations for research of VR on pain in the past. The practice of Virtual reality in medicine is relatively new (ref).

Research to mindfulness is very low and there are few clinical studies, because of high risk for bias. One of the earliest pioneers in the research was Kabat-Zinn who studied the clinic use of mindfulness for self-regulation of chronic pain (Kabat-Zinn, 1985) showing positive outcomes on pain. And Bawa et al. conducted a systematic review and meta-analysis about the effect of mindfulness on chronic pain in (2015).

Several systematic reviews, brief communications and narrative reviews have investigated the impact of hypnosis, or mindfulness, or suggestions, cognitive behavioural, positive conversation and therapeutic conversations on pain, and healthcare outcomes, including pain (Johnstone and Vogele, 1993; Di Blasi, et al. 2001; Beck, et al. 2002; Griffin, et al. 2004; Mistiaen et al. 2015, Howick, et al. 2018; Manai, et al. 2019; Lena et al. 2022). Although some of the reviews above were conducted after 2015, these reviews have only included one type of intervention. The present review will summarize effects of different types of both psychological and educational interventions on pain.

Due to the varying communication styles it seems to be useful to dived communication in subcategories to determine the effect of psychological interventions and communication on patients with acute or chronic pain. It is not easy to distinguish the different types of interventions exactly from each other. Some of the interventions included several types of treatments and combined them with each other. The classification of groups created by Mistiaen et al. 2015 provides as a basis for this review, but the recent study created three main group interventions with subgroups. Treatment groups are divided into psychological, educational and manipulation group. Whereas psychological care interventions aim to evoke

reduction in pain perception or pain unpleasantness by using positive suggestions, and emotional care is delivering enhanced empathy by a health care provider (Mistiaen et al., 2015).

2. 2 Objective of the study

Less is known about the psychological, educational, and manipulation treatment outcomes on patients with acute or chronic pain in nursing research. This receives little attention in nurses' clinical daily routine. Nurses are taught to have an empathic and friendly appearance and to embolden the patients but did not get extra training on communication with patients.

Communication about pain is located in the working area of an ICU nurse, therefore it is important to gain more knowledge about communication strategies that can decrease pain. This will improve patients' treatment outcome, satisfaction and has the side-effect to reduce economic burden and opioid abuse.

2. 3 Research Question

The aim of this review is to highlight the effect of educational, psychological and communication interventions on patients' pain and summarize the content of these interventions. placebo language, and therapeutic communication on pain. This raises the following questions:

- What are the content and delivery modes of psychological, educational, and placebo/nocebo communication interventions for patients with pain?
- Which effects can be expected from psychological, educational, and placebo/nocebo communication interventions on patients' pain, pain perception, attention, expectancy, and catastrophizing?

3. Theoretical framework

This chapter is starting with conceptual explanations, which are necessary to understand the following theories and the results from the randomized controlled trials. The theoretical background consists of three theories, two of them predicted on neurophysiological frameworks, the Theory of Neural Networks (TNN), and The Motivational Priming Theory.

The psychological theories based on cognitive behavioral theory and the principles of self-efficacy. The first subchapter is starting with definitions about pain.

3. 1 What is pain?

To understand the context between pain and communication it is helpful to find a definition about pain. The IASP defines pain as: “An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage, or described in terms of such damage” (IASP, 2020). According to this definition pain has biological, psychological, and social factors. Physically seen is a painful stimulus not needed to get pain experiences. Otherwise, from a psychological view, can the activation alone not be considered as pain. The perception of pain can be modulated through different psychological aspects, cognitive, motivational, affective, and evaluative (Lena et al., 2022). From a neurophysiological position, can subcortical and cortical nociceptiv circuits be activated by psychological factors, without a noxious stimulus (Lena et al., 2022).

Chronic pain differs from acute pain in terms of period, and the impact of daily life, and excluded explicit acute pain (Nicholas et al., 2019). The IASP described pain, as “Chronic pain is pain that persists or recurs for longer than 3 months.” (Treede et al., 2019). Chronic pain is classified with International Classification of Diseases (ICD) 11. As a result of a IASP taskforce the classification of chronic pain is inadequately. To remedy the lack, IASP developed a new classification together with the World Health Organisation (WHO) and coming to the definition above (Nicholas et al., 2019).

To evaluate the severity of acute or chronic pain, the numeric rating scale (NRS), or the visual analogue rating scale (VAS) is used. By using these rating scales, the intensity of pain, interferences with daily life activities, and the emotional distress are recorded. This code is a supplement to the NRS scale, rating from 0 = nil -10 = extreme. Codes are categorized from 0-3 for each dimension, whereas 0 means absent; 1 means 1-3/10 and yield as mild; 2 is moderate and laying between 4-6/10; and 3 is severe pain between 7-10/10 on NRS (Nicholas et al., 2019).

Taken together, pain is a multifactorial phenomenon, which composed of biological, psychological, and social factors contribute to develop chronic pain syndromes. In the next step these factors will be explained in more detail.

3. 2 The neurobiological view on pain

The process of pain is starting with detection of a noxious stimuli, for example mechanical, chemical, or thermal stimuli at the periphery, due to injury. The peripheral receptors are activated by stimuli, followed by an action potential. Second-order neurons transmit the message to the thalamus. The thalamus processes the somatosensory information, neurons project the information in various brain areas. If the response of a stimulus is escape or withdrawal, it is considered as nociceptive (Lee et al., 2023).

Several areas are involved in the perception of pain. They have been detected by hemodynamic methods like functional Magnetic Resonance Imaging (fMRI), by Positron Emission Tomography (PET), or by Electroencephalography (EEG). The localisation depends on the noxious stimulus. Through several studies research could detect main components in neural networks. Areas involved in pain perception are the primary somatosensory cortex (SI), secondary somatosensory cortex (SII), insula cortex (IC), anterior cingulate cortex (ACC), the prefrontal cortices (PFC), and the thalamus (Apakarian et al., 2005; Richter et al., 2009; Ritter et al., 2019). The area which activates pain processes, is called pain matrix.

Furthermore, research have shown differences in acute and chronic pain perception in neural networks. Apakarian et al. (2005) conducted a systematic review with total 30 studies, 20 based on psychological modulation and 10 on somatotopic organization. There was evidence for partially distinction between acute and chronic perception in brain. Chronic pain engages brain areas which are involved in emotional assessment. The connection between emotion and pain will be discussed in the following chapters.

3. 3 Psychological variables and behaviour

Psychological variables are directly related to pain and have impact on the outcome. Variables included in the perception are as followed expectancy, catastrophising, and attention. In case of negative expectation are they leading to anxiety and depression. Psychological conditions,

like anxiety, depression, and stress have impact on pain perception, these should be taken account (Bendetti et al., 2007).

3. 3. 1 Expectancy

Expectancy is an important factor in the perception of pain. Expectancy is very subjective and varying from patient to patient. It deeply depends on patients' earlier experiences with pain. Most patients who undergo a procedure have already an expectancy about their level of pain. Prior experiences are memorized in neural networks, negative experiences lead to negative expectancies and increase negative treatment outcomes (Manai et al., 2019).

It could be said that the patient as well as the healthcare provider have an influence on pain perception. From the patients view on pain treatment, expectancy emanates on prior experiences with pain and pain treatment, but it also depends on how the treatment is presented by the provider and which words are applied (Almarzouki et al., 2017). If the expectation is negatively affected, we are talking about negative suggestions.

So, when we are talking about perceiving of pain, expectancy must be considered. With other words, does the level of patients expected pain intensity, alters the intensity of pain, as shown by several studies (Keltner et al., 2007 in Benedetti et al., 2007). Expectancy is in correlation with another variable which is affecting on pain perception, and this is catastrophizing.

3. 3. 2 Catastrophising

Pain perception can also be influenced by catastrophising. Patients catastrophising pain perception have often the disposition to magnify, ruminate, or to feel helpless (Schumann et al., 2021, p. 698). Negative aspects of pain experience come to the fore and will be over evaluated, in addition catastrophizing will lead to greater pain problems (Schumann et al., 2021; Severeijns et al., 2001).

Whether the patient will experience pain or not, depends not only on his own expectancy or catastrophizing behaviour, but also on the verbal and non-verbal expressions of the providers. Negative suggestions, or the catastrophizing of temporary illness will have impact on the

patients pain perception (Maurus, 2016). The variable which is lying between catastrophising, and pain perception is the attention.

3. 3. 3 Attention

Attention is mobilised by affective responses, and it is a part of the motivational system (Bradley et al., 2001). In the processing of attention, somatic and autonomic physiological systems, in neural brain circuits, are involved. Furthermore, attention plays a role, when the defensive system is active, this happens in a fight or flight situation and will trigger metabolic mobilisation (Bradley et al., 2001). The increase of the defensive motivation is leading from attention to action, this means that a subject has attention on something and the result of this is a reaction (Bradley et al., 2001).

After describing neurobiological mechanisms underlaying pain, and explaining the impact of psychological factors on pain, the next chapter will have focus on the neurolinguistic mechanisms. The next question is, where are these words located in brain and what are they doing?

3. 4 Semantic priming

Previous chapters have shown that psychological factors are playing a role in the perception of pain. Neurobiological-, and physiological function have been explained, and it has been shown, that utilizing of pain-related words can increase pain (Richter et al., 2009). In contrast, positive words, in mode of suggestion or mindfulness can decrease pain. For this reason, is it important to understand how words are manifested in the brain. This chapter will explain, how the brain is defining words, how they will get a meaning, and how they are connected to our emotions. Answers are given by neurolinguistic science and neuropsychology.

From a neurophysiological view, language and behaviour are temporal organized in the prefrontal cortex (Faw, 2000). In linguistics words are considered as linguistic symbols. Symbols are representing something, and its function is to substitute something, that not necessarily has to be present. For example, someone can talk about his mother's love, without presence of the mother, but still feeling it (Schwarz-Friesel, 2013, p. 134). A linguistic symbol consists of two components: Form and content. Content is synonym for sense. Sense has a semantic value, which can be paraphrased e. g. a tree, through plant, has trunks, has

branches, or water is fluid, categorised as drink, and belongs to food. Words have a connotation to greater groups; every word has a basic meaning in the mental lexicon. These words are called hypernym in linguistic (Schwarz-Friesel, 2013, p. 135-137).
So, the use of a single word connected to pain in the mental lexicon can become a trigger for pain. In addition, are words emotional and a part of the affective neurolinguistic (Wu et al., 2020).

Emotional words are grouped in emotional label words and emotional laden words. An emotional label word is referring to states, such as fear, anxiety, or harm, and conveys emotions. Emotional laden words (spider, birthday) are also emotional words, but connecting emotions to connotations, without specifying individual affective states (Wu et al., 2020; Zhang et al., 2017). Applied on a medical context could be said that the word anxiety as an emotional label word affects patients' emotion and increase pain. This has been shown by several studies amongst others (Benedetti et al., 2007).

This approach applied to pain means that pain-related adjectives with affective meaning like excruciating, terrible, or pain-related adjectives with sensory meaning like burning, stabbing, or colic like could be a semantic trigger (Dillmann et al., 2000). Other examples are given by Richter et al. (2009) painted in table 1. To analyse the effect of words on pain most of the experimental studies have categorised the words into three or four groups: Pain-related, negative, positive, or neutral words. Words in the following table are taken from the trial conducted by Richter et al. (2009).

Table 1.

Pain	Negative	Positive	Neutral
Excruciating	Smelling	Warming	Pacing
Paralysing	Dirty	Cuddling	Auditory
Drilling	Scary	Refreshing	Pacing
Crampy	Disgusting	Stroking	Arched
Afflicting	Abhorrent	Elating	Angled

Semantic priming can also be elicited by phrases, prefixes, and adjectives. But the activation of pain-related information occurs often unconsciously, and often providers are not aware their priming (Swanell et al., 2016). Schenk (2008) is here talking about traps in language. Semantic priming is not only triggered by negative and pain-related words, but also by words like ‘normally’, ‘just’, ‘try’, ‘and’ ‘don’t worry but’, and the expert assertion or directive (Schenk, 2008, p. 54-55). Perception can also be manipulated by ambiguity, jargon, emphasising the negative, causing uncertainty, or by trivialization (Häuser, et al., 2012, p. 461). The following will give examples of language trap.

Priming words are leading to misinterpretation and confusion. ‘Just’ could be interpreted as a restriction. For example, the sentence "Just remember to avoid eating grapefruit when you take this medication” (Schenk, 2008, p. 54). The patient could construe this as the only restriction in the treatment and don’t remember the other medical instructions, because his focus is only on the grapefruits. Another communication failure is to lead the attention to pain with sentences like “Signal if you feel pain” (Häuser, et al., 2012, p. 461).

In a hospital setting critical care nurses can influence expectancy of patient in different situation. Especially in acute situations are patients exposed to language traps. This is starting by manipulating the expectation of patients in such acute settings, which are often connected to stress (Schenk, 2008). Another misapprehension but often well-intentioned is the attempt to encourage the patient by suggestions like “It will not hurt”. This sentence contains a negative suggestion, to wit the word hurt. From this moment, patients’ attention is laying on “hurt” which has a connotation to pain. Following table will give examples for negative and positive suggestions.

Table 2.

Negative suggestion	Positive suggestion
“Her’s your pain medicine.”	“Here’s some medicine to get you more comfortable.”
“You’re finished”.	“The surgery is complete; healing has already begun”.
“You can expect to have [symptom-for example, pain, swelling, bleeding]	“After that sort of treatment, I have had an occasional patient, who experienced [symptom], but I’m sure if you look after that healing area as we have instructed, you will be pleased as how quick it heals.” [Notice the intentional use of “but” in this sentence.

Examples are given by Schenk, 2008, p. 56

Taken together, words are referring to subjects or items, they are a part of our memories. Memories are playing a role in pain perception, but also in the development and maintenance in chronic pain conditions.

A better way to communicate with the patient is to use clear communication style by avoiding the use of negative or ambiguous words. Until now word categories are described as negative, positive, neutral, trigger or primes. In medicine the use of negative primes is called nocebo and manipulation in a positive way is called placebo effect (Häuser et al., 2012). The next chapter will give a definition and information about the effects of nocebo and placebo.

3. 5 The nocebo and placebo effect

The term nocebo comes from the Latin word "*nocebo*", which means "I shall harm" and is the negative antagonist of "*placebo*" which means" I shall please" (Schenk, 2008). Nocebo is caused by negative suggestions and must be seen in the light of a negative psychosocial context, and it can be explained as an adverse effect on a treatment, without causes in the actual treatment (Manai et al., 2019). Nocebo refers to the patient and the treatment around him and can be the cause for inadequate pain relief or worsening of pain intensity. A nocebo effect can be triggered by sensory, physiological, behavioral, and effective causes (Bagarić et al., 2022). In according to this, the responses of nocebo can be analysed on different levels or components. For example, could a sensory component be pain severity, on a physiological level the body could for example releases cortisol, measurement of reaction times can be attributed to the behavioral level, and discomfort with pain could be assigned to affective levels (Bagarić et al., 2022).

As already shown have emotions to be seen in relation to expectancy. The impact of nocebo on emotion is evoking greater levels of anxiety, distress, worsening of mood, and increased attention to bodily symptoms (Almarzouki et al., 2017; Bagarić et al., 2022).

The positive antagonist of nocebo is called placebo. The placebo effect was found in 1978 when researchers used a pharmacological approach to examine the effect of placebo (Levine et al., 1978). Placebo treatment is a sham treatment, and its aim is to make the patient believe

to get a better improvement of the therapy (Colloca & Barsky, 2020). Thus, placebo effect can be subsumed under the psychobiological phenomenon (Benedetti et al., 2005). Mechanisms behind the placebo effect are the expectation of improvement and conditioning in a Pavlovian sand. At least have placebo effects an impact on the mental and physical health (Benedetti et al., 2005). It reduces anxiety, which in turn reduce pain (Benedetti, et al. 2005). In other words, are there different ports and ways to induce pain, but also to battle pain.

To better understand the nocebo and placebo effect, it is necessary to give some neurophysiological explanations. The next chapter build on the knowledge from the neurobiological introductions and will describe functions of the several brain areas which are included in the perception of pain.

3. 6 Neurobiological approaches

On a neurobiological level, there will be an effect of nocebo or placebo language on patients' brain and body (Benedetti, et al. 2007). From a neurobiological view, there are differences between placebo and nocebo effects in different brain areas.

The pain matrix includes a set of brain areas, the thalamus, anterior cingulate cortex (ACC), which is a part of the limbic system, associated with emotions, dorsal anterior cingulum (dACC), anterior insular cortex (IC), and the postcentral gyrus (primary somatosensory cortex S1 and secondary somatosensory cortex S2, processing sensory information), which belongs to a part of the central nervous system structures. These regions are active both on an imagination and a distraction condition (Richter et al., 2010).

Areas above are reacting transient on nociceptive stimuli causing pain. As already mentioned, has pain also a cognitive component. The cognitive evaluation of pain occurs in the prefrontal cortex. In addition, the medial prefrontal cortex (mPFC), dorsolateral prefrontal cortex (DLPFC), and orbitofrontal cortex are areas associated with pain (Garcia Larrea &Peyron, 2013).

After the presentation of the different brain areas which are related to pain, the next chapter will explain the different types of treatment interventions.

3. 7 Therapeutic treatments

Aim of the following chapters is to explain and present the treatment interventions of this trial. Treatments are grouped in three main categories: Psychological interventions, manipulation communication, and educational therapy. The psychological interventions consist of: Cognitive behavioural therapy, neuro-linguistic programming, hypnosis, guided imagery, mindfulness, virtual reality, and combination of hypnosis and cognitive behavioural therapy, and hypnosis combined with virtual reality.

3. 8. 1 Cognitive behaviour therapy

Cognitive behaviour therapy bases on the cognitive model of mental illness and was developed by the psychologist Aron Beck in 1964. The theory of Cognitive behavioural therapy is that the emotion and behaviour of a human is influenced by his perception of an event. Cognition is described as the way we are reflecting and thinking about situations and the content of our thoughts (Fenn & Byrne, 2013). How a situation is evaluated depends on the perspective that a person has on an event. For example, a patient with fear and depressions tend to interpret a situation in a negative way (Fenn & Byrne, 2013).

Beck (1976) drafted three levels of cognition which have influence on patients. On the first level are the core beliefs, a negative example is a believe such as “I am not god enough”. The second level describes the view of the patient on the world. Such a believe could be “The world is bad”. And the last level tells something on the perspective on future “Things will never be god for me”. The key strategy to help the patient out of this cycle is self-efficacy. The patient should learn to define his problems and find a way to manage them. The strategy is to look forward and not past and to develop goals (Fenn & Byrne, 2013). Thereby will the therapist try to understand patients view on the world and help to expand their thoughts. Patients should also be aware the assumptions underlaying their unhelpful believes.

The aim of the cognitive therapy is to lead patients’ attention to something outside their focus (Fenn & Byrne, 2013). Another treatment option to change behaviour is the neuro-linguistic programming.

3. 8. 2 Neuro-linguistic programming

Neuro-linguistic programming has its origin in 1974 and was developed by the psychologist Richard Bandler, Frank Pucelik and the linguist professor John Grinder. The founders of neurolinguistic programming tried to create methodologies for modelling behaviour. Observing and collecting samples of the most successful psychotherapists they developed interventional techniques and replaced them in work with their participants. These efforts led to a set of intervention models and techniques (Harriss, 2013).

The intention of developers of neuro-linguistic programming was to understand how people internally represent their world, and how these representations are a reflected in the speech patterns of the subjects (Harris, 2013). Modelling techniques consists of anchoring-techniques, visualisation, reframing, changing the sub modalities, visual-kinesthetic dissociation. A neuro-linguistic programming practitioner primarily uses words to manipulate the participants thoughts and inner sensory processes, studying thinking and communication patterns. These techniques are used and accepted in psychotherapeutic settings like Cognitive Behavioural Therapy, Rational Emotive Therapy or Acceptance and Commitment Therapy (Zaharia et al., 2015).

Neuro-linguistic programming primarily bases on neurobiological, phenomenologically systemic, and metatheoretical considerations (Zaharia et al., 2015). The effectiveness of neuro-linguistic programming has been tested in several studies with different levels of validity scientific structures and have shown different results, presented by Zaharia et al. (2015). One strategy also used in neuro-linguistic programming is hypnosis.

3. 8. 3 Hypnosis

Hypnosis is defined as: “A state of consciousness involving focused attention and reduced peripheral awareness characterized by an enhanced capacity for response to suggestion.” (Elkins et al., 2015, p. 382).

How does hypnosis work? Hypnotic suggestions are capable to elicited changes into perceptual states, and consciousness in responsive subjects. Hypnosis and hypnotic suggestions have impact on activity in central nervous system (CNS) areas, thalamus, anterior

cingulate cortex, insula cortex, prefrontal cortex, and parietal cortices, which are the same areas involved in pain perception (Elkins et al., 2015).
Hypnosis is normally starting with an introduction into the procedure, given by a person to guide another. Participant is invited to follow the suggestion or suggestions and make imaginative experiences. Thereby the time of introduction and suggestion can be varying from a few minutes to several minutes (Elkins et al., 2015).

Aim of the hypnosis is, to make the participant using his own imagination, to expand the attention, such that the participant can absorb the suggestions, and getting a reduction of awareness. The content of hypnosis has a diverse repertoire, it may include relaxation, making the body feel heavy or easy, suggestions to increase alert, and attentional absorption (Elkins et al., 2015; Terhune et al., 2017).

Expectation also plays an important role in hypnosis. Some people are more sensitive for hypnosis then other (Terhune et al., 2017).
In psychology and neuroscience hypnosis yield as "top-down" regulation (Garcia-Larrea & Peyron, 2013). Top-down regulations perception goes downwards from brain to a more specific level.

Hypnosis have been applied in experimental studies, examining the effect of hypnosis on pain. The studies conducted by Derbyshire et al. (2004 and 2009) have shown, the impact of hypnosis on pain in healthy and chronic pain participants. In this experiment healthy participants got suggesting for feeling pain in the hand, the participants responded by reporting pain. In addition, activities in nociceptive brain circuits were shown in fMRI (Derbyshire et al., 2004). But on the other side can hypnosis or hypnotic suggestion decrease pain. Derbyshire et al. (2009) conducted a trial with chronic pain patients, suggesting pain with hypnotic and non-hypnotic inductions. Individuals got suggestions about that their pain was either low, medium, or high. The participants reported increased pain, and increased cortical activities occurred in fMRI after suggesting pain. Suggesting low pain, resulted in decreased pain, and decreased cortical activities. Furthermore, hypnotic suggestions had a larger impact, than non-hypnotic suggestion (Derbyshire et al., 2009). Hypnotic suggestions have also impact on pain unpleasantness. Research succeeded in increasing and decreasing in ratings of pain unpleasantness, but they did not have an impact on pain intensity (Rainville et al., 1997). Rainville et al. (1997) have also identified changes in EEG patterns following

hypnotic suggestions. Faster brain wave activities, e. g. beta-waves decreased, and the number of slower waves, like alpha-waves increased.
The Stanford Hypnotic Susceptibility Scale (SHSS) is an assessment tool to assess hypnotisability (Kekecs et al., 2021). Other studies are using the VAS scale, whereas hypnotisability is ranged from high to low (Rousseaux et al., 2020). Another method related to hypnosis is the guided imagery.

3. 8. 4 Guided imagery

Guided imagery is a mind body technique and is a part of the complementary medicine (Foji et al., 2015). An important factor in guided imagery is the relationship between body and mind. The participant of a guided imagery intervention will have benefit from this treatment (Foji et al., 2015).

In guided imagery all five senses are covered, but it seems that the visual sense is more dominant than the others (Pearson, 2019). Humans are processing imagination on different ways, but the content of an imagery can induce perceptual visual learning and improve the visual sensitivity (Pearson, 2019). With other words, applied on the pain situation of patients will a repeated session of guided imagery make it easier for the patient to visualize positive and helpful imaginations.

From a neurobiological point of view, the activation of individual areas depends on the content of the imagination. However, areas activated in the process of guided imagery are the frontal cortex, the hippocampus, visual cortex, and default mode networks, which are network groups some regularly show up in rest periods (Pearson, 2019). Furthermore, in guided images, the same areas in the brain are activated as in a real experience (Foji et al., 2015). Finally, mindfulness joins the suggestive treatment interventions.

3. 8. 5 Mindfulness

Mindfulness belongs to the different types of meditations found in different cultures. In mindfulness the subject is paying attention to change in breath, observation of discursive thoughts, to be present in the moment and have experiences (Tang et al., 2015; Zeidan et al., 2011).

Mindfulness have impact on attentions and emotions. Multiple brain regions are involved in the mindfulness process. Several studies found responses in cerebral cortex, subcortical grey, and white matter, brain stem, and the cerebellum. Tang et al. (2015) lead this back to interactive networks in brain. Mindfulness involves multiple aspects of mental function. Moreover, consistent changes were found in eight brain regions during meditation: the hippocampus, sensory cortices and insula, anterior cingulate cortex, frontopolar cortex, mid-cingulate cortex, orbitofrontal cortex, superior longitudinal fasciculus, and the corpus callosum (Tang et al., 2015; Fox et al., 2014). Compared to the hypnosis, the same brain regions are involved in the process of mindfulness (Tang et al., 2015).

Now, it is possible to combine these interventions with each other. Such an example is a hypnosis treatment combined with virtual reality.

3. 8. 6 Virtual reality and hypnosis

Virtual reality is a technique which allows the user to distract from the actual environment (Jensen, 2009). Virtual reality is playing in a three-dimensional, immersive space. The advantage of virtual reality is that it replaces the verbal cues of the therapist. The visualization of the therapeutic instructions is difficult for many clients. Another advantage is that virtual reality can be used by patients with hearing impairments, patients with compromised cognitive capacity, and and may enhance the hypnotic response in patients with low hypnotisability (Askay Wiechman et al., 2009).

Furthermore, virtual reality is a way to expand the use of hypnosis, but it cannot replace live hypnosis (Askay Wiechman et al., 2009). Virtual reality allows the researchers to adapt the virtual world to the clinical picture as shown by Askay Wiechman (2009) creating a snow landscape for patients with burn injuries.

Until now the psychological treatments such as cognitive behavioural therapy, neuro-linguistic programming, hypnosis, guided imagery, mindfulness, and the combination of hypnosis with virtual reality have been explained. All these techniques are manipulating suggestions and/or help the patient to visualize and reach pleasant states.

A more practical way in the treatments of pain is to educate patients about pain. The next chapter will give a short introduction in educational therapies.

3. 8. 7 Educational therapies

Educational therapy intervention includes several measurements to teach the patient about pain. Patients are getting explanations about chronic pain, underlying physiological processes, sleeping problems with pain, pain theories, and pain treatments. Sometimes patients are getting handouts or brochures for home practicing (Ehde & Jensen, 2004). The overall aim of the educational therapy is to provide the patient with more knowledge about pain, and the patient can integrate this knowledge in everyday life.

The previous chapters provided definitions to get a better understanding of the treatment interventions in the following trials. In the next chapters theoretical frameworks will be described, starting with two neurobiological theories followed by the psychological ones.

3. 9 Theories

3. 9. 1 Theory of neural networks (TNN)

Theory of neural networks was developed by the Canadian psychologist Donald Olding Hebb. In his publication "The Organization of Behaviour" in 1949, Hebb postulated the neurophysiological theory of cell assemblies. He hypothesized, that an axon of a cell can excite the neighbour cell. Through repeated and persistent interaction, the cell A is firing cell B, and a growth process is started. In addition, a metabolic change takes place in one, or both cells. As a result of this interaction, cell A is coming to be more efficiency and will grow. Those cell assemblies are building so-called neural networks.

Hebb related behaviour to synaptic organisation through the dynamics of neural networks (Hebb, 1949). Expressed with other words, is behaviour the result of the interaction of neuronal cell assemblies. The following motivational priming theory has to be seen in relation to the Theory of Neural Networks.

3. 9. 2 The Motivational Priming Theory

The motivational theory goes back to the American psychologist Peter J. Lang. Lang is a professor of psychology at the Graduate Research Centre for the Study of Emotion and Attention in Florida (https://chp.php.ufl.edu).

In the 1970s, he began to explore the connection between emotion and attention. Lang hypothesized, that emotion is organized around two motivational systems, so-called appetitive and defensive. These two systems are responsible for reactions which either support or threaten physical survival (Lang et al., 2001).

Lang et al. (2001) described emotions as systemic reactions, triggered by underlying motivations. These motivations arises when highly motivated actions are delayed or inhibited, such as escape or attack (Lang et al., 2001). Another option is, that an organism demands on something, that is considered important e. g. nourishment, which is essential for our body. As mentioned above, emotions were controlled by two opposite motivational systems, the appetive and the aversive system, also called the defensive system. The appetitive system is activated by consumption, propagation, and nourishment. The defensive system is activated when there is a danger to the body, such as pain. It is related to flight and expressing oneself in avoidant behaviour (Lang, 1995). When the defensive system is activated, neurophysiological, motivational circuits are stimulated, following by physiological responses (Lang, 1995). Neurophysiological, the so-called startle reflex or response can be observed. In laboratory experiments, an increased amplitude in the EEG has been observed, when the body is defensively motivated by unpleasant sensations, such as pain. Conversely, the amplitude is lower when the body was triggered by the appetitive system in connection with positive experiences (Lang, 1995). Taken together when a subject is supposed to a unpleasant situation, such as pain, the defensive system is coming to be activated, which is also evident in physical reactions. When a subject is positive motivated the defensive reaction will be diminished. In addition, are these reactions stronger, when a stimulus is emotionally experienced (Lang, 1995; Lang et al., 2001).

It was already shown that negative primes have influence on the pain perception, this was already described by Lang (1995). As a result of his experiments, it was shown, that negative

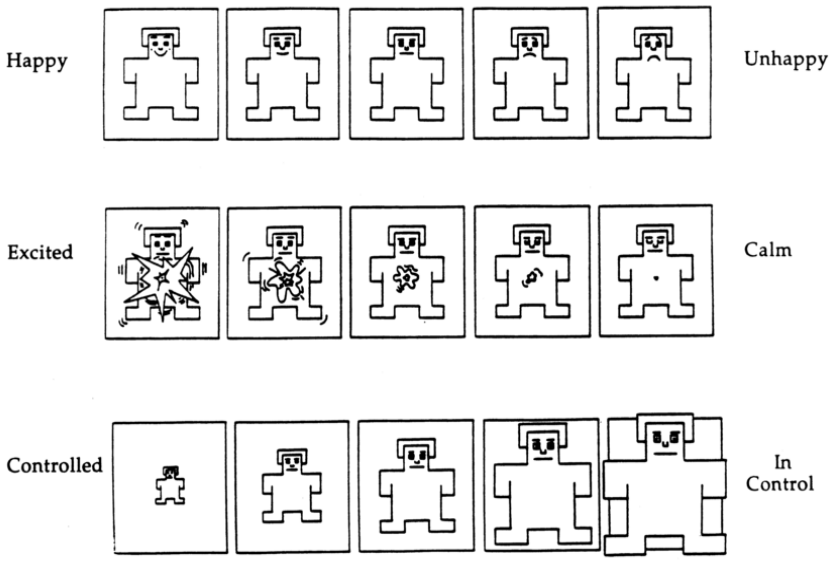
emotional priming (e. g. pain-descriptive words) can increase arousal, pain sensation and activate pain memory (Lang, 1995).

The Motivational Priming Theory has been tested in recent experimental trials. Ritter et al. (2019) and Williams et al. (2012) also concluded that the motivational priming theory could be applied in evaluating pain outcomes by priming with visual or auditory affects. In a trial conducted by Ritter et al. (2019) researchers found significant difference in outcomes when participants were informed about the addition of pain stimuli before starting the experiment. Pain-related and negative words increased pain intensity by semantic priming, i.e., by painful stimuli in opposition to neutral words. Consistent with motivational priming theory, Richter et al. (2014) found stronger pain assessment for subsequent electrical stimuli after negative and pain-related priming words in comparison to neutral priming words. The same reaction appears when participants were stimulated by negative pictures before they were exposed to an electrical stimulus. In this case, researchers observed an increased heart rate, nociceptive flexion reflex, and changes in skin conduction (Ritter et al., 2019). Similar results were found by Williams and colleagues (2012) determining the effect of noxious pictures on emotional reactions.

Taken together, recent studies have shown that priming the defensive system using unpleasant stimuli results in larger startle reflexes, called a defensive response, while priming the appetitive system with pleasant stimuli generally results in less frightening reflexes.

To make the results reliable and replicable, in the 1980s, Lang developed the Self-Assessment Manikin (SAM), a rating system to measure affective reactions. These are classified in the three variables valence, arousal, and dominance. Valence describes the experience of emotions, if they are experienced as negative or positive, arousal refers to relaxation or agitation, and dominance give information about emotion are connected to control (Lang et al., 2001).

Valence and arousal belong to specific motivational systems of the brain (Lang, 1995). SAM consists of three shrimps with five pictograms. In each shrimp, a dimension is displayed. The rating scale ranges from 1 to 9, with 1 being the lowest score and 9 the highest. SAM is objective, language-free and is transferable.



Picture 1: Hentet fra www.researchgate.net. https%3A%2F%2Fwww.researchgate.net%2Ffigure%2FThe-Self-Assessment-Manikin-SAM-Measure-Scales-valence-arousal-and-dominance-pole_fig1_227603901.

SAM makes it easier to assess emotions under experimental conditions and make them transferable. All affective stimuli utilized in experiments, such as images, acoustic stimuli and words are retrieved by standardized internationally used systems. Images were taken from The International Affective Picture System (IAPS) called EYE APS, together with the International Affective Digitized Sound system (IADS) and the Affective Norms for English Words (ANEW). All collections were developed by the NIMH Center for Emotion and Attention (CSEA) at the University of Florida. The systems are suitable for a standardized collection of emotions. The results are transferable to other experimental studies, are realizable and can be carried out internationally (Lang et al., 2008).

The following chapters will deliver psychological explanations about the behaviour underlying pain.

3. 9. 3 Cognitive behavioral

Modern psychological pain therapy treatments are based on cognitive behavioral approaches, which take biological, psychological, and social factors in considerations. In 1977 Albert Bandura an American psychologist, developed the concept of self-efficacy as a part of social learning theory (Bandura, 1977). Bandura postulated that every change in behaviour is mediated through a cognitive process. Furthermore, are expectations of personal efficacy

altered through psychological processes. Bandura distinguished between efficacy expectations and outcome expectations (Bandura 1977, p. 79-80). We are talking about outcome expectations, when a person estimate that the behaviour will lead to a certain outcome. Efficacy expectation is defined as the behaviour which allows a person to believe, that he or she has already the conviction that is needed to produce the outcome. If a person tries to cope with a difficult situation it depends on how strong the conviction of their own effectiveness is (Bandura 1977, 79-80).

Bandura performed four major sources for self-efficacy: Performance Accomplishment, Vicarious Experiences, Verbal Persuasion, Emotional Arousal. Performance Accomplishment is based on personal experiences. Thereby will success increase mastery expectations, while a repetition of failures will lower the effect. When a subject has developed strong efficacy expectancy, will a negative impact be reduced. When such expectancies are established, the subject will generalize in similar situations (Bandura, 1977, p. 81).

Subjects have different experiences and are guided by the behaviour of another person. This is called modelling. Seeing the succeed of the other person, they persuade themselves to achieve improvements. When the result of a models disinhibited behaviour is successful, it has more effect on the observant and will leads to more improvement, than a performance without evident consequences. With other words is the model successful with, the observant has reasonable basis to increase his own self-efficacy (Bandura, 1977, p. 81-82).

Verbal persuasive suggestion are used to make subject believe, that they can cope successfully with circumstances happened in the past. According to Bandura are verbal induced efficacy expectations not constant. Expectations will be extinguished by disconfirming experiences, cause of the long-time of failure (Bandura 1977, p. 82). Bandura points out, that verbal suggestions to create expectations should be based on authentic experience, otherwise suggestions will be too weak. Emotional arousal can also have influence on the efficacy expectation. High arousal decreases performance. Furthermore, the odd to expect success is higher when a subject is not beset by aversive arousal (Bandura 1977, p. 82).

3. 9. 4 Biopsychosocial model

At the same time George Engels plead for changes in biomedicine. Engels criticized several points in the traditional medicine at his time. First the reductionism in the traditional medicine. It was assumed, that medical phenomena derived from only a single source. Engle argued instead for a multifactorial approach (Fava & Sonino, 2017).

The other major critic referred to the lack of integration of behavioral and social science into the medical considerations. He also criticised the restricted view on diseases. Medicine primarily was based on diagnosis and treatment, not being aware the factors lying behind diseases (Fava & Sonino, 2017). Engels turned from a biomedical model to a biopsychological model. Engels underscored that pain is a psychic phenomenon. He also noted that the cause of pain is permanently registered in the central nervous system and called this for “pain memories” (Engel 1959, p. 901).

Summarized, the theoretical framework has shown, that pain perception is starting on a neurobiological level where cell assemblies are building clusters. On an overarched level are these assemblies determining the behaviour. It was also shown that behaviour depends on a motivational system, which is a trigger for emotions. When a subject experienced pain, the defensive system is active. The reaction of a subject depends on his experiences and expectations. Cognitive behavioural therapy can change unhelpful thoughts and guiding a subject to the principals of self-efficacy.

4. Method

4. 1 Design

For this study a restricted systematic review was conducted with regard to available time for a master thesis. Normally systematic reviews are considered as “the golden standard”. It requires much more time, up to two years, to create a systematic review than a so-called rapid review (Garrritty et al. 2016). The term rapid review has been criticized by several authors like Plüddemann et al. (2018) Garritty et al. (2016). They pointed out that the term rapid review is misnamed and recommend instead of systematic restricted review. Restricted systematic review is suitable for researchers conducting evidenced based decision makings in timely restrictions.

The cardinal feature of a restricted review is that it requires simplified or omitted elements as full performed systematic reviews. It should include a clear formulated research question, use in minimum one database, tools for assessing the risk of bias and additional steps. Research must be replicable, therefore an exact documentation of searching strategies is necessary. The advantage over a systematic review is, that determination of a study can be performed by a single researcher, but a second researcher with experiences in systematic reviews should be part of the team. ((Plüddemann et al., 2018).

Step 1: Data searches and sources

I followed the Preferred Reported Items for restricted systematic reviews (Plüddemann et al., 2018; Higgins & Green, 2011) and searched the following databases CINAHL, PubMed, and Embase. In addition, the reference lists of the studies were scanned. The electronic search strategy was created by the researcher and a professional librarian who was involved in search. To ensure that the findings reflect current research and to avoid repeating previous research, the period of published data was restricted from 2013 to 2023. This review is based on the systematic review from Mistiaen et al., conducted in 2015. The period of the present research is dated back to 2013 and included only one study from 2013, which was not conducted by Mistiaen et al. 2015 to avoid repetitions.

4. 2 Study selection

A Priori Eligibility Criteria

Key elements of this review are encapsulated by the Population, Intervention, Control, and Outcome, represented in textbox 1. Population includes diseases of patients, in addition timing assessment was attached. Randomized controlled trials were conducted because they yield as the “golden standard” in research (Polit & Beck). Searching strategy derived from the standard framework population, intervention, comparison, outcome (PICO).

The process proved to be difficult because communication includes several terms and meanings. It was necessary to find out the right keywords to get the desired results. Searching started with several terms like P= patient/pain; I= communication; negative and positive words; verbs, wording; C=usual care; O= pain improvement/opioid reduction. Getting not the desired results searching strategy was changed. The researching strategy included different types of psychological interventions and medical terms.

The terms listed above represent a high-level schema. The advanced search is presented in appendix 1.

- Population: Patients with chronic or acute pain
- Intervention: Communication
- Control: Standard care
- Outcome: Pain, pain perception, pain expectation, and anxiety

The inclusion and exclusion criteria are listed in textbox 1.

Textbox 1. Inclusion and exclusion criteria

Inclusion criteria

- Randomized controlled trials and quasi experimental trials
- Population of adult patients with acute or chronic pain
- Inpatients or patients in the doctor's office
- Enhanced empathy communication interventions
- Placebo effects by manipulating expectancy
- Psychological intervention and conversation, therapeutic conversation
- Face to face interventions or conducted by telephone
- Interventions with positive suggestions by Hypnosis
- Patient outcomes of pain or pain perception or expectancy on pain
- Before and after studies
- Published in English

Exclusion criteria

- Review studies, study protocols, book chapters, and conference contributions
- Children and adolescent patients
- Psychiatric instable patients, cognitive impairment, participants with alcohol or drug addiction and intellectual disability
- Noncomparator study designs
- Insufficient detail provided to estimate study outcome

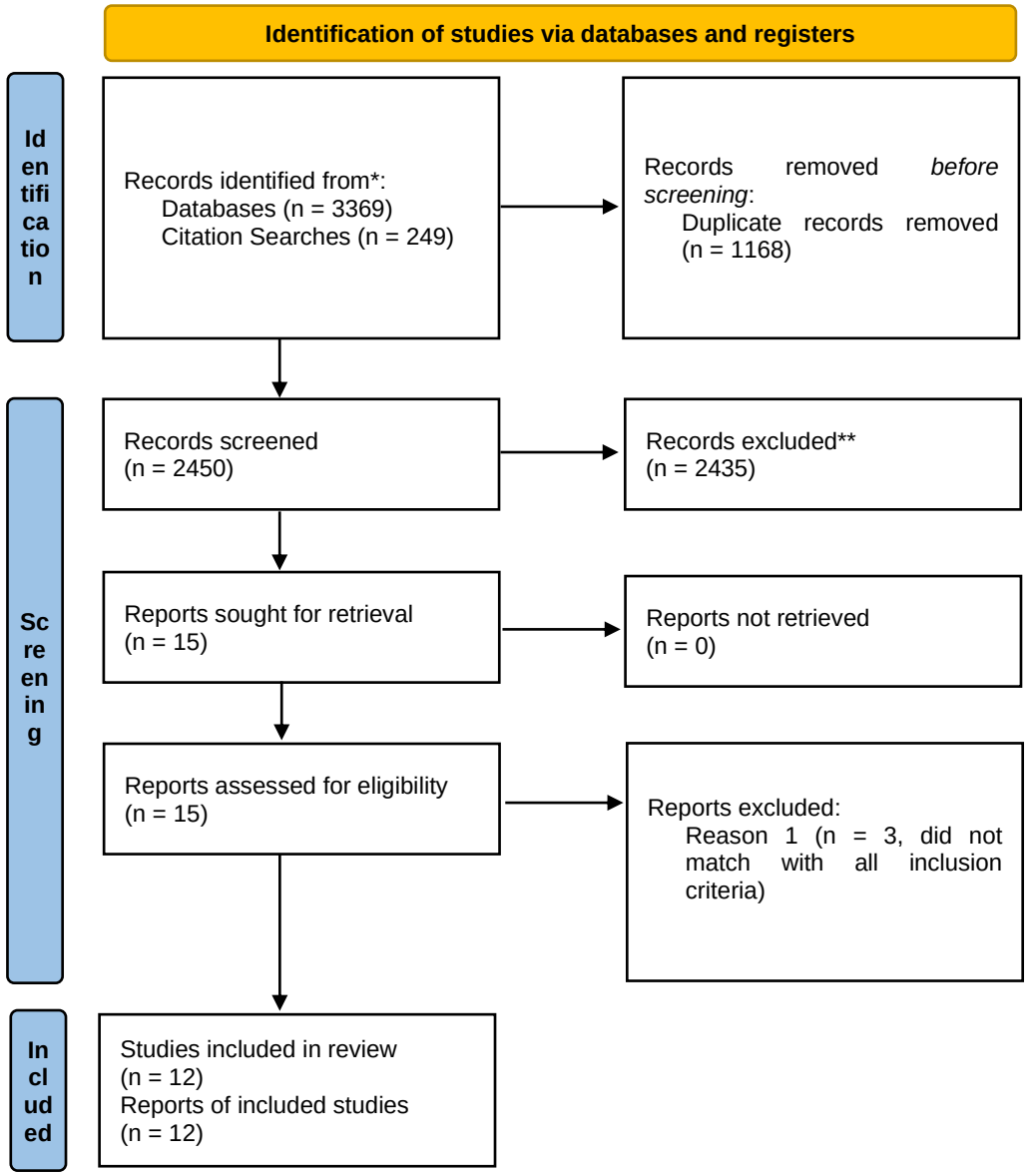
Step 2: Study Selection

There are ongoing discussions about what the best evidence for clinical decision-making is, and numerous of organizations have created evidence hierarchies. For this research the level of evidence (LOE) created by Polit&Beck (2020) was chosen. Level one is considered to be the best level. It is a source of systematic reviews of randomized controlled trials. To provide effects of controlled experiments, randomized controlled trials yield as the "golden standard" (Polit&Beck, s. 177). Aim of a randomised controlled trial is to determine an effect of an intervention, therefore is it the best design for the present research question.

The theoretical framework of this review is based on books as origins and systematic reviews have been used to find experimental randomized controlled trials to support the theories. The studies identified for inclusion in this review, in January 2023, were searched in the following databases: CINAHL, PubMed, Embase.

To identify further studies not retrieved by electronic search in the databases google scholar, Clinic Trial Gov and reference lists were checked. Systematic reviews and randomized controlled trials, theoretical articles and books were used as secondar literature. Methodological filters were applied to find randomized controlled trials in the databases. Using the a priori eligibility criteria, titles and abstracts were scanned in the different databases. Duplicates were removed from Rayan. The results of the data search and selection process are displayed in a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) flowchart. (Figure 1)

Figure 1:



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: http://www.prisma-statement.org/

Step 3: Data extraction

Tables were created to ensure consistent data extraction. Information extracted from included studies were as followed:

1. General information (author, published date, title, origin)
2. Study method (aim of the study, aim of the intervention, study design, methods of participant recruitment, inclusion and exclusion criteria, informed consent and ethical approval, funding)
3. Risk of bias (random sequences generation, allocation concealment, blinding of participants, providers and outcome assessors, incomplete outcome data, selective outcome reporting, statistical analyses)
4. Patients (description, geographic location, setting, number, age, principal health problem or diagnosis, treatment received)
5. Interventions (details of control or intervention group, time measurement, treatment duration)
6. Outcome (pain severity, assessing methods of pain outcome, timing of outcome values following up)
7. Providers

Step 4: Critical Assessment of Included Studies

To minimize the risk of bias and ensure the quality in the included studies, a Mixed Methods Appraisal Tool (MMAT) was used (Hong et al., 2018). This tool aims to appraise the methodology quality of studies in systematic reviews. For this review, the checklist for quantitative randomized controlled trials design were used. Following the algorithm for selecting the study categories each design started with two screening questions to answer with yes or no. For further assessment the list for the methodological quality criteria contains five assessment criteria to answer with Yes, No, Can’t tell (Hong et al., 2018).

The author (CB) independently assessed each primary study using the MMAT version 2018. One supervisor (IMM) independently appraised three of the articles to enhance objectivity and reduce bias. Disagreements were resolved by consensus.

Table 3. MMAT assessment included studies (Responses: Yes, No, Can't tell)

	Screening questions *Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.*		**Assessment criteria 2. Quantitative Randomized controlled trials**					**Comments**
First author year	1. Are there clear research questions?	2. Do the collected data allow to address the research questions?	2.1. Is randomisation appropriately performed?	2.2. Are the groups comparable at baseline?	2.3. Are there complete outcome data?	2.4. Are outcome assessors blinded to the intervention provided?	2.5 Did the participants adhere to the assigned intervention?	
Aghakhani (2022)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	
Broderick (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Chooi (2013)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	
Doğan & Saritaş (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Garland (2017)	Yes	Yes	Yes	Yes	Yes	No	Yes	Assessors were not blinded due to the intervention
Hernández (2022)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	
Jensen (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Parizad (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Rousseaux (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	Assessors were not blinded due to the intervention
Van Vliet (2019)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Yin (2022)	Yes	Yes	Can't tell	Can't tell	Yes	Can't tell	Yes	
Wiechman (2022)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	Randomisation 2:1:1 ratio

Step 5: Data synthesis

The findings on psychological interventions, educational therapy, and placebo/nocebo communication interventions on pain perception were systematically analysed by using thematical analysis, searching categories and themes across the studies as presented by Whittemore and Knafl (2005). The effect of communication on patient's outcome was reported and reviewed narratively and presented in tables.

Step 6: Publication

The results of this systematic restricted review will be published with all appendices and added data.

4. 3 Ethical considerations

All included studies were following ethical standards and considerations. No ethical conflicts are declared.

5. Results

5. 1 Overview

The literature search process is outlined in figure 1. The research yielded a total of 3369 references; after the removal of 1168 (35%) duplicates, 2450 (73%) titles and abstracts were assessed for inclusion. Of the 2450 titles and abstracts, 15 (1%) titles pertaining to communication interventions for patients with pain were screened for eligibility. Of the 15 studies evaluated for eligibility in full text 12 (80%) met all inclusion criteria and were included.

Screening the reference lists of the included studies yielded another study and screening the reference lists of relevant background material identified a further study. Finally, this review included 12 studies.

5. 2 Study characteristics

Four of the twelve studies (33%) have been conducted in the USA (Broderick et al., 2014; Garland et al., 2016; Jensen et al., 2020; Wiechman et al., 2022). Two studies (17%) have

been conducted in Iran (Aghakhani et al., 2021; Parizad et al., 2019). One study (8%) has been conducted in China (Yin et al., 2022), one study (8%) in Australia (Chooi et al., 2013), one study (8%) in the Netherlands (van Vliet et al., 2019), one study (8%) from Mexico (Hernández et al., 2022), one study (8%) from Turkey (Doğan & Saritaş, 2021) and one study (8%) from Belgium (Rousseaux et al., 2020).

Ten of the twelve studies (83%) contained psychological interventions such as cognitive behavioural therapy, neuro-linguistic programming, guided imagery, hypnosis, mindfulness, virtual reality, and psychological conversation (Aghakhani et al., 2021; Broderick et al., 2014; Doğan & Saritaş, 2021; Garland et al., 2017; Hernández et al., 2022; Jensen et al., 2021; Parizad et al., 2019; Rousseaux et al., 2020; Wiechman et al., 2022; Yin et al., 2022).

Two of the twelve studies (17%) had focus on placebo/nocebo communication interventions by delivering positive suggestion such as positive sentences, positive questions, and using a comfort scale (Chooi et al., 2013). The other intervention included manipulation of communication by using positive words, showing enhanced empathy, and manipulating the emotions (van Vliet et al., 2019). In this group, treatment interventions included manipulation of language by using positive words, psychological intervention which included psychological conversations, and manipulating emotion by showing enhanced empathy to the participants.

Two of the twelve studies (17%) determined the effect of educational intervention on pain (Garland et al., 2017; Jensen et al., 2021).

5. 3 Categories derived from Data analysis

In the following section the data analysis results are presented, thereby answering the research questions concerning intervention content and effects. In all, three modes of delivering psychological, placebo/nocebo communication, and educational interventions were identified (Table 1).

The specific strategies identified included; (1) psychological care with cognitive behaviour therapy by changing negative into positive helpful thoughts, pain coping skills training, establish positive goals, recall successful experiences, distraction through virtual reality,

attention on breathing trough mindfulness, modelling, reframing, and anchoring with neuro-linguistic programming, and getting relaxed, holding attention with hypnosis and guided imagery, (2) manipulation of communication by using placebo and nocebo effects, and (3) education delivering with educational brochures, education about pain, and interactive home practice.

Table 4. Data extraction

Study (first name, origin, year	Design	N analysed	Mean (SD) Age	Population	Trial arms	Effect Cohen's d	Contrast p-value for posttreatment pain
Aghakhani et al. (2022) Iran	RCT	70	GI 32.1 (5.67) CG 33.83 (5.95)	Patients with burn injuries	GI Control group	Not Applicable (N/A)	pain quality: p<.001 pain severity: p<.001
Broderick et al. (2014) USA	RCT	256	CT 66.37 (10.26) CG 68.00 (8.67)	Osteoarthritis knee and hips, chronic pain	Cognitive Therapy	N/A	p<.001
Chooi et al. (2013) Australia	RCT	300	Pain 31.2 Comfort 30.8	Caesarean sectio	Comfort scale Pain scale	N/A	pain in rest: p=0.001 pain in movement: p<.001
Doğan et al. (2021) Turkey	RCT	132	NLP 62.27 (9.85) GI 61.52 (9.99) CG 62.29 (10.22)	Open heart surgery	NLP GI Control group	N/A	P<.001
Garland et al. (2017) USA	RCT	244	51.1 (16.6)	All in patients with acute pain	HYP-suggestions Mindfulness Psychoeducation	N/A	p<.001
Hernández et al. (2022) Mexico	RCT	40	54.13	Breast cancer mastectomy	HYP	N/A	p=0.003
Jensen et al. (2020) USA	RCT	173	ED 56.3 (12.1) CT 52.7 (13.1) HYP	Lower back pain, MS, spinal cord injury, acquired amputation, muscle	HYP CT HYP-CT ED	N/A	p=0.93 p=0.20 p=0.05 -

			53.6 (12.9) HYP-CT 57.8 (12.5)	dystrophy			
Parizad et al. (2021) Iran	RCT	110	GI 43.14 (12.22) CG 37.32 (11.12)	COVID 19, muscle pain	GI Control group	d=0.89 d=0.81	Quality of pain: P<.001 Intensity of pain: P=0.003
Rousseaux et al. (2020) Belgium	RCT	100	66 (11.5)	Cardiac surgery, Coronary artery bypass graft surgery, Valve replacement, Multiple interventions	HYP VR HYP-VR Control group	N/A	P<.001
Van Vliet et al. (2019) Netherlands	RCT	128	28.01 (7.44)	Tonsillectomy	Manipulating expectancy, manipulating empathy	N/A	p=0.43
Wiechman et al. (2022) USA	RCT	153	VRH 33.3 (13.8) VRD 38.0 (13.9) NVR 33.8 (12.1)	Physical trauma, closed long bone, calcaneus fractures, intraabdominal injury causing blunt force trauma	VRH VRD NVR control group	N/A	p=0.159 p=0.857
Yin et al. (2022) China	RCT	84	PSYCH 50.94 (11.71) CG 53.01 (10.67)	Intestinal obstruction	Psychological communication	N/A	P<.001

The following chapters presented the results of the three categories described above, starting with psychological care. Statistical results are presented in Appendix 3.

5. 4 Results of psychological care intervention

In this review ten studies of 12, (83%) included psychological interventions including cognitive behavioural therapy, neuro-linguistic programming, hypnosis, guided imagery, mindfulness, virtual reality, and combination of interventions.

5. 4. 1 Cognitive Behavioral Therapy intervention

Two of the twelve studies (17%) investigated the effect of cognitive therapy on pain intensity (Broderick et al., 2014; Jensen et al., 2021). In the trial of Jensen et al. (2021) researchers monitored pain-related thoughts and tried to challenge them, by replacing more helpful and balanced thoughts. Patients were taught about the meaning of their unhelpful behaviour and cognitions, for example catastrophizing in chronic pain. In addition, participants got audio material for home practice. Mean changes from pre- to posttreatment were observed. In comparison with the other groups in this study, the results were not statistically significant for the cognitive therapy group. Pairwise contrast comparisons of the means of intervention groups with the mean of the education group were not statistically significant for the cognitive therapy group. Relative effect size (ES) relative to the education group were moderate for the cognitive therapy group (ES= - 0.36) (Jensen et al. 2021). But in average, there was a decreasing in pain from pre- to posttreatment. Change in pain interference has shown large mean changes. The effect sizes were very low (ES=-0.8) (Jensen et al. 2021).

Broderick et al. (2014) conducted a trial with pain coping skills training in ten sessions. Patients were taught to cope their pain with cognitive and behaviour skills. Techniques included relaxation, changing of negative, pain-related thoughts and emotions. Broderick and colleagues determined the treatment expectation for the five variables (pain intensity, fatigue, catastrophizing, self-efficacy, and daily pain ratings) as moderators of treatment effects for cognitive behavioral therapy for pain. Results have shown that the treatment with cognitive behavioural therapy has significant improved pain-related variables including pain intensity, coping with pain, self-efficacy for controlling pain, activity interferences due to pain, and reduced pain medication in comparison to the group with usual care (Broderick et al., 2014). The treatment effects were significant for several of the variables, the patients in the intervention group reported less posttreatment pain ($p<0.001$) (Broderick et al. 2014). In posttreatment measurements, differences in the means of pain intensity between the groups were observed. The mean in the control group was (– 0.17), in the treatment group (– 38) , the p-value for group differences was p=.017 (Broderick et al., 2014).

5. 4. 2 Neuro-linguistic programming

One of the twelve studies (Doğan & Saritaş, 2020) compared the effect of neuro-linguistic programming with the effect of guided imagery on pain and comfort with patients which

underwent open cardiac surgery. The researchers used the behavioural techniques developed by Grinder and Bandler which are reframing, breaking negative anchors, creating new behaviour, analysing the linguistic structure of believes. Every session varied between 25 and 30 minutes. Postoperative pain levels measured with the VAS scale have shown statistically significant differences between the groups immediately after the operation ($p<.05$). The NLP group had a significant lower mean VAS score compared to Guided Imagery and the control group. Statistically significant differences were observed after 72 hours regarding the mean VAS score ($p<0.05$). the intervention (Doğan & Saritaş, 2020).

5. 4. 3 Hypnosis

Five of the 12 studies (42%) determined the effect of hypnosis on pain quality, pain severity, and pain-related anxiety. Studies found an effect of hypnosis on pain reduction (Garland et al. 2017; Hernández et al. 2021; Jensen et al. 2020; Rousseaux et al., 2020). Sessions varied between 15 – 20 minutes. Most of the hypnotic suggestions were either scripted, or audio recorded (Garland et al. 2017; Jensen et al. 2020; Hernández et al. 2022; Parizad et al. 2019; Rousseaux et al. 2020).

The hypnotic intervention group in the trial of Garland et al. (2017) was getting a single session hypnotic suggestion. Focus in this session was on sensations of floating, imagine the visual, auditory, olfactory, and tactile details of a pleasant scene of their choosing. Script provided suggestions for transforming pain into sensations of warmth, coolness, or tingling (Garland et al. 2017). This trial revealed statistically significant effect of hypnotic suggestion on baseline-adjusted pain severity post-intervention ($p<0.001$) and pain unpleasantness ($p<0.001$). In addition, participants in the hypnosis intervention group, reported higher baseline-adjusted relaxation ($p<0.001$), lower desire for opioids ($p<0.001$) and at last more pleasant body sensations ($p<0.001$) (Garland et al., 2017).

In the hypnosis intervention group conducted by Jensen et al. (2020) each session began with a relaxation and a hypnotic induction, followed by a suggestion for pain reduction. The posthypnotic suggestion transported the message that the benefit of each session would increase in duration with practice. In addition, participants would be able to enter a state of hypnosis using a cue (Jensen et al. 2020). The study presented a less change from pre- to post-treatment – in comparison to the other intervention groups – in average of pain intensity in the

results of descriptive analysis. The improvement of two points from pre- to post-treatment in the pain scale for the hypnosis group was 0.20, that means that there was a decrease in pain intensity on average. Jensen et al. (2020) also observed a mean change for change in pain interference and opioid use from pre- to post-treatment. The following-up has shown, that 32% of the hypnosis group improved “much” or “very much” for change in pain and 10% stated “no change” or “worsening” (Jensen et al.2020). Dissatisfaction with hypnosis intervention (0.0%). Participants in the hypnosis group of Hernández et al. (2022) got a 20 min recorded audio session before surgery and another audio recorded hypnotic script, called the “imagination healer” to be listened at home. A statistically significant reduction of pain perception in women underwent breast cancer mastectomy, was shown in the trial of Hernández et al. (2022). Large effect sizes were shown in the five variables interference in daily activities due to pain (p=.003), mood (p=.001), social relationship (p=.001), sleep (P=.001) and life enjoyment (p=.001) (Hernández et al. 2022). Although not statistically significant, variables of pain interference had a medium effect size.

Rousseaux et al. (2020) conducted a trial with patients who underwent cardiac surgery. Participants in the hypnosis group received a 20 min hypnosis session, named “Soothing white clouds”. Hypnosis included suggestions about positive body sensations, relaxation, and an invitation to observe a beautiful landscape, relaxing in a white cloud chair (Rousseaux et al. 2020). No statistically significant effects were observed in comparison to the other groups in this study.

5. 4. 4 Hypnotic Cognitive Therapy intervention

In the Hypnosis-Cognitive Therapy group in the study of Jensen et al. (2020), participants got a hypnosis in addition to cognitive therapy to enhance and extend the duration of the positive effect, which was a result of the cognitive therapy. The suggestions in the Hypnosis-Cognitive Therapy Group focused on changing the meaning of pain, based on cognitive restructuring principals. Participants were instructed to listen recordings once every day (Jensen et al., 2020). A large mean change from pre- to posttreatment in average pain intensity was observed. In comparison with the mean of the educational intervention group, the results in the Hypnosis-Cognitive Therapy group were statistically significant. The effect sizes of this group were (ES= -0.80). In addition, changes in the pain interference from pre- to posttreatment were large in this group.

The comparison with the educational group was statistically significant. In the 12- month follow-up assessment for the Brief Pain Inventory (BPI) pain interference had a consistent lower mean over the time in comparison to the other groups in the study (Jensen et al., 2020). Furthermore, Jensen et al. (2020) observed significantly greater reductions in pain intensity in this group and a significantly greater reduction in pain interference compared with the educational intervention group. Pre- to posttreatment improvements in pain intensity, pain interference and depressive symptoms were maintained after 12-months follow up.

5. 4. 5 Guided imagery

Three of the 12 studies (25%) determined the effect of guided imagery on pain (Aghakhani et al., 2021; Doğan & Saritaş, 2020; Parizad et al., 2019). The intervention with Guided Imagery varied between 25-30 min in all the trials.

Aghakhani et al. (2021) conducted a study with burn patients. Patients were given one hypnosis session a day by headphones in an interval from four days. The session started before dress changing on the morning. Analysis of variance (ANOVA) showed significant differences in the intervention group before and after the intervention ($p<0.001$) and differences between the intervention and control group ($p<0.001$) in pain severity, pain quality ($p<0.001$), and pain-related anxiety ($p<0.001$).

The effect of guided imagery on patient with CABG was lower compared to the NLP intervention group, but decreased pain and increased comfort in patients (Doğan & Saritaş, 2020).

Parizad et al. (2019) conducted a trial with COVID 19 patients analysing the effect of guided imagery on muscle pain and anxiety. The hypnosis intervention group was getting ten training session. The duration of each session was about 25 min. Each session had five different guided audio tracks from other sessions (Parizad et al., 2019). In the statistical analysis Cohen's d indicated an effect on pain quality ($d=0.08$) and pain intensity ($d=0.16$) after guided imagery. Furthermore, Cohen's d revealed differences in mean scores after the intervention between the intervention and control group (Parizad et al. 2019). Trait anxiety and state were significant different between both groups ($p=.004$). Parizad et al. (2019) found

also a statistically significant difference in pain intensity and pain quality, between the intervention and control group in pre- and posttreatment. Guided imagery can reduce the intensity and quality of pain and has the level of anxiety in patients with COVID 19.

5. 4. 6 Mindfulness

Garland et al. (2017) determined the effect of mindfulness on pain. Patients received a 15-min single, scripted training session. Attention was focused on body sensation and breathing, accepting discursive thoughts, negative emotions, and pain (Garland et al. 2017). Patients in the mindfulness group reported statistically significant lower baseline-adjusted pain severity ($p<0.001$) after the intervention (Garland et al.2017). Additionally, mean reductions in pain intensity ratings were observed during the mindfulness intervention ($p<0.001$). Pain unpleasantness, measured by an analysis of covariance (ANCOVA) model, revealed a statistically significant effect ($p<0.001$).

5. 4. 7 Virtual reality

The effect of virtual reality on pain intensity was determined in two studies (17%), (Wiechman et al., 2022; Rousseaux et al., 2022). Wiechman et al. (2022) conducted a study with patients getting a significant physical trauma. Patients in the virtual reality group were immersed into a Snow World They were allowed to throw snowballs at snowman and pinguins while floating down a canyon. Patients were holding the controller and thereby they were active involved (Wiechman et al., 2022). The results showed no effects.

Participants in the virtual reality group in the study of Rousseaux et al. (2022) received a visualisation of an immersive landscape, seeing a shed near a lake at sunrise following by relaxation in a cloud. No effects in reducing pain, anxiety or opioid analgetic use were found in statistical analysis (Wiechman et al., 2022) The study of Rousseaux et al. (2022) was showing the same results, that there is no benefit of treatment with virtual reality on patient with cardiac surgery.

5. 4. 8 Virtual reality and hypnosis

Wiechman et al. (2022) determined the effect of hypnosis and virtual reality on trauma patients. Patient in the virtual reality hypnosis group received a 40 min, three-dimensional,

computer-generated virtual word, called “Snow world”. In the first four minutes received audio taped instruction while hovering at the top of a canyon. The patient slowly descended into the canyon seeing numbers from 1 to 10, floating over a blue lake. At this point receiving posthypnotic suggestions for pain control. After this participant ascended back up the canyon seeing the numbers from 10 to 1. (Wiechman et al., 2022). The study of Wiechman et al. (2022) did not investigate an effect of virtual reality hypnosis in pain reduction in patients with significant physical trauma. The virtual reality-hypnosis group in the study of Rousseaux et al. (2022) received the “White clouds” hypnosis combined with a 3D visual movie shown an immersive landscape and a relaxing moment in the clouds. The suggestions were the same as in the hypnosis group (Rousseaux et al., 2022). They did not observe statistically significant effects on the variables pain, anxiety, relaxation, fatigue, and opioid use in their virtual reality-hypnosis intervention group.

5. 4. 9 Psychological conversation

There was only study (8%) that analysed the effect of psychological conversation on pain. Yin et al. (2022) conducted a study with four psychological interventions. The intervention group was treated with open psychological intervention, positive psychological guidance, heuristic psychological intervention by communicating with the patient, and at last a discussion with the patient about the interventions. The researchers tried to change negative thoughts into helpfully by using positive language. Differences between pre- and posttreatment pain was found. The VAS score after intervention in the study group was significantly lower than VAS in the control group ($p<0.05$). After intervention, the scores of SDS and SAS in the study group were lower than those in the control group (Yin et al., 2022).

5. 4. 10 Manipulation of communication with placebo and nocebo

Of the 12 studies in this review two (17%) included cognitive care with manipulation of communication (Chooi et al. 2013; van Vliet et al. 2020). In these two studies manipulations were done by using positive or neutral words or by getting enhanced empathy. In the study of Chooi et al. (2013) the participants were manipulated with placebo and nocebo effects. Participants were divided in two intervention groups. In the comfort group researchers used an inverted NRS scale to ask women about their comfort after a caesarean sectio. In addition, positive primes like “Your wound is healing now” and “You are in process of recovery”

(Chooi et al. 2013) should promote a positive outcome. In the control group the NRS scale was used to evaluate pain. The women received questions like: “You have had a Caesarean section and I am interested in your pain from the surgical trauma. So, is it okay if I ask you some questions about your pain?” (Chooi et al. 2013). The results showed increased pain and anxiety when communicating with negative words. Interestingly only 15 % of the women in the comfort group reported that they were bothered of pain, while in the pain group 55 % of the women were bothered by pain (Chooi et al. 2013).

In the trial conducted by van Vliet et al. (2020) the participants were divided into two intervention groups and two control groups. Participants in the intervention group, where their expectancy was manipulated, expected that their pain medication was working very well. This was underpinned by sentences like “The medication I am giving you now will lead to a strong decrease of your pain.” Or “This pain medication is known for working very well” (van Vliet et al. “2020). Patients in the empathy intervention group were treated with a warm and friendly behaviour in a warm created atmosphere. When the patient received proper instruction, the researchers reacting extra empathically to patients verbal and nonverbal cues (van Vliet et al., 2020). In the first standard control group no expectation was created, using sentences like “This is your pain medication.” Or “This is your medication.” Providers gave the pain medication in silence (van Vliet et al., 2020). In the second control group patients were treated in a non-empathically atmosphere. The researchers used behaviours like reacting with standard empathy to patients’ cues, keep standing when communicating, not exploring concerns in detail, and did not express an extra interest in patient as a person (van Vliet et al., 2020). The results showed no significant main and interaction effects on patients’ perceived pain.

The intervention which contained nurses enhanced expression of pain medications’ effectiveness did not lower pain levels on day 1 ($p=0.43$), day 2 ($p=0.96$) nor day 3 ($p=0.33$).

5. 5 Educational conversations

Two of the 12 studies (17%) determined the effect of educational conversation on pain. Participants in the intervention group got a 15-minute session with educational interventions. In the trial of Jensen et al. (2020) participants were educated about their pain, and pain medication. They were also informed about the costs, neurophysiology, and impact of pain (Jensen et al. 2020). The participants of the Education intervention group reported no change or worsening in pain (29%) after the intervention. Only 37% of the participants reported

improvement in pain, and 37% reported a change in pain interference (Jensen et al., 2021). The effect size on average pain intensity and pain interference from pre- to posttreatment was moderate (-0.60) in the Education intervention group. The participants reported an improvement of two points from pre- to posttreatment on the pain scale (0.15), (Jensen et al. 2020).

In the study of Garland et al. (2017) the educational intervention group was one of three intervention groups. The Education intervention group was getting empathic responses provided by social workers in a single session. While reviewing pain coping strategies, social workers attempted to increase the perception of pain control, e.g., using hot or cold compresses, stretching. Participants were getting a pain coping education brochure. In statistical analyses significant mean reductions in pain ($p=0.009$) was observed. Although in comparison to the other to intervention groups, education intervention differed in the proportion of participants, they achieved a clinically significant reduction in pain of 15% (Garland et al., 2017).

5. 6 Effects from Follow-Up Interventions on Patient outcome

Of the 12 studies four (33%) included a follow-up (Broderick et al., 2014; Hernández et al., 2022; Jensen et al., 2020; Wiechman et al., 2022). Whereas three of the studies reported a follow-up after 12 months (Broderick et al., 2014; Jensen et al., 2020; Wiechman et al.,2022), and only one study (Wiechman et al., 2022) presented a follow up after 24 months. Hernández et al. (2022) reported a follow-up one week after the hypnosis intervention. One week after surgery the effect of hypnosis on women after a breast cancer mastectomy maintained with a medium effect size. Changes in pain intensity perception after one week showed a mean (-1.75) and SD (2.42), (Hernández et al., 2022).

Jensen et al. (2020) observed that the pain intensity in the treatment groups was not statistically significant over time. But the pre-treatment average pain intensity was statistically significant ($p<0.001$). The assessment of the Brief Pain Inventory (BPI) pain interferences displayed a consistent lower mean over time in the Hypnosis-Cognitive Therapy group (Jensen et al., 2020).

The follow-up intervention from Wiechman et al. (2022) did not find any differences on outcomes between the three intervention groups after 6-, 12-, and 24-months. Participants

either improved or stayed the same from the discharge to the 24-month follow-up (Wiechman et al., 2022).

5. 7 Critical Appraisal of the Studies

Eleven of the twelve studies (92%) performed the randomization process appropriately. Only the study of Yin et al. (2022) did not describe the randomization process, just mentioning that the groups were randomly divided (Yin et al., 2022). Groups were comparably at baseline in 10 of the 12 studies (83%). Garland et al. (2017) reported that fewer females were assigned to the suggestion group (41%) than to the mindfulness (66%) or education group (62%). Yin et al. (2022) did not report the demographic characteristics.

All studies reported outcome data. Eight of the 12 studies (67%) were single blinded (Aghakhani et al., 2021; Chooi et al., 2013; Doğan & Saritaş, 2021; Parizad et al., 2019, van Vliet et al., 2019) In the study of Broderick et al. (2014) assessors were blinded. In the study of Rousseaux et al. (2020) neither patients nor investigators were blinded because it was in the nature of treatment with hypnosis and virtual reality (Rousseaux et al., 2020). In the study of Jensen et al. (2020) one research stuff member was prespecified to not be blinded to the treatment allocation (Jensen et al., 2020). In the study conducted by Garland et al. (2016), social workers and participants were not blinded. Hernández et al. (2021) did not report blinding, also Wiechman et al. (2022). General statistical power was described in most of the studies with a power of 80 and alpha at 0.05. The study of Yin et al. (2022) did not calculate the statistical power.

Loss of participants was reported by Wiechman et al. (2022). They described that the score on the Stanford Clinical Hypnotic Scale indicated a low level on hypnotisability cause of missing data. Reasons for the lost were either that participants refused or were discharged before administering (Wiechman et al., 2022). Rousseaux et al. (2020) reported a drop out of 30%, because patients had fatigue, sedation or confusion, intubated patients (Rousseaux et al., 2020). One limitation is the low population in the studies. Jensen et al. (2021) stated that a larger sample is needed in future research. They are also criticising the low number of treatment sessions was tested in contrast to other clinic trials of psychological chronic pain interventions (Jensen et al., 2020). In all studies participants adhered the assigned intervention.

The types of interventions are clearly described in most of the studies, but there is a lack of information about the content in the study of Parizad et al. (2021). The researchers delivered a guided imagery to the patients by an audio track. The content is not described, it is noted that the audio track was used in other session (Parizad et al., 2021). That makes it difficult to transfer the intervention to other studies and to assess the trustworthiness. Doğan & Saritaş (2022) used in the Neuro-linguistic programming intervention group the new behaviour generation technique of Neuro-linguistic programming but did not describe the intervention clearly. Concerning to the content of guided imagery interventions, Hadjibalassi et al. (2018) are criticising that reporting content and details of the guided imagery interventions are limited.

Pain scores were measured in eleven of the twelve studies (92%) at baseline and post-treatment (Aghakhani et al., 2022; Broderick et al., 2014; Doğan & Saritaş, 2022; Garland et al., 2017; Hernández et al., 2022; Jensen et al., 2020; Parizad et al., 2021; Rousseaux et al., 2022; van Vliet et al., 2019; Wiechman et al., 2022; Yin et al., 2022). Chooi et al. (2013) did not measure pain at baseline, this may be due to the intervention. Partly it was described that staff members were adequately trained to the intervention when necessary. In the study of Garland et al. (2017) clinical social workers were trained to deliver all the three interventions. Training comprised three hours of instruction in the interventions (Garland et al., 2017). The guided imagery in the study of Aghakhani et al. (2022) the audio track was prepared and approved by a psychiatrist. The delivering formats can be classified as high-intensity (face-to-face, with a specialist) or low-intensity (face-to-face, delivered from a para-professional or self-help techniques) as described by Roth & Pilling (2007). There is risk for bias because the competence of the researchers who carried out the interventions is not clear.
Two studies (17%) conducted out a randomized controlled trail without a control group (Garland et al., 2017; Jensen et al., 2020). These trials compared different interventions groups with each other.

6. Discussion

In this restricted review the effect of three different treatment categories; psychological, educational and manipulation of communication interventions, on patients' pain in a clinical

hospital setting were examined. Twelve studies were evaluated, and the findings were synthesist. Contents and delivery modes were presented in text and tables.

The major findings of this restricted review were, that some of the psychological treatment interventions showed a moderate to large effect on the perception of pain. Whereas the effect of educational interventions on the perception of pain was small, and the manipulation of communication, showed varying outcomes from moderate to large effect.

In this review, no effect of cognitive behavioural therapy on the outcome of pain was shown in the study conducted by Jensen et al. (2020) analysing the effect of this therapy on patients with lower back pain and spinal cord injury, whereas the trial of Broderick et al. (2014) has shown a significant reduction on pain intensity in patients with osteoarthritis after the treatment with cognitive behavioural therapy. In addition, Broderick et al. (2014) revealed a correlation between the variables age, education, and the outcome of pain. The oldest and most educated patients had the strongest treatment effects on pain (Broderick et al., 2014). Furthermore, revealed the researcher that the expectancy on the treatment is also in correlation to the outcome of pain. Patients with moderate to high expectations on the treatment effect had most benefit from it as well as patients with moderate to high disease. Patients with low expectations experienced very little benefit from the treatment on pain. It seems also, that the success of a cognitive behavioural therapy depends on several variables and that expectancy is playing a pivotal role in the perception of pain.

The results of my review were partly in line with the findings of the systematic review of Mistiaen et al. (2015), which found no evidence or low evidence on cognitive behavioural therapy and cognitive care. The results of Mistiaen et al. (2015) may be due to the circumstances, that in contrast to the studies of my review, cognitive behavioural therapy was categorised as information giving, and was combined with other interventions such as giving information (Mistiaen et al., 2015).

Furthermore, Fordham et al. (2018) conducted a meta-review of systematic reviews and panoramic meta-analysis for the evidence of Cognitive Behavioural Therapy on health-related quality of life (HRQoL) and pain. The results of their meta-analysis showed in contrast to the findings of Mistiaen et al. (2015), an improvement in quality of life and pain for patients with different mental and physical conditions, but by a modest amount. Fordham et al. (2018)

pointed to the knowledge gaps that exist in relation to demographic variables, such as ethnicity, education, culture, religion. This objection is in line with one of the trials of this restricted review (Broderick et al. 2014), which also reported different outcomes on pain due to age and education. These findings were confirmed in a follow-up study from the same authors conducted in 2016. In this study the researcher observed again that different outcomes on pain rating and catastrophising were due to age, education, and expectancy (Broderick et al., 2016). Interestingly, the youngest patient (age=57.7) experienced no reduction in pain from treatment. Treatment effects for average age (age=67.2) was d=0.19 for the oldest patients (age=76.7) d=0.37. The average age (d= 0.14) has shown a small improvement, in contrast the oldest (d=0.52) had much larger improvement in the treatment group compared to control group (Broderick et al., 2014). The level of catastrophising was influenced of the educational level. High educated patients tended to catastrophise less (Broderick et al., 2016).

In accordance with Broderick et al. (2016)) came Goossens et al. (2005) also to the result, the outcome of a cognitive behavioural therapy treatment depends on expectancies. In their trial, Goossens et al. (2005) found evidence, that patients who believed that the treatment would help them coped better with their pain and catastrophised less (Goossens et al., 2005).

The findings from Goossen et al. (2005) and Broderick et al. (2016) that expectancy is related to pain, are in line with neurophysiological trials. The following experiment conducted by Benedetti et al. (2003) showed the effect of Ketorolac on verbal suggestions. Participants in an intervention group received analgesia (Ketorolac) two days on a row, for a pharmacological pre-conditioning. The researcher replaced Placebo on day three with a verbal suggestion of analgesia. The outcome showed a strong placebo analgesic response on the participants. In contrast, the control group received the same pharmacological pre-condition, but the given placebo on day three has been commented with verbal suggestions, representing the drug as a hyperalgesic agent. As a result of the suggestions and the expectancy, the placebo analgesia effect was totally blocked, and in addition hyperalgesia occurred (Benedetti et al., 2007).

In this review, the results of the treatment intervention with hypnosis on the reduction of pain, varied from no effect on patients after cardiac surgery (Rousseaux et al., 2020), to moderate effect on patients with acute pain (Garland et al., 2017) and spinal cord injury (Jensen et al., 2020), and had in addition a large effect on women underwent a mastectomy after breast

cancer (Hernández et al., 2022). Furthermore, hypnosis in combination with cognitive behavioural showed a large effect on pain reduction on patients with lower back pain and spinal cord injury (Jensen et al., 2020). The combination of hypnosis with virtual reality had no effect on pain reduction in patients with physical trauma (Wiechman et al., 2022).

The effect of hypnosis has been partly confirmed in the studies of this restricted review. Interestingly hypnosis seem to have an effect on gynaecological treatments. In a previous systematic review from (2015), Cramer et al. found sparse but promising evidence for the effectivity of hypnosis on women with breast cancer. This is in line with the findings on the study from my review (Hernández et al. 2022), and a previous study from Montgomery et al. (2007). Montgomery and colleagues carried out a clinic trial with breast surgery patients. The main outcome was to test the hypotheses that a brief presurgery hypnosis would decrease intraoperative analgesia and anaesthesia. As a result, patients in the hypnosis group required less Propofol and Lidocaine. In addition, patients reported less pain intensity, pain unpleasantness, nausea, fatigue and discomfort (Montgomery et al., 2007).

The results of hypnosis treatment on the outcome of pain from this restricted review are also partly in line with the findings of Tomonori et al. (2014), who carried out a meta-analysis investigating the effect of hypnosis on chronic pain. They reported that only a few studies determined the efficacy of hypnosis on chronic pain, amongst them Jensen & Patterson (2006) and Patterson & Jensen (2003), who reported the overall efficacy of hypnosis on chronic pain. In a following review, Jensen (2009) repeated the benefit of self-hypnosis training on patients with chronic widespread pain, headache, spinal cord injury, and idiopathic orofacial pain. Thirty percent of patients with spinal cord injury and multiple sclerosis reported pain relief when they practiced self-hypnosis and improvements in daily pain intensity (Jensen, 2009).

Furthermore, Montgomery et al. (2000) conducted a meta-analysis, which included in total 933 participants over 18 years with clinic pain including burns, cancer headache, coronary disease, and experimental pain induced by cold, pressor, ischemic pain and focal pressure (Montgomery et al., 2000). Calculated effect sizes revealed that hypnosis had a large effect in managing of pain (d=0.80) and a moderate to large effect on managing experimental pain (d=0.70) in this group.

Mistiaen et al. (2015) have not explicitly determined the effect of hypnosis on pain in their systematic review, but pointed to the studies of (Faymonville et al., 1997; Lang et al., 2000; Liossi and Hatira, 2003), which have shown that hypnosis is superior to emotional care interventions and/or usual care in pain reductions.

Further showed the findings in my study that virtual reality without combining with other treatments did not decrease pain in patients with physical trauma (Wiechman et al., 2022) nor leading to improvement in patients after cardiac surgery (Rousseaux et al., 2020). But a randomised controlled trial with patients undergoing lipoma excision with local anaesthesia conducted by Bozdoğan Yeşilot et al. (2022) showed a significant effect on pain reduction. In this study patients watched a relaxing video with the virtual reality viewer and simultaneously the researcher watched the virtual reality intervention on a smartphone. In comparison to the studies of my review (Rousseaux et al. 2020; Wiechman et al., 2022), the investigators communicated with the patients, using techniques like asking questions or reflecting the content of the intervention and emotions of the patients (Bozdoğan Yeşilot et al., 2022).

Also, Wong et al. (2022) conducted a review by determining the effectiveness of virtual reality on the variables pain reduction, anxiety, depression, and mood. In contrast to the findings of my review, it was reported that virtual reality is suitable to reduce pain in patients with chronic neck and chronic low-back pain, headache, and phantom limb pain (Wong et al., 2022).

My study showed that guided imagery lowered pain in patients underwent a cardiac surgery (Doğan & Saritaş, 2020) and in addition led to decreased muscle pain in patients with COVID 19 (Parizad et al., 2019). But in comparison to this review, came Montgomery et al. (2000) to the result, that treatments with guided imagery showed a moderately effect on patients with chronic pain in a postintervention phase. They showed furthermore that hypnosis was moderately more effective than guided imagery.

The results of this review showed that patients with acute pain experienced significant reduction in pain after the intervention with mindfulness (Garland et al., 2017). These findings are in contrast to the findings of Hilton et al. (2017), who determined the effect of mindfulness on specific types of chronic pain, e. g. lower back pain, fibromyalgia, or

somatisation disorders, and found low evidence for reduction on pain. The authors of this article caused the limited evidence to methodological issues (Hilton et al., 2017).

Psychological conversation was the last treatment in the category of psychological intervention. In my review, presented one study (Yin et al., 2022) the outcome of psychological interventions, which is similar to emotional care, on pain in patients with intestinal obstruction. The results showed that patients revealed an improvement on pain. Compared to the findings of Mistiaen et al. (2015) seems the effect of emotional care on pain to be varying. Mistiaen et al. (2015) analysed the effect of emotional care in 14 studies. They reported that the focus mainly was on emotions, but often not sole. The aim of the studies was to make patients suffering from pain, feel easier. The intervention was often combined with other interventions like relaxation. The 14 studies did not found evidence of effect that emotional care alone had impact on pain. But four of the 14 studies showed that empathic holistic care may have positive influence on pain (Mistiaen et al., 2015).

The next category of this review is the manipulation of communication. The treatment with manipulation of communication, by using positive suggestions showed different results in my study. Women after a caesarean sectio reported less bothering of pain after receiving manipulated communication, with positive suggestions (Chooi et al., 2013), while patients after a tonsillectomy did not report an improvement of pain after they were treated with positive suggestions and enhanced empathy (van Vliet et al., 2020).

Mistiaen et al. (2015) identified in total 19 studies determining cognitive care interventions in their systematic review. In thirteen of the 19 studies found the researchers significant differences between the intervention groups on pain outcomes (Mistiaen et al. 2015). On trend occurred less pain in the groups which have been treated with positive and neutral suggestions in comparison to the group receiving negative suggestions. Mistiaen et al. (2015) reported that two of six randomised controlled trial studies (Ronel et al., 2011; Suarez-Almazor et al., 2010) presented in their results that positive suggestions lead to less pain. Ronel et al. (2011) e. g., determined the effect of positive suggestions on patients with lung cancer which underwent a thoracotomy. The results showed just a small significant effect on the outcomes of pain. In contrast came Suarez-Almazor et al. (2010) to the result that positive suggestions had better effect on patients with painful knee osteo-arthritis than neutral or control

suggestions. This is also in line with a previous study conducted by Chooi et al. (2011), where women underwent a caesarean sectio.

In case of negative suggestions, the studies of Wang et al. (2008), where woman underwent an abdominal hysterectomy, and Varelman et al. (2010), determining healthy parturient at term requesting labour epidural analgesia, and Chooi et al. (2011), came to the result that negative suggestions led to increased pain. Chooi et al. (2011) concluded, that the word pain used in assessment could lead patients to interpret sensations as pain which they do not do otherwise (Chooi et al., 2011). These findings are in line with the results of neurophysiological trials. The research of these studies showed that the pain matrix can already been activated by pain-related visual and semantic cues, without noxious stimuli e. g. heat or electric stimuli as shown by Richter et al. (2010) in experimental studies with healthy participants. This is also in accordance with the trial of Ritter et al. (2016), which examined the effect of words on pain in a randomised controlled trial. The result of a fMRI screening of healthy participants, showed a stronger brain activation in the pain matrix, after priming with negative words, in contrast to neutral words, in the anterior cingulate cortex (ACC) and dorsolateral prefrontal cortex (DLPFC) and the precuneus, which are a part of the pain matrix. Ritter et al. (2016) showed furthermore that pain-related words can activate body- and action related areas of somatosensory and motor areas in the brain, in contrast to negative words which did not affect these areas as strong as pain-related words.

Similar results were shown in the study of Dillmann et al. (2000), using three categories of verbal primes. Each category consisted of adjectives divided into pain-related primes with affective meaning, somatosensory meaning, and neutral primes. Researchers observed a priming effect presented in fMRI, when using pain-related primes to an acute heat stimulus in the participants.

It must be said that there are restrictions in research of the nocebo effect because of the ethical considerations which are related to the use of nocebo effects. So, there is less known about the nocebo effect than about the placebo effect because of these ethical constrains. Although there exists research about natural nocebo effects as e.g., informing patients with cancer that means to deliver negative verbal suggestions with negative outcome (Benedetti et al., 2007).

The last category in this trial was the treatment of patients suffering from pain with educational interventions. In my review did educational intervention result in very low pain improvement in patients with lower back pain and spinal cord injury (Jensen et al., 2020) and patients with acute pain (Garland et al., 2017).

Mistiaen et al. (2015) have not explicit determined educational interventions, but information giving either solely or in combination with other procedural preparation intervention and therefore information giving could be seen as similar. Five studies compared information giving as a single intervention with usual care (Mistiaen et al., 2015). Three studies compared the combination of information giving with behavioural instruction and with usual care, and four further studies compared the combination of information giving with cognitive behavioural interventions and usual care (Mistiaen et al. 2015).

Summarized, Mistiaen et al. (2015) did not found statistically significant results which indicates for reduction in pain by information giving. This is in line with the findings from Ehde and Jensen (2004), who analysed the effect of cognitive restructuring intervention on pain in patients with disabilities, and this is also in line with the randomised controlled trial from my review (Garland et al., 2017; Jensen et al., 2020). Interestingly, the average pain intensity in the educational group in the study of Ehde & Jensen (2004) did not decrease, but the participants in educational group experienced the intervention as most helpful (Ehde & Jensen, 2004).

The results of this restricted review showed that alternative treatments have an impact on the perception of pain and have partly improved the intensity and quality of pain. These were not the only findings in the conducted trials of my studies. In addition, had treatments also the effect to reduce anxiety as showed by Parizad et al. (2019) and it was already mentioned, that anxiety may increase pain (Michaelides & Zis, 2019). These findings are important in the clinical hospital setting because an improvement of pain through alternative treatments may lead to decrease the use of opioids and reduce side effect of them. In addition, may nonpharmacological treatments also prevent patients to develop chronic pain.

What does the findings mean for our clinical everyday living? The major problem of patients in a clinical hospital setting is that pain and especially chronic pain is often undertreated and can contribute to disability in addition to the primary disability (Benrud-Larson & Wegner,

2000). In accordance with the guidelines of NSFLIS should critical care nurses protect the patient against complications and implement measures to prevent further development (NSFLIS, 2017). The findings of this restricted review may contribute to reach better outcomes on patients suffering from pain and protect the patient against complications.

The cognitive behavioural therapy has been shown as a suitable treatment for the adjustment of the patients' beliefs on pain and could be a treatment option on an ICU. But the transferability to a post anaesthesia care unit may be difficult due to the restricted and short stay of patients on this unit. In contrast is the delivering of an audio recorded hypnosis, or guided imagination, or mindfulness session, or a 3D virtual reality brill an applicable treatment on ICU and PACU. All these interventions have common that they will lead the attention of the patient from pain to their content (Matamala-Gomez et al., 2023). This allows the patient to relax and makes the patient more receptive to suggestions (Jensen, 2009). The studies in my review described that this treatment intervention did not require advanced knowledge, just an introduction. So, the implementation seems to be possible in a clinical everyday clinical practice.

7. Study limitations

This systematic restricted review has several limitations. First, there is heterogeneity across the conditions is prone to bias since this review is restricted and not a systematic review (Higgins et al., 2019). Second, heterogeneity in the included studies made meta-analysis impossible. Third only one study in this review determined the effect of neuro-linguistic programming on pain. Therefore, it is difficult to generalise these findings.

8. Conclusion

This study determined 12 studies determining the effectiveness of a psychological, educational and manipulation of communication intervention. Treatments from the psychological category seems to be auspicious to improve the perception of pain, especially hypnosis, followed by cognitive behavioural therapy, mindfulness, and virtual reality. As a common result of the findings from this review and the previous studies, it appeared that women who underwent gynaecological surgeries or caesarean section benefit from hypnosis. Furthermore, may hypnosis, guided imagery and mindfulness be suitable treatments to

decrease pain for patients who receipt cardiac surgeries. This patient group exposed for stress and will have benefit from such treatments.

Summarized, pain is a condition where patients are bothered in a physiological and psychological way. This makes them feel helpless and vulnerable. Critical care nurses can contribute to help them feel better. It is starting with that critical care nurses should be aware the risk of pain induced by their words. They should avoid using negative and pain-related semantic primes and try to lead the patient's attention to helpful thoughts. To reach this, critical care nurses need skills and training in communication. Communication techniques should be a part of nurses' education.

The treatment interventions of this review could be seen as useful and simple applicable tools to make the patient feel better and protect him from pain. They may reduce the use of analgesia and opioids and contribute to reduce economical costs in hospitals and society.

Further research in this field is needed. As far as we know have only the studies of Chooi and colleagues determined the effect of positive and negative words on pain in a hospital setting since 2013 and in previous studies before 2013, only Wang et al. (2008) determined the effect of negative words on patients with abdominal surgery. Guscoth & Cyna, (2022) conducted an observational study on nocebo language in anaesthetic patient written information. Cause of the very few findings of clinic research in this area it will be necessary to conduct more studies related to patients on ICU and PACU in future. Further studies should also determine how communication training for critical care nurses can be implemented in clinical routine.

Especially one treatment intervention in this review was unexplored and this was neuro-linguistic programming. The treatment with neuro-linguistic programming in patients with anxiety proved to be effective (Zaharia et al. 2015). But as already shown only one study in my review, conducted by Doğan & Saritaş (2022), determined the effect of neuro-linguistic programming on pain. The results of the study from Doğan & Saritaş (2020) showed an effect of neuro-linguistic programming in reduction of VAS scoring. As far as we know is this actually the only randomised controlled trial which determined the effect of neuro-linguistic programming on pain. Further studies determining the effect of neuro-linguistic programming on pain in the PACU area are needed.

As we have seen increases negative and pain-related words pain. This raises questions about the use of NRS and VAS scales. Further studies should determine if these scales contribute to increase pain.

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10. Appendix

Appendix 1. Searching strategy

Database Searches (CINAHL, PubMed, Embase):

Search 1:
pain* AND communication* AND randomized controlled trial* AND outcome* AND surgery*

Search 2:
pain* AND hypnosis AND guided imagery* AND mindfulness* randomized controlled trial*

Search 3:
pain* AND communication* AND (surgery or operation or surgical procedure) AND randomized controlled trial*

Search 4:
pain* AND effect* AND communication* AND placebo* AND nocebo* AND randomised controlled trial*

Search 5:
pain catastrophizing*AND randomized controlled trial* AND (nurse or nurses or nursing)

Search 6:
pain* AND pain perception* AND virtual reality*

Search 7:
pain* AND neuro-linguistic programming* AND nursing*

Google Scholar Searches:

Search 1: pain AND communication

Search 2: pain AND neuro-linguistic programming

Clinic Trial Gov:

Search 1: pain AND communication AND priming

Search 2: pain AND nocebo language

Appendix 2: Data exctraction

Study (first name/yaer/origin)	Study method	Risk of bias	Patient (n)	Intervention	Outcome	Provider
Aghakhani et al. (2022). The effect of guided imagery on the quality and severity of pain and pain-related anxiety associated with dressing changes in burn patients: A randomized controlled trial. Iran.	RCT	low	N=70	Guided Imagery: Patients got a ten-minute session with audio files including guided imagery	Primary outcome: Pain severity Pain quality	Nurses Psychiatrist
Chooi et al. (2013). Pain vs comfort scores after Caesarean sectio: A Randomized Controlled Trial. Australia	RCT 1:1 allocation	low	N=300	Manipulation of communication, with positive and negative suggestions Intervention group 1: Using comfort scale and numeric rating scale Intervention group 2: Using a nurmeric rating scale	Primary outcome: Assess pain severity as measured by a 0-10 point VNRS for pain compared with an equivalent inverted VNRS for comfort. Secondary outcome: Patients report of pain severity as measured by a VAS for pain compared with VAS for comfort.	Nurses
Doğan & Saritaş (2020). The effects of neuro-linguistic programming and guided imagery on the pain and comfort after open-heart surgery. Turkey	RCT 1:1:1 allocation ratio	low	N=132	Intervention group NLP: Getting a 25-30 min session with NLP Intervention group GI: Getting a 25-30 min session with NLP	Primary outcome: Pain	Nurses
Garland et al. (2017) Randomized Controlled Trial of Brief Mindfulness Training and Hypnotic Suggestion for Acute Pain Relief in the Hospital Setting. USA	RCT 1:1:1 allocation ratio	low	N=244	Mindfulness group: Mindfulness group getting a 15-min single, scripted mindfulness training. Hypnotic suggestion group: Hypnotic suggestion consisted in a single, scripted 15-min self-hypnosis session. Psychoeducational Group: Psychoeducation consisted of a single 15-min session.	Primary outcome: Measurment of pain intesity and unpleasantness	Social workers
Hernández et al. (2022). Clinical Hypnosis for Pain Reduction in Breast Cancer Mastectomy: A Randomized Controlled Trial. Mexico	RCT 1:1 allocation ratio	low	N=40	Hypnosis group: Hypnosis group received a hypnotic audio recorded 20 min. Control group: Control group received standard medical care after surgery. Given headphones without sound or music playing.	Primary outcome: Effect of clinical hypnosis on pain intensity and its interference in daily activities	Nurses
Jensen et al. (2020). Effects of hypnosis, cognitive therapy, hypnotic cognitive therapy, and pain education in adults with chronic pain: A Randomized Clinical Trial	RCT 1:1:1:1 allocation ratio	low	N=173	Hypnosis Group: Hypnosis intervention. Each session began with a relaxation and a hypnotic induction (a “favourite place”) followed by suggestions for pain reduction, reductions in the bothersomeness of pain. Cognitive therapy group Participants were taught to monitor and evaluate their pain-related thoughts, and to challenge and replace than with thoughts that were more helpful. Hypnotic cognitive therapy group: Hypnosis to enhance the efficacy and extend the duration of positive effects of cognitive restructuring.	Primary outcome: Average pain intensity.	Not applicable

				Educational group: Pain educational intervention (ED). Educated about pain, including its costs, neurophysiology, nature, and impact.		
Parizad et al. (2019). Effect of guided imagery on anxiety, muscle pain, and vital signs in patients with COVID-19: A randomized controlled trial. Iran.	RCT 1:1 allocation ratio	low	N=110	Guided imagery group: The intervention group was getting ten training sessions of guided imagery about 25 min. Each session had five different guided audio tracks from other sessions. Control group: Usual care	Primary outcome: Reduction in pain quality	Nurses Psychiatrist
Rousseaux et al. (2022). Virtual reality and hypnosis for anxiety and pain management in intensive care units. Belgium.	RCT 1:1:1:1 allocation ratio	low	N=100	Hypnosis group: 20 min pre-recorded hypnosis session, with suggestions for positive body sensations Virtual reality group: 20 min virtual reality session wearing a head mounted display with goggles, graphical landscape, consisting of a mountain cabin near a lake at sunrise, followed by a relaxing moment in the clouds. Virtual reality hypnosis combination group: A 20 min VRH session. The recorded hypnosis session was combined with the virtual reality display. Control group: Daily standard care.	Primary outcome: Assessment of pain	Nurses
Wiechman et al. (2022). The Impact of Virtual Reality Hypnosis on Pain and Anxiety caused by Trauma: Lessons learned from a Clinical Trial. USA	RCT 2:1:1	low	N=153	Virtual reality- hypnosis intervention: 3D world (Snow World) combined with hypnotic induction, 40 min session. Virtual reality distraction. Patients immersed into Snow World, throwing snowballs on penguins and snowmen, so long as they want. Usual care: Standard pain treatment	Primary outcome: Pain	Nurses
Van Vliet et al. (2020). Placebo Effect of Nurses' Communication alongside Standard Medical Care on Pain and Other Outcomes: A Randomized Controlled Trial in Clinical Tonsillectomy Care. Netherlands	RCT 2x2 design 1:1:1:1 allocation	low	N=128	Intervention Group 1: Getting enhanced conditions expecting that pain medication is working very well. Intervention Group 2: Getting enhanced empathy conditions. getting an extra warm and friendly created atmosphere. Control group 1: Getting usual care, without enhanced expectancy Control group 2: Getting usual care, without enhanced empathy	Primary outcome: Perceived pain Secondary outcomes: Post operative pain expectations.	Nurses
Yin et al. (2022). Observation of the Effect of Focused Psychological Intervention Combined with Standardized Pain Nursing on Postoperative Pain Levels and Depression and Anxiety in Patients with Intestinal Obstruction. China	RCT 1:1 allocation ratio	moderate	N=84	Psychological conversation group: Patients were given psychological interventions: 1) open psychological intervention 2) positive psychological guidance 3) heuristic psychological intervention 4) Discuss psychological intervention	Primary outcome: Pain reduction	Nurses

Appendix 3: Master contract

UNIVERSITETET I STAVANGER

MASTERS I SPESIALSYKEPLEIE, spesialisering i: Intensivsykepleie MASTEROPPGAVE
SEMESTER: (høst – 2023)
FORFATTER/MASTERKANDIDAT: Christina Baetzel VEILEDER: Ingvild Margareta Morken
TITTEL PÅ MASTEROPPGAVE: Norsk tittel: Engelsk tittel: How can critical care nurses improve patients' pain perception by delivering non-pharmacological treatments?
EMNEORD/STIKKORD: Pain; pain perception; psychological, educational intervention, manipulation of communication, pain reduction; review
ANTALL ORD: 18124 STAVANGER DATO/ÅR 12.05.2023

Appendix 4: Veiledningsavtale

Universitetet i Stavanger Veiledningsavtale for masteroppgave i spesialsykepleie

STUDENT 1
Navn: Christina Baetzel
e-post: bokn75@gmail.com
Mobilnummer: 92321443
STUDENT 2
Navn•
e-post:
Mobilnummer:
HOVEDVEILEDER
Navn: Ingvild Margreta Morken
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Mobilnummer/arbeid 91510483
BIVEILEDER
e-post:

Mobilnummer/arbeid•

Retningslinjer Veiledningsplan:
Veiledningen skal følge en oppsatt fremdriftsplan (vedlegg prosjektplan) der alle vesentlige elementer i utforming av opplegget, gjennomføring og analyser, samt skriving inngår. Veileder plikter å gi respons på innleverte deler av oppgaven.

Det gis inntil 10 timer veiledning pr oppgave. Det beregnes 3 timer for- og etterarbeid til hver veiledningstime, totalt 40 timer. Honorar til ekstern veileder utbetales etter satser fastsatt av Universitetet i Stavanger. Fremmes ønske om å utnevne biveileder må dette først godkjennes av veileder. Biveilederfunksjonen betraktes som en støttefunksjon. Det utbetales ikke honorar. Veilederen plikter å holde studenten løpende orientert og gi beskjed om lengre fravær, forskningsfri etc. i god tid, slik at dette kan tilpasses planen for arbeidet. Dette gjelder også eventuell medveileder og intern kontaktperson.

Dersom veilederen finner at studenten ikke overholder sine forpliktelser på en tilfredsstillende måte ifølge retningslinjene, eller veiledningsforholdet blir problematisk, kan veilederen på dette grunnlag be om å bli løst fra veiledningsoppgaven.

Dersom studenten finner at veiledningen er utilfredsstillende kan han/hun be om å få oppnevnt en ny veileder. Studieledelsen treffer avgjørelse i saken.

Dersom både veilederen og studenten under arbeidet med masteroppgaven, finner at det av faglige grunner bør oppnevnes ny veileder, skal de henvende seg til studieledelsen.
Dersom det oppnevnes medveileder, skal arbeidsfordeling veilederne imellom avtales.
Eiendomsrett til masteroppgaven

Masteroppgaven er studentens eiendom, men kan fritt nyttes av universitetet i undervisnings- og forskningsformål så lenge studenten ikke eksplisitt har begrenset bruken av materialet
Arkivering og registrering av veilederavtalen

Avtalen (original) med godkjent prosjektbeskrivelse arkiveres ved Det helsevitenskapelige fakultet. Student og veileder beholder hver 1 kopi av avtalen.

Sted / dato: Stavanger, 04.05.2023

Student Christina Baetzel

Hovedveileder Ingvild Maarita Moksen

Eventuell medveileder

_____

Intern kontaktperson (evt.)

_____

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