Treating Depression with Activation

Markus BT Nyström

Department of Psychology
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When you walk through a storm
Hold your head up high
And don't be afraid of the dark
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Abstract

The aim of this thesis was to evaluate and compare four therapist-supported Internet-administered treatments for depression. Three studies were conducted. The first was a systematic review to determine the most effective mode and dose of physical activity (PA) for treating major depressive disorders (MDDs), and to suggest guidelines and recommendations for clinicians. These recommendations included that the PA needs to be individually customized, performed for at least 30 minutes, preferably under supervision, and with a frequency of at least three times per week to be effective for treating MDDs. Recommendations, however, must be viewed in light of the relatively few studies that match the inclusion criteria. The second study aimed to empirically evaluate and compare the effect of four therapist-supported Internet-administered treatments for mild to moderate depression. Two of the treatments were based on PA and two on behavioural activation (BA). One PA group was provided with a rationale; whereas, the other was not. The treatment in one BA group was based on Lewinsohn’s model and the other on Martell’s model. Results showed that all groups (including the control group) significantly reduced their depressive symptoms. Group comparisons revealed that three of the four treatment groups (all except the PA group that did not receive a rationale) had a significantly greater symptom reduction than the control group. This suggests that some sort of rationale is important for symptom reduction. The third study aimed to examine if a relapse prevention program would affect symptom change during a 24-month follow-up. We also examined if symptom change during the acute phase (AP) treatment period predicted symptom change during the follow-up period. A third and final aim was to examine if the number of symptoms post-AP treatment predicted symptom change during the follow-up period. The initial analysis indicated that the introduction of a relapse prevention program did not affect symptom change during follow-up. The symptom change during AP treatment did predict symptom change during follow-up for three of the four treatment groups (all except one of the BA groups). The number of symptoms post-AP treatment, however, did not predict symptom change during follow-up for any of the treatment groups. The main conclusion from this thesis is that PA seems to be effective for treating and preventing depressive symptoms. PA with a rationale is more effective than without one, and an understanding of the person’s situation is important for a treatment outcome. If a symptom change can be achieved during the acute phase, the likelihood for symptom change during the follow-up increases.
List of Papers


## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ADM</td>
<td>Antidepressant medication</td>
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<tr>
<td>AP</td>
<td>Acute phase</td>
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<tr>
<td>BA</td>
<td>Behavioural activation</td>
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<tr>
<td>BAL</td>
<td>Lewinsohn’s model of behavioural activation</td>
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<td>BAM</td>
<td>Martell’s model of behavioural activation</td>
</tr>
<tr>
<td>CBT</td>
<td>Cognitive behavioural therapy</td>
</tr>
<tr>
<td>CP</td>
<td>Continuation phase</td>
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<tr>
<td>CT</td>
<td>Cognitive therapy</td>
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<tr>
<td>DSM-IV</td>
<td>Diagnostic and Statistical Manual version IV</td>
</tr>
<tr>
<td>DSM-V</td>
<td>Diagnostic and Statistical Manual version V</td>
</tr>
<tr>
<td>GAD-7</td>
<td>Generalized Anxiety Disorder Screener 7</td>
</tr>
<tr>
<td>iCBT</td>
<td>Internet-based cognitive behavioural therapy</td>
</tr>
<tr>
<td>ICD-10</td>
<td>Related Health Problems 10th revision</td>
</tr>
<tr>
<td>ITT</td>
<td>Intention to treat</td>
</tr>
<tr>
<td>MADRS-S</td>
<td>Montgomery–Åsberg Depression Rating Scale</td>
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<tr>
<td>MDD</td>
<td>Major depressive disorder</td>
</tr>
<tr>
<td>MDE</td>
<td>Major depressive episode</td>
</tr>
<tr>
<td>PA</td>
<td>Physical activity</td>
</tr>
<tr>
<td>PA</td>
<td>Physical activity without rationale</td>
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<td>PHQ-9</td>
<td>Patient health questionnaire</td>
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Introduction

Depression is one of the most common forms of mental illness and a major cause of ill health in society; it is estimated to affect more than 300 million people worldwide (World Health Organization, 2017). The prevalence of depression is estimated to be between 2% and 15% and is today considered to be the fourth largest contributor to disease-generated disability in the world (Vigo, Thornicroft, & Atun, 2016). The social costs are significant since depression tends to increase sick days and reduced productivity at work. Individuals affected by depression are in need of more than twice as much sick pay than their colleagues, and when at work, their work tends to be reduced due to difficulties with organization and concentration (Adler et al., 2006; Birnbaum et al., 2010). In addition to the suffering it brings to the individual and the immediate problems it creates in everyday life, depression has a negative impact on health in the long run and increases the risk of developing other severe conditions (e.g., heart disease; Nemeroff & Goldschmidt-Clermont, 2012). The societal costs associated with depression are dramatically increasing. In Sweden the total cost for depression, when considering healthcare costs and secondary costs, doubled between 1997 and 2005 (Ekman, Granström, Omerov, Jacob, & Landen, 2013).

Even though the individual suffering caused by the depression can be severe, it is estimated that fewer than 50% (and less than 10% in underdeveloped countries) of those affected seek help (World Health Organization, 2017). This could, to some extent, be explained by the characteristics of the disease (e.g., hopelessness, decreased interest, increased isolation, difficulty making decisions and an inability to absorb information). Research also suggests that the cost of treatment can play a crucial role in why so few of those affected seek help (Mojtabai, 2009).

Another possible reason for not seeking help may be that the usual treatments (i.e., antidepressant medication [ADM] or psychotherapy) do not feel appealing. ADM is associated with a variety of side-effects such as weight gain, nausea, insomnia and reduced sex drive, as well as not having a sustained effect (Bet et al., 2013; Montejo, Montejo, & Navarro-Cremades, 2015; Segal, Williams & Teasdale, 2002). Depression has a tendency to develop into a chronic condition, be recurrent and over time contributes to an increased disability (Andrews, 2001; Solomon et al, 2004). The risk of relapse for those affected by depression is 40% within
the first year and 85% within 15 years (Steinert, Hofmann, Kruse, & Leichsenring, 2014). These findings illuminate the importance of finding alternative treatments for depression.

Based on this information, the primary aim of this thesis was to evaluate and compare two Internet-based treatment forms (PA and BA) for mild to moderate depression (Carlbring et al., 2013). The rationale for these two treatment forms will be experimentally manipulated, creating four different treatment groups, two focusing on PA and two on BA. The present thesis consists of four major sections. The first is a general background of depression, Internet-based treatments, PA as treatment and BA. The second gives a brief overview of the Actua project, which generated the data for studies II and III. The third part provides a summary of the empirical studies, and the fourth part consists of a general discussion of the findings.
Background

Depression

After almost 40 years of research on the construct of depression, as defined by the *Diagnostic and Statistical Manual*, versions IV (DSM-IV; APA 1994) and V (DSM-V; APA, 2013), there is no categorical conclusion explaining why some people develop the disorder while others do not (Cuijpers, 2017). Instead, there is a widespread consensus that depression should be considered a multifaceted disorder, which can develop for a variety of reasons or a combination of reasons (Schuch et al., 2016). It is safe to state that no single explanation can capture the many facets of the disorder.

Most people at some point are affected by some sort of sadness, and if this mood state is extended, does not return to a more common state or is prolonged by a new triggering factor, then the mood state can develop into a major depressive episode (MDE). It is important, however, to distinguish between what is commonly called “feeling sad” or temporary feelings of despair and an MDE. A major depressive disorder (MDD) is classified as a mental disorder, as opposed to “having the blues”, which is usually a more temporary mood state (APA, 2013). Some common characteristics of MDD are difficult and persistent indignation, deep sadness and/or a sense of despair, slight irritation and a lost ability to experience “enjoyment” (APA, 2013). An MDD is more than a temporary feeling of sadness; the symptoms must be present or frequently recurrent for at least two weeks to be classified as an MDD. MDDs are exceedingly prevalent and are closely correlated to decreases in quality of life for the person in question as well as his/her family and surroundings (Kolovos, Kleiboer, & Cuijpers, 2016). To be diagnosed with MDD (according to DSM-V), the person has to experience a depressed mood or a loss of interest or pleasure in daily activities for more than two weeks (APA, 2013). This represents a change from the person’s baseline (impaired function: social, occupational, educational) and at least five of the following nine criteria must be present nearly every day for a fortnight:

1. Depressed mood or irritable most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful)
2. Decreased interest or pleasure in most activities, most of each day
3. Significant weight change (gain or loss of 5%) or change in appetite
4. Change in sleep: insomnia or hypersomnia
5. Change in activity: psychomotor agitation or retardation
6. Fatigue or loss of energy
7. Guilt or worthlessness: feelings of worthlessness or excessive or inappropriate guilt
8. Concentration: diminished ability to think or concentrate, or more indecisiveness
9. Suicidality: thoughts of death or suicide, or has a suicide plan

The number of these criteria that are met and the extent to which they occur is an indication of the degree/severity of the depression. The degree of depression is commonly divided into three levels. Even though the difference between the intensity levels to some extent can differ between individual experiences, they are usually described as follows:

**Mild depression:** If you have a mild depression, you often can function socially and professionally in your daily life, even though you experience internal sadness/despair. You can manage to go to work or hang out with friends, though it requires effort and “a stiff upper lip”.

**Moderate depression:** If you suffer from a moderate depression, the difficulties can be too much to bear so that you no longer can handle your usual daily life or relationships. For example, it may not be possible to work, sleep properly, or spend time with your friends. It can, however, also be that you manage to fulfil your duties, and by doing so you can avoid showing others how you really feel.

**Severe depression:** If you suffer from a severe depression, your mood is affected to the extent that you do not care about basic needs such as eating and drinking. Suicidal thoughts or direct plans on how to take their own life is common in people suffering from severe depression, but that does not mean that everyone with severe depression has suicidal ideation (Birmaher, Brent, & AACAP Work Group on Quality Issues, 2007).

For a person suffering from depression, self-esteem and self-respect often are affected and the person thinks less about his or her self and may have
degrading thoughts of being bad or worthless (Orth, Robins, Meier, & Conger, 2016). These thoughts also tend to strengthen the longer the depression goes on, creating a destructive pattern. A common description of an MDE is the feeling of being caught in a destructive treadmill. This can develop into feelings of indifference for one’s existence and the affection to people in the individuals surrounding are often declining, which could lead to feelings of isolation and exclusion from the outside world (Kendler, 2016). The negative thoughts tend to be repeated, resulting in feelings of misfortune and inadequacy, and once these feelings are established, thoughts may arise that it would be better to be dead. These thoughts often are linked to feelings of anxiety, low self-esteem and despair about the future, resulting in thoughts of being worthless or a burden for friends and family, which in the worst case could result in suicide attempts. Sometimes the person who is depressed can become angry, irritable or aggressive, which could be a signal to friends and family that perhaps there is something not right (Rößner-Ruff, Krieger, & Graef-Calliess, 2017). A depression also can be felt in the body (e.g., constipation; headache or pain in the neck, stomach or back; heart palpitations and shortness of breath; Knapen, Vancampfort, Moriën, & Marchal, 2015). These more somatic symptoms can cause the person to seek professional care, and when making first contact with the doctor, it is noted that the depression is causing the physical pain.

There are major gender differences in the diagnosis of MDD, where women are significantly overrepresented. This is by no means something unique for MDD but rather more of a rule than an exception for effective diagnoses. However, gender differences tend to be noticeable in younger patients now more than ever (already at the age of 12) and seem to peak in the teenage years, where females have been suggested to be at 2.37 times higher risk of being diagnosed with MDD (Salk, Hyde, & Abramson, 2017). Furthermore, something that may be a little surprising is that the differences appear to be greater in countries with higher gender equality (Salk et al., 2017). This does not mean, however, that MDD should be overlooked in male populations. It may just be that MDD in men expresses itself differently than in women, which may make the female version of MDD easier to identify with symptoms that define the condition. Previous research has shown that when combining alternative and traditional symptoms when diagnosing MDD, the gender differences disappear (Martin, Neighbors, & Griffith, 2013). It has even been suggested that male depression could be considered a specific condition or subtype of MDD,
since men tend to exhibit symptoms other than the more traditional ones (e.g., aggressiveness, alcohol abuse and irritability; Rößner-Ruff et al., 2017).

There are unipolar and bipolar mood disorders, where the unipolar disorders only swings in one direction and the bipolar disorders swings in both directions (i.e., the individual mood state can shift between bursts of euphoria and deep sadness; APA, 2013). In DSM-V, nine different categories/types of MDD are specified (for a short description see Table 1; APA, 2013).

<table>
<thead>
<tr>
<th>Name</th>
<th>Characterizing features</th>
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<tr>
<td>With anxiety distress</td>
<td>Feeling tense, unusually restless, unable to concentrate because of anxiety, afraid something bad will happen, feelings of losing control</td>
</tr>
<tr>
<td>With mixed features</td>
<td>Increased mood, grandiosity, difficulty with being quiet, experiences of thoughts rushing through the head, increased energy, increased or exorbitant involvement in activities with likely unpleasant consequences, reduced sleep need</td>
</tr>
<tr>
<td>With melancholic features</td>
<td>Regularly waking up earlier than usual, decrease in physical and psychological activity, unintended weight loss, inappropriate feelings of guilt</td>
</tr>
<tr>
<td>With atypical features</td>
<td>Mood enhancement in response to positive events, weight gain, hypersomnia, heavy feelings in arms and/or legs</td>
</tr>
<tr>
<td>With mood-congruent psychotic features</td>
<td>Delusions and hallucinations consistent with depressive themes (e.g., personal inadequacy, guilt, or worthlessness)</td>
</tr>
<tr>
<td>With mood-incongruent psychotic features</td>
<td>Delusions and hallucinations not consistent with typical depressive themes</td>
</tr>
<tr>
<td>With catatonia</td>
<td>Immobility or excessive mobility, extreme negativity, inability to speak, repeating behaviours</td>
</tr>
<tr>
<td>With peripartum onset</td>
<td>More neurotic depression and higher rates of dysthymia</td>
</tr>
<tr>
<td>With seasonal pattern</td>
<td>Seasonal, usually linked to periods of less sunlight, often results in experiences of fatigue and a lower sense of mind</td>
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Comorbidity
Depression also increases the risk of concurrent illnesses, and those suffering have an increased risk for suicide (Cummins et al., 2015; Moussavi et al., 2007). Previous research has postulated that depression also has an influence on and a high comorbidity with other psychological conditions (e.g., anxiety, dementia, obsessive compulsive disorder, substance use disorder and personality disorders; Davies, Uezato, Newell, & Frazier, 2008; Katon et al., 2010; Overbeek, Schruers, Vermetten, & Griez, 2002; Rimlinger, 2010; Strine et al., 2015). As an example, one study reported that approximately 85% of patients diagnosed with depression also suffer from anxiety, and 90% of those diagnosed with anxiety also suffer from depression (Miller, 2013). Previous research also has demonstrated that depression has a high comorbidity with a wide range of physical and/or somatic conditions (e.g., cardiovascular diseases, chronic pain and diabetes; Arnow et al., 2006; Barengo et al. 2004; Katon et al., 2010).
Treatments of Depression

The two most common forms of treatment for depression today are ADMs and/or psychotherapy. But since no two people are affected in exactly the same way by depression, there are no one-size-fits-all treatments for curing depression. Meaning that a treatment that works for one person does not necessarily work for another.

Antidepressant medication

ADMs are the most used treatment for depression today, but that does not mean they are the most effective treatments for all people, since depression is not solely about a chemical imbalance in the brain. Medications can help relieve some symptoms of moderate and severe depression, but they do not cure the underlying problem, hence perhaps they are not the best long-term solution. ADMs also can come with side effects (e.g., weight gain, sleep disorder, and sexual dysfunction; Bet, Hugtenburg, Penninx, & Hoogendijk, 2013; Montejo et al., 2015). In the case of ADMs, substances are used that increase serotonin and noradrenaline levels. There are many studies that have compared ADMs to placebos as well as different drugs to each other, but the results are somewhat contradictory (e.g., Anderson, 2000; Barbui & Hotopf, 2001; Bech, Tanghøj, Andersen, & Overø, 2002). A recent meta-analysis concluded that there are no major differences in effectiveness between ADMs and psychotherapies in reducing depressive symptoms. It is suggested, however, that the long-term effect can be better for psychotherapies than for ADMs (Cuijpers et al., 2013).

Psychotherapy

The second most commonly used treatment for depression is some form of psychotherapy, which can be very effective in decreasing depressive symptoms. The therapy also can provide skills and insights that can help the person feel better in the moment as well as help to prevent depression from coming back (e.g., Dimidjian et al., 2011; Dobson et al., 2008). In this thesis, psychotherapy has been used as an umbrella term for psychological treatments.

A common assumption about therapy is that it is conducted face to face and individually with only the client and the therapist present. This is a somewhat outdated view of therapy, however, since today it is as common,
if not more common, to attend group therapy when treating depression. Group treatments also have been shown to be as effective in reducing depressive symptoms as individual treatments (Cuijpers & Gentili, 2017). In individual treatments, there is a clearer focus on establishing a strong relationship between the client and the therapist, which then can be the foundation on which the treatment rests. Another difference is that the client receives undivided attention from the therapist, which could result in a more individualized treatment.

In group therapy, participants can listen to others who are going through the same struggles and be validated in their experiences, which then can help in building self-esteem. Different group members can be at different stages of their depressions, so one could get tips from someone in a similar situation as well as a patient who has worked his/her way through a challenging problem. As well as offering inspiration and ideas, attending group treatment also can help increase social activities, which can help in the creation of new networks and have an antidepressant effect (Renner, Cuijpers, & Huibers, 2014). Recently published research also has concluded that individual and group therapies are effective and that the anti-depressive abilities are comparable (Cuijpers & Gentili, 2017).

A number of psychotherapies have been developed and tested for efficiency against depressive symptoms. A recent overview of a series of meta-analysis concluded that all tested psychotherapies, which were tested in at least 10 randomized trials, were effective in reducing depressive symptoms, compared to care as usual, placebos and waiting lists (Cuijpers, 2017). The most researched therapy form for depression is CBT, but there are a plethora of evidence-based psychotherapies available (e.g., emotion-focused therapy, interpersonal therapy, psychodynamic therapy; Driessen et al., 2017; Greenberg, 2017; Lemmens, DeRubeis, Arntz, Peeters, & Huibers, 2016). Psychotherapies also have been linked with positive side effects (e.g., increased quality of life; Kolovos et al., 2016).

**Different ways of administering depression treatments**

Traditionally, psychotherapies for depression were administered through weekly appointments at a clinic were the patient/client would meet the therapist behind closed doors. For a long time, this way of delivering psychotherapies went unchallenged. It was assumed that psychotherapies were supposed to be delivered face to face and one on one, between client/patient and therapist. During the last decade, research has identified
alternative ways of delivering psychotherapy and by doing so has challenged these stereotypes. Research on the effects of group-delivered depression treatment has shown similar effects in symptom reduction compared to traditional one-on-on treatments (Burlingame et al., 2016). In addition, group treatments also are considered to be cost-effective (Barkowski et al. 2016; Burlingame, et al., 2016; Huntley, Araya, & Salisbury, 2012; McDermut, Miller, & Brown, 2001). Another well researched way to administer/deliver psychotherapies is over the Internet; for the last 15 years, there has been a significant development in the field of Internet-administered psychotherapy.

This development can help meet the escalating need for effective depression treatments. This need becomes even clearer when considering that only about 50% of those suffering from depression are seeking help (World Health Organization, 2017). There are probably a variety of reasons why so few sufferers seek help, but likely contributors are stigma and the risk of side effects from antidepressant drugs (Andersson, Carlbring, Heedman, Johansson, & Paxling, 2013). Another possible reason may be the lack of trained treatment personnel (e.g., psychologists). Therefore, one way to reach more individuals with mild to moderate symptoms of depression is to offer Internet-administered psychotherapy, a method that has become increasingly common in recent years (Andersson, 2016).
Internet

What today falls under the umbrella term “Internet-administered treatments” had its origins in bibliotherapy, which can be defined as any form of text that aims to help the reader achieve better health, mentally and/or physically (Alston, 1962). Today, bibliotherapy has almost exclusively been replaced by the term “self-help,” at least when the term refers to psychotherapies. It can be in the form of self-help books, written instructions and/or other texts that help aid the individual to help him/herself without the assistance of a therapist. There are different forms of self-help, often defined by the extent of contact with, for example, a therapist. On one end of the continuum is pure self-help, where the patient diagnoses him-/herself and identifies adequate treatments in the form of books or texts. On the other end is therapy without homework (e.g., psychoanalysis). Self-help books had an explosive development in the 1970s, and today there are about 2,000 self-help books published each year. Unfortunately, only a few of those are evidence based. Some of the most obvious advantages are that these materials have the potential to reach a lot of people, are usually quite affordable, and are relatively easy to use (Sundram et al., 2017). However, a downside with self-help in general and pure self-help in particular are problems with diagnosing the minimal (or in some cases, nonexistent) support and not understanding the instructions (Sundram et al., 2017).

For a long time, therapists used written instructions (e.g., treatment manuals, psychoeducation and homework) as an aid when treating various psychological disorders (Starker, 1988). It could be argued that a fundamental part of CBT consists of bibliotherapy since much of the therapy comes in the form of written texts such as treatment manuals and home assignments for the patient. When computers became widely available, it was a natural step to digitalize these various self-help instruments, which led to the birth of computer-based CBT. One of the first studies on the effects of computer-based CBT on depression was published by Selmi, Klein, Greist, Sorrell, and Erdman (1990); it reported a large effect size.

As access to computers increased, so did access to this type of treatment. The treatment could now be reached by the majority of people, at least in Western societies (Andersson & Carlbring, 2003). In the wake of technical progress, the development of the first computer-based treatments
followed, evolving from a text-only format to one that includes images, sounds and movies (Imamura et al., 2014). In this way, the treatment method was made more user friendly and more appealing. Today, there also is a rapidly expanding range of mobile phone applications which further increase accessibility, since the vast majority of people (in the Western countries) have mobile phones (Roepke et al., 2015). Common names for this type of therapy are Internet therapy, Internet-based CBT, guided self-help. Internet treatment differs from psychotherapy, especially in how it is conveyed to the patient. It is important, however, to distinguish Internet treatments from various forms of pure self-help tools that are transmitted over the Internet but not accompanied by any form of support (e.g., in the form of mobile apps or individual instructions on a website). The main difference is that guided self-help has the support of a therapist from beginning to end, involves qualified personnel, a defined diagnosis, and the patient/client has, throughout the process, the opportunity to get help and support when problems or ambiguities arise. Feedback also is continuously available throughout the treatment.

There are many types of Internet-administered treatments available today, with research indicating effects on various psychological conditions besides depression, such as anxiety disorders, panic disorders, stress, posttraumatic stress disorder and eating disorders. When it comes to depression, meta-analysis provides good evidence on the effects of different types of Internet-administered treatments for depressive disorders (Andersson, Cuijpers, Carlbring, Riper, & Hedman, 2014; Spek et al., 2007). One study indicates that Internet-administered treatments for depression also seem to have positive side effects in terms of increased self-esteem and quality of life, similar to face-to-face interventions (Crisp, Griffiths, MacKinnon, Bennett & Christensen, 2014). Even though Internet-administered psychotherapies often are thought of as synonymous with CBT, there is growing evidence for other forms of treatments that could be suitable to administer over the Internet (e.g., psychodynamic treatments; Johansson et al., 2013).
Physical Activity

PA is defined as any type of movement that increases energy consumption. This concept applies to everything from regular exercise to gardening and other active chores (Garber et al., 2011). In contrast, exercise is defined as a planned, structured, repeated and intentional movement intended to improve and/or maintain physical fitness and is considered a subcategory of PA. It is established that all forms of PA are beneficial to overall health and well-being. There also is strong evidence that physical inactivity increases the risk of a variety of diseases, both physical and mental (Jayakody, Gunadasa, & Hosker, 2014). Inactivity is estimated to explain 6% of the disease burden in heart disease, 7% in type-II diabetes disease and 10% each in breast and intestinal cancer in the world (Lee et al., 2012). In addition, inactivity causes 9% of premature mortality (i.e., more than five million of the 57 million premature deaths in the world in 2008; Lim et al., 2013). These are numbers that are in parity with other major risk factors for ill health such as smoking and obesity (Lee et al., 2012). In line with this, regular physical activity also seems to have a strong protective effect since it has a relationship with reduced mortality and a decreased risk for developing various psychological disorders (Löllgen, Böckenhoff, & Button, 2009; Martinsen, 2008).

Different forms of physical activity

PA can be divided into two major categories: aerobic and anaerobic (e.g., resistance or weight training) with the first form being the most researched. It is characterized by activity that predominantly depends on the aerobic generating process; whereas, PA focused on triggering lactic acid formation is considered to be anaerobic. PA also can be delivered/received in a variety of forms (e.g., in groups, individually, supervised face to face or over the Internet) and at different intensities, modes and duration levels.

Somatic effects of physical activity

The effects of PA and/or exercise for human health is well established (e.g., Bauman, Merom, Bull, Buchner, & Fiatarone Singh, 2016; Ekelund et al., 2016; Racette, Cade, & Beckmann, 2016). However, the bulk of research has traditionally been focused on the effects on somatic disorders.
The most well-known and researched effect of regular physical activity is related to the circulatory system. Through increased oxygenation of the blood, the organs that supply the muscles with oxygen can work more efficiently, which can result in an improved physical condition for the individual (e.g., Kenney, Wilmore, & Costill, 2015). To achieve health/condition improvements, the strain must be greater than normal; if the strain is higher than normal, the condition increases, but the same goes if the strain is lower than normal, then the condition decreases (Hassmén & Hassmén, 2005). Thus, it is not possible to store the physical condition (i.e., if you were physically active at a younger age, it does not automatically mean that you will have a good physical condition throughout your life—the condition must be maintained; Hassmén & Hassmén, 2005). The human heart and lungs respond quickly to increased physical activity; some studies have measured improved values after only a few weeks of increased physical activity (Pedersen & Saltin, 2015).

Other positive effects related to increased physical activity are the strengthening of the immune system; people who often catch a cold report that they, after having increased physical activity, are no longer bothered by colds to the same extent as before (Shek & Shepard, 1996). The increase in type II diabetes in the population could be viewed as a sign that an increasing number of people are becoming less physically active (Guariguata et al., 2014). The diet becoming fattier and more sugar laden does not help. There are reports that children as young as 8–10 years are developing type II diabetes (Dabelea et al., 2014).

Another positive effect of increased physical activity is weight loss and lowered cholesterol levels, which are contributing causes of cardiovascular disease and are strongly related to premature death (Barengo et al. 2004). Additionally, physical activity tends to increase the opportunity/possibility for a more active leisure, which in turn can stimulate or enable further physical activity.

**Psychological effects of physical activity**

There also is a positive relationship between PA and mental health, according to a major European study with participants from 15 European Union countries (Abu-Omar, Lehtinen, & Rütten, 2004). This relationship remained even when age, sex, marital status, income and academic level were controlled for (Abu-Omar et al., 2004). A negative relationship between physical activity and a variety of mental illnesses, such as major
depression, panic attacks, social phobia and specific phobia have also been described; this relationship also was sustained when demographic variables and physical diseases were controlled (Goodwin, 2003). Furthermore, low PA increases the risk of developing a wide range of psychological disorders (e.g., anxiety; Jayakody et al., 2014), and low PA also can sustain a current mental state even when socio-economic status and comorbidity is controlled (aan het Rot, Collins, & Fitterling, 2009).

Research has emerged over the last 10 years that shows positive effects of psychological interventions aimed at increasing PA, which is further discussed in the following section (Cooney, Dwan, & Mead, 2014; Josefsson et al., 2014; Rebar et al., 2015; Rethorst et al., 2009).

**Effects of physical activity on depression**

A number of cross-sectional studies investigating the relationship between physical activity and depression and longitudinal studies investigating the effect of physical activity on depression have been conducted (e.g., Cooney et al., 2014; Schuch et al., 2016b; Ströhle, 2009). There also is a variety of studies investigating the preventive as well as symptom-reducing abilities of PA (e.g., Harvey et al., 2017; Mammen & Faulkner, 2013; Martinsen, 2008). In addition, several studies have investigated the effect/efficacy of physical activity, in combination with other treatments, often CBT, as a treatment for depression (Josefsson et al., 2014; Rimer et al., 2012; Teychenne, Ball, & Salmon, 2008).

There has been some debate surrounding the effect of PA on depressive symptoms, with some meta-analysis suggesting there are small to moderate effect sizes (e.g., Cooney et al., 2014), while other meta-analysis have reported large effect sizes (Wegner et al., 2014). Often it is highlighted in meta-analysis that if only studies of higher methodological quality are included, the effect sizes of PA on depressive symptoms decreases (Josefsson et al., 2014; Rosenbaum, Tiedemann, Sherrington, Curtis, & Ward, 2014). A contrasting view was offered in a recently published meta-analysis that adjusted for publication bias, suggesting that previous meta-analyses may instead have underestimated the benefits of PA on account of publication bias (Schuch et al., 2016b). Schuch and colleagues (2016b) reported large and significant effect sizes in their meta-analysis, suggesting that publication bias may at least partly explain previous less favourable results.
Physical activity compared to treatment as usual

A number of meta-analysis have compared PA to more traditional treatments for depression (i.e., ADM and various forms of psychotherapy; Hallgren et al., 2015). An older meta-analysis by Craft and Landers (1998) reported no differences in antidepressive effects between PA, psychotherapy and ADM. A more contemporary meta-analysis reported comparable effects of PA and ADM (Blumenthal et al., 2007), which were in line with Lawlor and Hopker (2001), who also reported no differences between PA and cognitive therapy (CT) in their meta-analysis. In summary, previous research on differences in efficacy between PA and other types of depressive treatments indicated no differences in effect, whether it be ADM or psychotherapy. The effect of the treatment has been shown to be comparable with CBT and/or ADM (Blumenthal et al., 2007; Hallgren et al., 2015; Rethorst et al., 2009; Rimer et al., 2012).

Results regarding the effects of physical activity

The debate nowadays is not so much focused on whether PA is effective in reducing depressive symptoms, but rather on what constitutes the most effective PA in regard to frequency, intensity, duration and type (e.g., Cooney et al., 2014; Harvey, et al., 2017; Schuch et al., 2016b). Let us consider these variables.

Optimal frequency of physical activity

Although the vast majority of studies have indicated a clear relationship between physical activity and depression, there still are areas with conflicting results. One such area concerns the frequency of PA needed to achieve an effect (Cooney et al., 2014; Rethorst et al., 2009; 2014; Schuch et al., 2016b). For instance, an earlier study reported that those who exercised two to three times a week had significantly fewer depressive symptoms than those who exercised fewer times per week (Hassmén, Koivula, & Uutela, 2000). Another interesting finding from that study was that those who were most active, those who exercised daily, had a slightly higher risk of depression. (Hassmén et al., 2000). This could be interpreted as that it is not a case of the more the better, but rather a bit more complicated.

Optimal intensity of physical activity

Another area of conflicting results regards the intensity of the PA needed for an antidepressive effect. There are a vast number of studies using
different intensity levels of PA, ranging from walking to high-intensive forms of exercise, that have reported effects on depressive symptoms (e.g., Robertson, Robertson, Jepson, & Maxwell, 2012). One study reported a significant relationship between walking and decreasing depression, while the relationships between higher intensity PA (moderate and vigorous PA) and depression were not significant (Gavric, Culafic, & Markovic, 2011). Examples of other low-intensity PAs that have been reported to be effective in decreasing depressive symptoms are Tai Chi and Qigong (Robertson et al., 2012). Some older studies report that the dose/intensity of PA are of importance and that higher intensity PA is more effective in reducing depressive symptoms than lower intensity PA (e.g., Dunn et al., 2005; Singh et al., 2005). Schuch and colleagues (2016b) also concluded in their meta-analysis that moderate to vigorous intensity PA was more effective in reducing depressive symptoms than light to moderate PA. Stanton and Reaburn (2014) suggested in their meta-analysis that the intensity level should be based on the client’s preference, to benefit treatment outcome. A prior study by Callaghan, Khalil, Morres and Carter (2011) found that those randomized to receive customized PA had a significantly larger reduction of symptoms compared to those who received pre-determined intensity of PA.

A recently published study comparing three intensity levels of PA to treatment as usual found no significant difference, on account of intensity levels, in antidepressant effect (Helgadóttir, Hallgren, Ekbom, & Forsell, 2016). However, the number of depressive symptoms decreased more for those patients randomized to any one of the three groups receiving PA, compared to those randomized to TAU (Helgadóttir et al., 2016). There is a growing body of evidence to support the notion that there is no direct relationship between energy expenditure and a reduction in depressive symptoms, suggesting that it is perhaps other mechanisms (e.g., contextual factors, perceived intensity) that are responsible for the positive effects of PA on depression (Cooney et al., 2014; Rethorst et al., 2009; Robertson et al., 2012).

**Optimal duration of physical activity**

When it comes to preferred duration of PA for best effects on reducing depressive symptoms, the results differ (Nyström, Neely, Hassmén, & Carlbring, 2015). Some studies suggest that physical activity should be performed for a minimum amount of time to be effective, while others conclude that the duration is of less importance to gain an effect. In fact,
there are studies that have used shorter sessions and studies that have used longer sessions of PA that have reported effects on depressive symptoms (e.g., Mammen & Faulkner, 2013; Nyström et al., 2015). There is a consensus, however, that it is important that the PA is performed regularly; if it is performed three or four times a week, it is of secondary importance. The number of sessions per week also should be adjusted based on the degree of depression, previous experience of PA, physical status and the choice of PA. The optimal length of the treatments (i.e., number of weeks) needed to be effective in reducing symptoms also is debated. There are some treatments lasting for 10-days that have resulted in a significant decline in symptoms (Knubben et al., 2007); whereas, other results suggest that a duration of at least nine weeks should be recommended for optimum symptom reduction (Stanton & Reaburn, 2014).

**Optimal type of physical activity**

When comparing effects of different Pas, the results also differ, some indicating that aerobic PA is more effective than anaerobic PA and vice versa, (Danielsson, Noras, Waern, & Carlsson, 2013; Nyström et al., 2015). The results from a recent meta-analysis, adjusted for publication bias, concluded that only aerobic PA had large and significant effects on depression in clinical populations (Schuch et al., 2016b). In a recently published treatment guideline for depression, the authors state that both aerobic and anaerobic PA is effective in reducing depressive symptoms (Hallgren et al., 2017). Conclusively, the literature on optimal type of PA (aerobic or anaerobic PA) is divided.

Thus, in terms of duration, frequency, intensity and type of PA, several meta-analysis and systematic literature reviews have been published indicating that it does not seem to matter how much and what type of PA is performed (Nyström et al., 2015). Perhaps then the primary focus should be on encouraging the patient to do something physical—anything physical—rather than focusing too much on the type, frequency, and intensity levels of the PA. This suggestion also is supported by other researchers (for a review, see Danielsson et al., 2013). When comparing effectiveness/efficacy between different forms and types of PA, there are large differences on account of populations (e.g., clinical or sub-clinical, degree of symptoms, age) which should be taken into consideration when giving recommendations on preferred treatment.
Does the delivery of physical activity affect outcome?

There are a variety of ways in which PA can be delivered and performed. It can be in individual or group settings, it can be supervised or unsupervised and it can be delivered face to face or remotely (e.g., Internet administered). Following is a short summary of what the literature tells us regarding differences in effects based on the delivery methods.

**Individual vs group physical activity**

A number of meta-analysis and systematic reviews have compared differences in effect/efficiency between individual and group-delivered PA (e.g., Cooney et al., 2014; Perraton, Kumar, & Machotka, 2010; Stanton & Reaburn, 2014). Results indicate that both individual and group interventions are effective and that they seem to be used to a similar extent (Perraton et al., 2010). Today there is no clear evidence for a preferable way of delivering PA (i.e., individually or in a group) to treat or decrease depressive symptoms.

**Supervised vs unsupervised physical activity**

Some meta-analyses and systematic reviews have reported that most of the included studies have used supervised PA for a variety of reasons (e.g., motivational aspects, to ensure that the PA is performed as intended and to minimise the risk for injuries; e.g., Danielsson et al., 2013; Nyström et al., 2015; Perraton et al., 2010). In some of these meta-analyses, it has been proposed that since most studies use supervised PA, this may indicate that supervised PA is preferred solely on the basis of this preference (e.g., Perraton et al., 2010). An area that is still relatively unexplored is if electronic devices could be used for supervision, such as phone applications, exercise/smart watches and pedometers and if they are as effective as human supervision. A growing number of researchers have also been focusing on studying the effectiveness of how well modern technologies could be used as tools for supervision (e.g., using Skype and social media). Since it has been suggested that the effectiveness of the supervision/supervisor is not decisive for the treatment outcome, exploring this option could be the next step (Perraton et al., 2010). On the other hand, a recently published meta-analysis argues the importance of the supervisors having some sort of physiological training (e.g., physiotherapists, exercise physiologist; Schuch et al., 2016). Which could, be interpreted as an indication of the importance of human supervision.
**Face-to-face vs remotely delivered physical activity**

The majority of contemporary studies that have used PA as a treatment for depression, as referenced above, human instructors have introduced the PA, but perhaps it would be possible, and even as effective, to use other ways to deliver the PA. For instance, the PA could be delivered by prerecorded instructions or via Internet-based training programs.

Although there are no clear guidelines when it comes to different ways of delivering and performing the PA, some notable themes exist. It can be argued that how the PA is delivered could have an effect on other variables, which in turn could affect motivational aspects, which could influence compliance and eventually influence the outcome. There is a large variation in reported compliance between different studies (50–100%) which could, to some extent, depend on how well the delivery of PA suited the participants (Stanton & Reaburn, 2014). In their meta-analysis, these researchers highlighted how complex and important it is to fit the PA to the individual’s needs to make the treatment as effective as possible.

**Methodological weaknesses**

Although there are many studies that indicate that PA has antidepressant properties, some rather common issues have been highlighted regarding methodological difficulties or weakness (e.g., Cooney et al., 2014; Josefsson et al., 2014) and about the difficulty in determining the causal relationship (Nyström et al., 2015). Some of the more frequently raised methodological questions concern allocation concealment, intention to treat (ITT), blinded outcome assessment, how depression was defined/operationalized and the use of control group or not. Below I discuss these different aspects and how they could influence the results. It should be noted, however, that these are not the only potential sources of bias but rather some that are more frequently raised.

**Allocation concealment**

This weakness concerns the randomization process of assigning participants to different groups. To ensure that group assignment has been randomly performed, it is required that neither the researcher nor the participants can affect group assignment (Forder, Gebski, & Keech, 2005). It is here that allocation concealment plays a vital role. If allocation concealment is done properly, it ensures that the researcher and participants are unaware of the allocation. This may seem like a small matter, but to illustrate what effects this could have on the results, I have
provided two examples: one where the allocation concealment is not done properly and one where it is.

Example 1.
Say that we are going to examine the differences in effect between two interventions for increasing people’s PA levels. We will allocate those who signed up into two groups without using any allocation concealment. The researcher could choose to assign persons that have a history of being physically active to one group and those who do not to the other. The outcome of this study would not necessarily depend on the interventions—instead, previous experience of PA will most likely have a greater influence on the results.

Example 2.
If we stay with the same example but instead use a proper randomization process, neither the researcher nor the participants can influence which group the participants end up in. This will ensure that allocation concealment has been used which will increase the likelihood that the outcome depends on the different interventions and not the previous experience of PA. Since the allocation concealment (if done properly) should make sure that differences between the groups are not influenced by the researcher, hence giving a fair evaluation of the two interventions.

These examples describe one of the most commonly reported problems with studies on the effect of PA for depression (for a review see, e.g., Cooney et al., 2014). A review reported that as many as 40% of studies published in major medical journals suffered from inadequate allocation concealment and/or did not describe how they concealed allocation (Hewitt, Hahn, Torgerson, Watson, & Bland, 2005).

Intention to treat
When an ITT analysis is conducted, it means that all participants who were randomized are included in the outcome analysis, regardless of whether they completed the treatment or not. By adopting ITT, the results will not be affected by the fact that only those who completed the treatment/intervention are included. If we use the previous example, it might be that those who do not have previous experience with PA may not be motivated and thus drop out of the study/treatment. If we do not adhere to the
principle of ITT, our results will be based on those who completed the study (i.e., those who had previous experience with PA), which will unlikely give a fair picture of how effective the treatment/intervention was in increasing levels of PA. This weakness has been highlighted in a number of meta-analyses and literary reviews and constitutes a real threat to the randomization principle, which in turn risks the possibility of generalizing the results to a wider population.

**Blinded outcome assessment**
The procedure of blinded outcome assessment is used to mask treatment allocation for the outcome assessor. Even if the therapist knows which treatment a certain patient received or if he or she were randomized to the control group, the requirement for blinded outcome assessment still can be achieved. The crucial element is that the person who analyses the outcome measure does not know to which group the patient was randomized to (Forder et al., 2005). So, by concealing the treatment allocation from the persons who are analysing the data, blinded outcome assessment is achieved. Using this method reduces the risk that results will be affected by individual preferences and hence less sensitive to expectancy and observer and/or information bias (Forder et al., 2005). The aim is to keep the outcome as objective as possible, which can be difficult when the patient is asked to assess their own progress (e.g., when using self-assessment forms). On those occasions, it is recommended to use at least two items when assessing one construct to enable reliability estimations.

**Defining depression**
Another, commonly highlighted weakness relates to the instruments used and whether they display sufficient reliability and validity. In some studies, the participants estimated their depression levels by using self-assessment forms, which becomes problematic since most people who do not feel well tend to overestimate their symptoms (Dunlop et al., 2010). It should be noted, however, that as treatment continue and symptoms decrease, the difference in symptom estimation also tends to decrease. By not restricting inclusion to depressed people, the results are harder to generalize since the possible conclusions are limited (Josefsson et al., 2014). For instance, the outcome could be a result of level of symptoms, rather than the effectiveness of the treatment under study.
Use of control group
Finally, the variation in the use of control groups have also influenced the conclusions that are possible to draw regarding the effect of PA. Or perhaps it is the differences in how control groups have been defined that have made it difficult to compare results from different studies. Several of the previous meta-analyses that investigated the antidepressant properties of PA included studies that used control groups that received some form of alternative treatment/placebo with antidepressive properties (e.g., Klein et al., 1985; Krogh, Saltin, Gluud, & Nordentoft, 2009). Some of the alternative treatments/placebos the control groups received were relaxation training and bright light therapy (Fortney & Taylor, 2010; Pinchasov et al., 2000; Rethorst et al., 2009). However, there are ethical aspects to consider, especially when recruiting participants for treatment studies. For example, people suffering from painful conditions and are in great need of help may never have volunteered if they knew that they might be randomized to a control group. Furthermore, the researcher may find it difficult to get an ethical approval if all included participants are not offered some kind of treatment (Boutron, Tubach, Giraudeau, & Ravaud, 2003).

Genetic question marks
De Moor, Boomsma, Stubbe, Willemse and de Geus (2008) conducted a monozygotic twin study that strongly questioned the relationship between depression and PA, which indicates that the effect is not guided by the training itself but rather by genetic factors. The results did not indicate that the twin who was less physically active showed more depressive symptoms than the physically active twin, hence it was concluded that genetics could be a decisive factor for the outcome. However, a more recent study conducted by Waller and colleagues (2016), reported a more frequent use of ADM for less active twins than for their more active twin siblings. Even though this pattern was more evident amongst the dizygotic twins, it was still seen amongst the monozygotic twins (Waller, Kaprio, Korhonen, Tuulio-Henriksson, & Kujala, 2016). Waller et al., (2016) concluded that PA in midlife can act as a buffer against developing depression later in life. However, more twin studies are needed to draw firmer conclusions regarding the importance of genetic factors in the development of depressive symptoms.
Antidepressant mechanisms of Physical activity

The exact antidepressant mechanism of PA is still unclear; however, a number of prominent physiological and psychological hypotheses do exist.

Physiological suggestions
Steinberg and Sykes (1985) proposed the endorphin hypothesis, which suggests there is an association between PA and the release of endogenous opiates (e.g., beta endorphins which subsequently enhance the mood state to increase well-being). There is also evidence that PA affects a number of hormones and neurotransmitters, which in turn affects the brain in a mood-enhancing way (Eyre, Papps, & Baune, 2013; Meeusen & De Meirleir, 1995). A recent meta-analysis proved that PA prompts direct and long-term reactions, especially amongst hormones, neurotrophins and inflammation biomarkers (Schuch et al., 2016a). Schuch et al. (2016a) also reported a connection between the volume of hippocampus and a reduction in depressive symptoms. Furthermore, it has been suggested that PA can be effective and used for comorbid populations (e.g., MDD + cardiovascular diseases); that is, PA can be effective in decreasing the depressive symptoms as well as minimizing the risk for cardiovascular issues (Blumenthal et al., 2012). Previous research also has proposed that PA activates processes that stimulate neuroplasticity, which increases the individual's ability to respond to new demands from the environment through behavioural change (Hötting & Röder, 2013). Furthermore, combining PA and cognitive training could increase the potential for a better effect of both interventions (Fabel et al., 2009; Hötting & Röder, 2013).

Psychological suggestions
Research also indicates that PA is associated with a number of positive psychological effects such as increased self-esteem, sense of control, feeling of success, increased sense of independence, and also the sense of belonging (Knapen, Vancampfort, Moriën, & Marchal, 2015). It has been suggested that the social aspect of PA (e.g., having to say hello to other people at the gym), is a major antidepressant agent. PA also has been thought of as a distraction from everyday distress and that the antidepressant properties are related to this break from the individual’s distressing thoughts (for a review see Gleser & Mendelberg, 1990). However, it has been proposed that social support is not crucial for the antidepressant effect of PA, instead it is other psychological factors such as
improved self-efficacy, sense of mastery, distraction and change of self-concept, that are central to the antidepressive aspects of PA (Ströhle, 2009). A study on severely depressed inpatients concluded that PA had an effect on depressive symptoms as well as on quality of life (Schuch et al., 2015).

**Future research**

There are, however, a number of questions that need further research. For example, the effects of combination treatments where PA is accompanied by elements such as motivational support have been suggested to be more effective than PA alone (Callaghan et al., 2011). It also seems to be an added beneficial side-effect from the combined PA treatment compared to the stand-alone PA treatment in the form of increased self-esteem and well-being (Callaghan et al., 2011). The motivational aspect should be investigated since it has been indicated to play a vital role in treatment outcome. There also seems to be a growing support for individualized PA so that the treatment is tailored after the individual client’s preferences in regard to frequency, type and intensity (Carlbring et al., 2015). More studies are needed to draw any conclusions regarding how client input affects treatment outcome. Further research is needed on the sustainability of PA on depressive symptoms, how relapse/recurrence rates are influenced by PA treatment—is it comparable with more traditional treatments for depression?
Behavioural Activation

Background

Lewinsohn and co-workers developed BA in the 1970s (Dimidjian, Barrera, Martell, Munoz, & Lewinsohn, 2011). The development spun from an interest to test different hypotheses about what is effective in the treatment of depression, which has its roots in CT, developed by Aaron T Beck and associates (Beck, Rush, Shaw, & Emery, 1979). CT assumes that how people think about their life situations affects what they do and how they feel (Beck, 1979). When people are depressed, they have a problematic way of thinking, which aggravates the depression. CT, therefore, focuses on helping people identify these thoughts and beliefs, assesses how they affect people and bring about changes in these thinking patterns (Dimidjian et al., 2011). Thus, the main hypothesis is that people feel better when they have more realistic thoughts.

The strategies used in CT are multifaceted and can be divided into three primary categories: behavioural strategies for changing how people act in specific situations, cognitive strategies to change how people think in specific situations and cognitive strategies to change fundamental assumptions that people have about themselves, their future and their surroundings (Dimidjian, Martell, Addis, Herman-Dunn, & Barlow, 2008). A particular focus is placed on cognitive strategies with an emphasis on strategies for cognitive change. The effect of CT for depression is well documented (e.g., De Rubeis et al., 2005; Hollon et al., 2005), but there is some uncertainty regarding how it works and what are the active ingredients.

One of the first studies that tried to answer these questions concluded that all strategies (behavioural, cognitive and cognitive restructuring), in isolation, had similar antidepressive properties (Zeiss, Lewinsohn, & Muñoz, 1979). A component analysis study also investigated the active interventions in CT, where the different treatment components (BA, BA + cognitive restructuring of automatic thoughts and the complete CT format) were isolated and the effects were compared to see which components were causally active (Gortner, Gollan, Dobson, & Jacobson, 1998). The results showed no difference in effect between the various components. These results further indicated that the behavioural component of CT had (on its own) antidepressant properties and subsequently, the BA component was
extracted from CT and presented as a stand-alone treatment (Gortner et al., 1996).

**Learning theory**
From a learning theory perspective, depression is defined as the result of, and maintained by, an absence of positive reinforcement and pleasant activities and by the existence of unpleasant events (Lewinsohn & Graf, 1973). From this perspective, the predecessor to depression is some kind of environmental stressor associated with negative effects, which leads to increased inactivity (Lewinsohn & Graf, 1973). The reduced activity level has the tendency to result in less positive reinforcers, which in turn serves to magnify the depressed mood, creating a vicious circle that could lead to clinical depression (Lewinsohn & Graf, 1973). Ferster (1973) also highlighted the necessity of lack of positive reinforcers for the development of depression, but also added that depression is associated with increased avoidance and escape behaviours. Typical for all understanding of depression that originates from the learning theory is that they do not ignore the importance of biological and cognitive factors, even though they mainly focus on observable behaviours of the individual and the interaction between these behaviours and the individual’s surroundings (Jacobson, Martell, & Dimidjian, 2001).

**Behavioural activation**
Lewinsohn (1974) highlighted the lack of positive reinforcement in depressed individuals’ lives. In fact, he defined depression as a consequence of the absence or low levels of action dependent upon positive reinforcements (Lewinsohn, 1974). By action dependent, Lewinsohn meant that reinforcement is dependent on what the person does, so consequently, if a person does not get positive reinforcement on his/her behaviour, then he or she will stop with that particular behaviour (Lewinsohn, Biglan, & Zeiss, 1976). Lewinsohn assumed that a lack of positive reinforcement could minimize behaviours usually associated with positive responses, hence have a destructive impact which could cause or maintain the mood state (Lewinsohn & Graf, 1973). But it is not, according to Lewinsohn and Mermelstein (1985), the absolute amount of positive responses that define the individual’s behaviour, but rather the subjective experience of the positive response which has the strongest effect on the individual’s mood.
It has been proposed that negative life events decrease the probability for use of adaptive ways to interpret everyday events for people with a higher vulnerability for depression, since they may lack the tools to handle such events (Dimidjian et al., 2008). This could result in sustained feelings of despair, which can cause people to become excessively self-critical with an increased focus on their own persons (Veale, 2008). This also could affect the person’s motivation for engaging in similar situations, with the risk of creating a negative spiral, that could prolong or and deepen the current mood state. Based on the assumption that depressed persons may be more sensitive to everyday incidents, it has been assumed that desensitization can have a decisive impact on the effectiveness of the treatment.

BA is a structured short-term treatment for depression that focuses on activating the patients/clients in such a way that they increase pleasant experiences in their everyday lives (Lewinsohn et al., 1976). To do so, BA focuses on highlighting processes that complicate activation (e.g., escape and avoidance behaviours). Hence, BA focuses on breaking the vicious circle and reintroduce positive reinforcers into daily life (Dimidjian et al., 2011). The therapy sessions in BA are action oriented and focus on problem-solving with majority of the work done outside the therapy room. BA focuses on specific problem areas identified for the individual and is based on his or her special needs. This makes BA a very concrete form of treatment, which facilitates a person’s motivation to stay in treatment and to understand the importance of the various elements of treatment. Consequently, most BA treatments are manual based; they are relatively easy to administer, which facilitates implementation to regular healthcare (Jacobson et al., 2001).

There are several recent evidence-based treatments with a similar or compatible focus as BA (e.g., dialectical behaviour therapy), and acceptance and commitment therapy (Robins & Rosenthal, 2011). The evidence for these methods could indicate the importance of activation for the clinical change process for people suffering from depression and others. The importance of modifying behavioural tendencies that are governed by a lack of emotion regulation have been highlighted in treatments for a variety of psychological disorders (e.g., Barlow, Allen, & Choats, 2004).

BA has become a well-established form of treatment for depression, and its effects have been proved and are comparable to other therapies (e.g., CBT)
as well as antidepressants (Cuijpers et al., 2007; Cuijpers, 2017; Dobson et al., 2008; Mazzucchelli et al., 2009). It also has been found that the effect of treatment with BA lasts longer than treatment with antidepressants (Dobson et al., 2008). In addition, a study by Masterson and colleagues (2014) showed that BA offers so-called “sudden gains” (positive effects immediately after the initiation of treatment) in individuals with mild to moderate depression. In more contemporary versions of BA, an even bigger emphasis is put on understanding people’s behavioural pattern and strategies, to be able to test new and more effective strategies to enhance their moods (Martell, Herman-Dunn, Dimidjian, 2010).
Conclusion

People suffering from depression usually feel powerless and lose the desire to do things that they previously thought of as rewarding and fun, which in turn leads to isolation and an inactive lifestyle. One way that has proven effective in reducing depressive symptoms is to break the pattern by reintroducing enjoyable activities (Dimidjian et al., 2011). Two types of treatments for mild to moderate depression that focus on activation are PA (Blumenthal et al., 2007; Cooney, Dwan, & Mead, 2014; Dinas, Koutedakis, & Flouris, 2011; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005; Josefsson, Lindwall, & Archer, 2014; Rethorst, Wipfli, & Landers, 2009) and BA (Cuijpers, Straten, & Warmerdam, 2007; Dobson et al., 2008; Mazzucchelli, Kane & Rees, 2009). Both types of treatment are based on concrete and observable behaviours, which makes them relatively easy to administer and do not require as experienced therapists compared to other methods. Thus, the methods have the potential to be administered via the Internet (Dimidjian et al., 2011), which has been confirmed by previous studies (O’Mahen et al., 2013; Rosenbaum, Newby, Steel, Andrews, & Ward, 2015). Internet implementation of effective evidence-based depression treatments provides opportunities to reach people who, for various reasons, may be unable to come in contact with a mental healthcare provider. Furthermore, previous studies also indicate that PA and BA are time- as well as cost-effective (Cuijpers et al., 2007). However, many unresolved issues remain. The aim of this thesis is to address some of these issues. In particular, focus has been given to the antidepressant effects of PA and BA, the role that psychoeducation can play in the implementation of treatment and the long-term effects of Internet-based treatments based on PA and BA.
Aims of Thesis:

To evaluate and compare potential effects between four therapist-supported Internet-administered treatments for mild to moderate depression. Two of these treatments involve physical activity while two focus on BA. Initially, a systematic review of previous research was performed to determine if any specific type of physical activity is considered preferable for treating MDD (Study I). Study II evaluated and compared the effects of four Internet-administered treatments on depression. Study III was a 24-month follow-up aimed at investigating if differences existed between the four groups in relapse/recurrence and if a relapse prevention program had any measurable effects.

Specific aims in the three studies:

**Study I:**
Determine the most effective mode and dose of PA for treating MDDs, and to suggest guidelines and recommendations for clinicians.

**Study II:**
Evaluate which of the four Internet-administered treatments for depression was most effective. A secondary aim was to determine if any change in anxiety symptoms followed the same path as the proposed change in depressive symptoms.

**Study III:**
Examine how a self-help Internet-administered relapse prevention program affects symptom change over the follow-up period. To investigate the predictive abilities of symptom change during AP treatment and for change during a 24-month follow-up. To investigate the predictive abilities of number of symptoms, post-AP treatment, for change during a 24-month follow-up.

Table 2 offers a summary of the three studies.
Table 2

Overview of the empirical studies included in this thesis

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*Note. PHQ-9 = Patient health questionnaire 9, GAD-7 = Generalized Anxiety Disorder Screener 7*
The Actua Project

The data used in studies II and III were collected within the Actua project (Carlbring et al., 2013). This project is a collaboration between four Swedish Universities: Linköping, Stockholm, Umeå and Uppsala.

Participants were recruited nationally from different parts of Sweden by ads in the media and on the Internet as well as through different social media. All applications to participate were made on the project’s website (actua.se). To be considered, participants had to meet the criteria for MDD (according to the DSM-IV-TR), present with a score of 15–35 on the Montgomery–Åsberg Depression Rating Scale (MADRS-S), have reached the age of 18, have access to a computer with Internet connection, live in Sweden and be able to speak and read Swedish. Applicants who were considered too depressed or suicidal, too physically active, had another primary diagnose (than depression) and were presently undertaking any other form of psychotherapy were excluded. Being on an ADM was not a reason for exclusion per se, but if the dose had been changed (or if other mood-changing medications were being administered) during the last three months, the applicants were not considered for inclusion.

Participants were enrolled continually between January 2013 and May 2014 in two steps. First, the applicants filled out a number of Internet-administered self-assessment forms. Depression levels were assessed using the MADRS-S and the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001), PA was assessed using the International Physical Activity Questionnaire (Hagströmer, Oja, & Sjöström, 2007), and anxiety was determined using the Generalized Anxiety Disorder Screener 7 (GAD-7; Löwe et al., 2008). Finally, the quality of life inventory (Frisch, Cornell, Villanueva, & Retzlaff, 1992) was used. Of the initial 1,179 applicants, 659 were not considered to meet the inclusion criteria and were excluded. In the second step, the remaining 520 applicants were contacted for further assessment by phone to participate in a semi-structured interview. In the second step, an additional 208 participants were excluded. The remaining 312 participants were randomized into one of five groups (four treatment groups and one control group). For a schematic overview of the recruitment process, see Figure 1.

Two treatments were based on PA, and two were based on BA. The difference between the PA groups was that Group 1 did not receive a
treatment rationale while Group 2 did. The rationale consisted of a seven-page informative document about depression, which aimed at helping the participants view their depression in a wider context and increase the understanding of the disorder. Both of the PA groups also received easy-to-use pedometers to help facilitate the participants when reporting the PA and to assist the therapists when giving feedback on how well the participant had worked during the week. The purpose of offering a rationale was to enable deeper understanding of the participants’ situations.

The difference between the two BA groups was that they were based on two forms of BA. Whereas Lewinsohn’s model focuses more on identifying existing pleasant events and increasing their frequency, Martell’s model puts more emphasis on understanding the behavioural patterns to identify new more effective actions to enhance mood.
Figure 1. Flow diagram of the recruitment process and treatment.
Study I


**Background/Aim**
Previous literature reviews and meta-analyses have concluded that PA has antidepressant properties as a treatment and as a prevention (Cooney et al., 2014). It has been frequently reported, however, that many of the studies included in previous overviews suffer from methodological shortcomings; the opinions also differ in what kind of PA (i.e., type, frequency, duration, and intensity) is most effective in reducing depressive symptoms (Danielsson et al., 2013; Dunn et al., 2005; Josefsson et al., 2014).

Therefore, the aim of this systematic overview was to examine the existing literature with the purpose of identifying what activity and dose of PA has demonstrated the best effect in reducing depressive symptoms in clinically depressed individuals. To ensure the inclusion of only high-quality studies, the sample was restricted to randomized controlled trials. Furthermore, in contrast to previous reviews, we also considered studies that did not report significant treatment effects. As has been previously noted, there are many discrepancies in the literature and by excluding studies that have not found an effect of exercise, some of this variation is missed. Based on our systematic overview of only high-quality research papers, specific recommendations were made to help health professionals advising patients in regard to the optimal PA dose for depression.

**Screening criteria**
The selection process consisted of a comprehensive search that was conducted up until April 2014 in the following databases: PsycINFO, Medline, PubMed, and Scopus. To identify possible studies for inclusion, two independent reviewers matched all studies from the initial search against the preestablished inclusion criteria. When a discrepancy was detected, the reviewers discussed the study and decided if it should be included or not. Only studies with a randomized controlled trial design that specifically addressed the treatment of depression in otherwise healthy populations, from English language peer-reviewed journals published after
1990, were considered. In addition, depression was required to have been diagnosed using a validated diagnostic criteria (e.g., DSM-IV, ICD-10; American Psychiatric Association, 1994; ICD-10, 2010). Treatment had to consist of aerobic and/or anaerobic activities. Studies also had to have a detailed description of the activity, intensity, duration, and frequency of the treatment; a thorough description of the control group also was a requirement. Studies that did not comply with these criteria were excluded, as well as all studies that explicitly identified as being pilots or describing preliminary results.

**Results**

The stringent and systematic selection process resulted in 12 reviewed studies. For a more detailed description of the selection process, see Figure 2.

*Figure 2. Flow chart of the inclusion process*
Discussion
Our results suggest that aerobic and anaerobic PA seem to effectively reduce depressive symptoms. Perhaps the focus should instead be on the preference of the patient, as has been suggested elsewhere (e.g., Burton, Khan, & Brown, 2012). By tailoring the PA to the patient’s preferences (e.g., in regard to confidence, autonomy and abilities), potential benefits will be maximised. Participation in PA at least three times a week can be recommended, and for at least 30 minutes per session. Supervised PA increases the likelihood of a successful outcome.
Study II


**Background/Aim**

A major problem today is that only about fifty percent of those affected by depression seek help. One way to reach more people would be to offer easily accessible Internet-based treatments. Since some of the most prevalent features of MDD are fatigue, inertia and a decreased desire to engage in things previously thought of as enjoyable, which results in increased withdrawal and a more inactive lifestyle, alternatives are needed. One way to decrease depressive symptoms would be to break that pattern, by reintroducing enjoyable activities into daily life (Dimidjian et al., 2011).

Two types of treatment, which have been shown to be effective in reducing depressive symptoms and target the inactivity elements of depression are BA (Cuijpers et al., 2007; Dobson et al., 2008; Mazzucchelli et al., 2009) and PA (Blumenthal et al., 2007; Cooney et al., 2014; Dunn et al., 2005; Josefsson et al., 2014; Rethorst et al., 2009). Since BA and PA are based on concrete and visible behaviours, they are relatively easy to administer and require less experienced therapists than other methods (Richards et al., 2016). Previous studies also have concluded that these treatments are time-efficient (Cuijpers et al., 2007); these methods also have the potential to be administered over the Internet (Dimidjian et al., 2011; O’Mahen et al., 2013; Rosenbaum et al., 2014). Even though proven effective in decreasing depressive symptom, these treatments administered over the Internet, have to the best of our knowledge, never previously been compared. The purpose of this study was therefore to compare/evaluate four therapist-supported Internet-administered treatments.

**Method**

All data used in this study were collected within the Actua project. For an overview, see the chapter about the Actua project in this thesis. For a detailed description, see Carlbring et al. (2013) and Nyström et al. (2017).
The ITT principle was employed (Streiner, 2002; Streiner & Geddes, 2001), which means that all participants who provided data for at least one weekly measure or the posttreatment assessment were included in the analyses. For a description of the participants, see the Actua chapter. Those who were randomized to the control group were, after 12 weeks, randomized to one of the four treatment groups, hence all participants included in the study were at some point offered treatment. One of the PA groups was provided with a rationale; the other was not. The two BA groups differed in that one of the conditions was based on Lewinshon’s (1974) model and the other on Martell’s model (Martell et al., 2010). All four treatment groups followed a 12-week program consisting of eight separate modules. Each week, all participants (including the controls) were asked to fill out the PHQ-9 and the GAD-7, assessing their depressive and anxiety symptoms respectively. After the 12 weeks, participants were encouraged to fill in a posttreatment form. On a weekly basis, the participants could communicate with and received feedback from their therapists (for a more extended description of the procedure, see Carlbring et al., 2013b).

**Results and discussion**

When the treatment groups were combined and compared with the control group, the treatment group had a significantly larger decrease in depressive symptoms than the control group. This also was the case when the respective treatment groups were compared to the control group, with one exception: the PA without rationale (see Figure 3). When we compared the antidepressive effect of the four treatment groups to each other, no significant differences were detected.

The anxiety symptoms had a similar pattern when the treatments were pooled and when the respective treatment groups were compared to the control group. The decrease in anxiety symptoms, however, was not of the same magnitude as for depressive symptoms.

The results indicate that participants in three of the groups (PA with rationale, Lewinsohn’s model of behavioural activation and Martell’s model of behavioural activation [BAM]) had a greater decline in depressive symptoms, even though not statistically significant, than PA without rationale. This indicates that psychoeducation (e.g., rationale) is important for reduction of depressive symptoms. Participants in the groups with a more systematic psychoeducation (e.g., BAM) might have experienced more support, since they received more material to work with, which has
had an effect on treatment outcome in previous studies (Johansson & Andersson, 2012; Richards & Richardson, 2012). It is possible that this sense of support is particularly important in Internet-administered treatments and in a way compensates for the lack of physical contact and functions as a form of therapeutic alliance. Results from previous studies on the importance of therapeutic input (e.g., therapeutic alliance) in ICBT has been mixed, however. Some studies have suggested that alliance may not be as important in ICBT as in face-to-face treatments of depression (Andersson et al., 2012), while some have implied that therapeutic input is an important determinant of treatment outcome (Nordgren et al., 2013; Palmqvist et al., 2007).

Even though there were differences between how many modules the participants completed, analysis showed that the number of completed treatment modules did not significantly affect symptom decline. Nor did analysis of the missing data reveal any significant differences between the five groups in number of actively announced dropouts, or any significant differences between those who dropped out and those who completed the treatment, when controlling for gender, severity of symptoms (for depression and anxiety) and age.

To conclude, these results are in line with previous studies, which have highlighted the effectiveness of Internet-administered PA and BA treatments for reducing depressive symptoms (Carlbring et al., 2013a; Chartier & Provencher, 2013; Chen et al., 2013; Mailey et al., 2010; Rosenbaum et al., 2015; Ström et al., 2013). Similar to the results of Johansson and Andersson (2012), the present study indicates that support is important for a positive treatment outcome in depression treatments administered over the Internet. The same seems to apply for the degree of psychoeducation, which tends to affect the treatment outcome, but also to some extent, the inclination to remain in treatment. If/When these factors are considered, when developing and conducting new treatments for depression, it increases the likelihood of positive treatment outcomes.
Figure 3 A1, B1. PHQ-9 & GAD-7 slope trajectories for active treatments pooled compared to the control group. A2, B2. PHQ-9 & GAD-7 slope and trajectories for each of the active treatment groups compared.
Study III


**Background/aim**

The risk of relapse for people recovering from an episode of depression is substantial, regardless of whether the remission occurred after treatment or by itself (Clarke, Mayo-Wilson, Kenny, & Pilling, 2015). Irrespective of the quantity of previous episodes, as many as 50% of those who have experienced MDD will relapse within a 20-year period (Eaton et al., 2008), with even higher percentages in clinical populations (Muller et al., 2008). Those having suffered more than one depressive episode are at an even higher risk of relapse, with the risk for those having experienced three or more episodes as high as 90% (Waugh & Koster, 2015).

Differences in relapse have been reported between those who received pharmacological and psychotherapies; percentages of relapse are lower for psychotherapies (Dobson et al., 2008; Vittengl & Jarrett, 2015). At present, the most commonly used relapse prevention approach is continued pharmacological treatment. However, since some patients, for different reasons (e.g., increasing side effects), want to quit antidepressive medication, the demand for sustainable psychological alternatives is considerable (Clarke et al., 2015).

Since the internet is a rapidly growing method of delivering psychotherapies, it is important to investigate the long-term effects, as well as the relapse-preventive effects, of treatments delivered online. If proven effective, internet-administered relapse prevention could be a preferable, or at least a sustainable, alternative to more traditional continuation phase (CP) treatments as a stand-alone relapse prevention program and a CP treatment after AP psychotherapies and pharmacological treatments. The first aim of the present study was, therefore, to determine how a self-help internet-administered relapse prevention program, focusing on giving the participants additional strategies to navigate in their daily lives, affect symptom change over a 24-month period of follow-up.

Among the more frequently raised suggestions for future research in the contemporary literature is the call for an increased understanding of
predictors of relapse recurrence (e.g., Clarke et al., 2015; Cuijpers, 2017). Additionally, a contemporary review by Vittengl and Jarrett (2015) argued that two of the more established predictors of relapse are the amount and quality of symptom reduction during AP treatment. Hence, the second aim was to investigate if symptom change during AP treatment would be predictive of change during a 24-month follow-up period. Finally, we were interested in the predictive abilities of amount of symptoms, post-AP treatment, for change during a 24-month follow-up period.

**Method**
The participants in the present study consisted of 249 individuals that had all been enrolled in a previous online depression treatment study (Nyström et al., 2017). Those who announced that they had dropped out from the previously mentioned treatment study were not included in this follow-up effort (see Figure 4; for a more detailed description of the inclusion/exclusion criteria that were used, see Nyström et al., 2017). The statistical method that was employed was piecewise growth curve modelling, which was based on data from the 12 weekly PHQ-9 scores from the AP treatment period, and the eight quarterly measure points of the follow-up period. In total, there were 20 measure points used in the analysis.

**Figure 4.** Randomisation process for the relapse prevention program
**Results and discussion**

The results from the analysis indicate that there were no differences in relapse after the 24-month follow-up period between those who received the relapse prevention program and those who did not. This finding was the case when we looked at the treatment groups combined and at the treatment groups separate. However, the analysis did indicate that symptom change during the follow-up period could be predicted by symptom change during the AP treatment period. This was true when the treatments were pooled and when they were analysed separately, with the exception of one of the groups (i.e., the BAM group). Furthermore, it did not appear that the number of symptoms at treatment termination could explain symptom change during the follow-up period, neither when the treatments were combined or for the respective groups.

Regarding the effect of relapse prevention the results from study III do to some extent contradict previous research which have concluded that self-help relapse prevention programs could be effective in preventing relapse (e.g., Andersson et al., 2013). This discrepancy, between study III’s results and previous findings could perhaps be due to the fact that participants in study III had relatively few residual symptoms after the AP treatment which could have reduced the effects of the relapse prevention program. A further possible reason could be that the participants in study III had a quite markedly decelerating decline in symptoms during the second part of the AP treatment, which in turn also could have influenced the impact of the relapse prevention. Previous research has pointed out that if a patient internalize their treatment then they tend to relapse to a lesser extent, and hence do not feel that they have the need for relapse prevention.

The results from study III indicated that symptom reduction during the AP treatment predicted symptom change during the follow-up, which is in line with previous research that has identified quality of symptom reduction as a predictor of risk of relapse (Vittengl & Jarrett, 2015). The amount of residual symptoms post AP treatment did not seem to predict change in symptoms during the follow-up, which disputes prior research, which has suggested residual symptoms to be a predictor of relapse (Berwian, Walter, Seifritz, & Huys, 2017). A possible reason for this discrepancy could be the deceleration during AP-treatment, resulting in a stabilization in symptoms and therefore smaller changes post treatment. Another plausible
interpretation could be that the participants in study III had so low levels of symptoms left after the AP and was hence not at high risk for relapse.
General Discussion

The main aim of this thesis was to evaluate and compare four different therapist-supported internet-administered treatments for mild to moderate depression. Firstly, we wanted to determine whether or not results from previous studies could identify a preferable dose and mode of PA for treating depressive symptoms and, hence, could be used as recommendations for clinicians when treating this population (Study I). Secondly, we compared the AP treatment effects of the four treatments, in the first step pooled and compared to the control group; secondly, the different treatments to the control group and in the final stage, we compared the treatments to each other (Study II). In addition, we wanted to examine the effects of an internet-administered relapse prevention program during a 24-month follow-up period (Study III). In this study we also wanted to examine if the change in number of symptoms during AP treatment affected symptom change during the follow-up and if the number of symptoms after the AP treatment affected change during the follow-up. The discussion will be structured in the following way: First I will discuss the findings of the three studies that are included, then the limitations of the included studies will be analysed and, after that, suggestions about future directions will be offered.

Identifying the most effective type and dose of physical activity

It is well established that PA has a lot of positive effects on the physical and mental state of an individual. This has been shown on clinical and non-clinical populations, and on different age groups (Abrantes et al., 2012; Barnes, Blackwell, Stone, Goldman, Hillier, & Yaffe, 2008; Jayakody, Gunadasa, & Hosker, 2014; Mammen & Faulkner, 2013). So, the question is not so much if PA has an effect on depressive symptoms; rather, it seeks to determine if there are differences in effect on account of the type or dose.

The results from Study I showed that the majority of included studies used aerobic PA. This could, of course, be for more practical reasons (e.g., it could be considered to be easier to administer, implement and also easier to compare the results with previous studies). In line with this outcome, a previous meta-analysis (which only included randomized controlled trials) concluded that the lack of research using anaerobic PA makes it hard to draw any conclusions about the antidepressant effects of anaerobic PA.
(Perraton, Kumar, & Machotka, 2010). A more recent meta-analysis, using the same inclusion criteria as Perrotta at al. (2010), came to the same conclusion (i.e., not enough studies used anaerobic PA as treatment to be able draw any conclusions about effects on depressive symptoms; Stanton & Reaburn, 2014). Even though two of the included studies in the present study used anaerobic PA, it is not possible to draw any conclusions or make any assumptions on the differences in effect because both studies using aerobic and anaerobic PA reported similar treatment effects. It is also important to acknowledge that the distinction is not always easy to determine. Weight lifting, for example, could be considered as aerobic (many repetitions with lighter weights) and/or anaerobic (heavier weights with fewer repetitions), so just because the PA consists of weight lifting does not automatically mean that it is anaerobic PA. Very few studies make (or at least report) these kinds of distinctions, so it becomes hard to detect, and even harder to conclude, if there is any differences in an antidepressant effect between aerobic or anaerobic PA.

No differences in effect, on account of being supervised or non-supervised PA, were identified in the present study. It is hard to interpret these results, however, because all the included studies, at least to some extent, used supervised PA. The studies that did not show any significant treatment effects also had supervised PA, which further complicates the possibility to draw any conclusions about the importance of supervised PA. These results are in line with previous research, which also points to the difficulty of determining the importance of supervision for how effective PA is in treating depressive symptoms. A recent meta-analysis by Stubbs and colleagues (2016) suggested that one benefit of supervised PA is that it decreases the risk for dropout. In addition, Schuch et al. (2016) reported that, of the studies included in their meta-analysis, the treatments using supervised PA had the largest effects. They also highlighted the importance that the supervisors had adequate training (e.g. being physiotherapists, physical educators or exercise physiologists; Schuch et al., 2016).

What remains to be explored is how the supervisor affects the outcome: from the role of instructor (i.e., showing how to perform the PA) or from a motivational aspect. Previous studies (e.g., Schuch et al., 2016) have stressed the importance of adequately educated supervisors, which could indicate that it is the instructional role (versus the motivational role) in which supervised PA has shown larger effects. To answer this question, more research is needed. Another interesting aspect of the role of
supervised PA is in the form of the possibilities with modern technical devices; could smartphones and other gadgets potentially replace the human supervisor? Researchers have, for some time now, started to investigate if and, in that case, how electronic devices can be used as a compliment or perhaps instead of human supervisors (Bassett, Rowlands, & Trost, 2012; Patel, Park, Bonato, Chan, & Rodgers, 2012). To date, electronic devices are mainly used as compliments (i.e., largely to remind the patient/client) rather than as replacement. The development and use of pre-recorded training sessions is also a growing field with large potential, perhaps primarily because it gives the individual the freedom to perform the physical activity when it best suits him/her.

The results from Study I are in line with previous studies and indicate no difference in effect between group and individually performed PA (Stanton & Reaburn, 2014). These researchers suggested that PA that was delivered individually or had individual and group components had fewer dropouts, which they interpreted as PA with individual components having some sort of addictive effect. However, Study I did not find any support for such conclusions.

Even though there was a rather large range of duration time per session between the included studies (30-90 minutes), it did not seem to affect the treatment outcome. However, the study using the longest sessions of PA (90 minutes) did not report any significant decline in symptoms, which could indicate that more is not always better. It is also worth pointing out that only one study used 90-minute sessions in this overview. It is, therefore, somewhat difficult to draw any conclusions regarding the importance of duration for treatment effects. On the other hand, it has, in previous studies, been suggested that the relationship between PA and mental health could have a curvilinear shape, suggesting that there is an optimal range of PA for mental health benefits (Kim et al., 2012). Kim and colleagues (2012) found that individuals who reported PA levels outside the threshold of the optimal range (below and above) did not report as good a mental health as individuals who reported PA levels within this range. The optimal levels that were identified were 2.5–7.5 hours of PA per week, meaning that the lower level is in line with previously recommended PA levels for general health (Garber et al., 2011) and the upper level is equivalent to running for one hour per day (Kim et al., 2012).
It should also be pointed out that most of the previous recommendations regarding PA levels for good general health are not specifically designed for depressed populations. This could perhaps explain why so few studies have identified an upper level of recommended PA and, instead, suggested a linear relationship between PA and depression (Dunn et al., 2005; Sieverdes et al., 2012).

The intensity level of the PA did not affect the treatment outcomes in this review. Prior research has also indicated that a wide variety of intensity levels seem to be effective in reducing depressive symptoms, from low levels (e.g., walking, Thai chi, yoga, etc.) to high levels (e.g., running; Cooney et al., 2014). In fact, some studies have suggested that lower intensity levels of PA are more effective in reducing depressive symptoms than higher levels of PA (Gavric et al., 2011). In contrast, Trividi and colleagues (2011) reported results that suggested that the intensity could actually be decisive in the reduction of depressive symptoms. In their study, those randomised into a high-dose PA group showed a larger decline in depressive symptoms in comparison to those randomised into the low-dose PA group (Trividi et al., 2011). It is essential, however, to point out that the low-dose group demonstrated higher adherence, which could point to the importance of individually “suited” PA. This outcome was evident in a study comparing adherence between one group of women allocated to tailored PA and one group allocated to a standardised PA program, where the tailored group had significantly higher adherence than those receiving the standardised PA (Callaghan et al., 2011). The participants of that study were exclusively women, so it cannot automatically be assumed that these results are gender neutral. However, Stubbs et al. (2016) reported no gender differences in their meta-analysis, investigating dropouts from PA-based depression treatment studies, which suggested that gender does not affect adherence rates in studies using PA as a treatment for depression.

Perhaps one reason why the intensity level does not seem to be decisive for effect can be the characteristic of the condition (i.e., depression). Some of the most prominent features of MDD are withdrawal, increased passivity and inactivity; therefore, it is not so far-fetched to assume that it is not the intensity level that is decisive, but rather the ability to break the passive spiral. This could, perhaps, partially explain why previous studies have found so many different intensity levels of PA to be effective in reducing and protecting against depressive symptoms. Of course, it could also say
something about the need for more nuanced diagnoses and customised treatments, but this point will be discussed later.

The frequency of the PA seemed to have an effect on the reduction of depressive symptoms in Study I; however, there was only one study that used less than the recommended frequency of three times per week, so caution is needed when drawing conclusions about the importance of frequency. However, in light of the previous argument (about the characteristics of MDD), it does not seem to be overly presumptuous to think that the number of times one “breaks” the vicious circle, the better.

It could be that it is the secondary gains that PA brings (e.g., in form of increased self-esteem) that are effective in reducing depressive symptoms and it is, in fact, those who break the pattern of the disorder. Perhaps it is, for instance, standing next to someone and saying hello in the changing room at the gym, having to get out of the house to go for a walk or having to call and confirm a session at the local gym that are effective in breaking the pattern, rather than at what pace you walk. Some studies have indicated that enjoyable activities are more effective in reducing symptoms than activities that are not considered to be pleasant (Chen, Stevinson, Ku, Chang, & Chu, 2012). In addition, a prior study by Harvey and colleagues (2010) concluded that social support, context and social engagement, to a larger extent, could better explain the negative relationship between leisure-time PA and depressive symptoms than biological changes could make. Another factor that seems to play a central part is to what extent the individual is able to influence his or her PA treatment so that they feel that it is achievable. By letting the patient be involved in designing the treatment, the clinician has, in a way, gotten the consent of the patient/client which, in the long run, make it much harder for the patient to drop out since he or she has actively agreed to the terms of the treatments. A by-product would therefore be increased adherence to the treatment. Also, by making sure that the patient has (and feel that they have) the best possible odds of accomplishing the PA treatment, it will further enhance the “secondary gains” (i.e., increased confidence, wellbeing and pride of completing the treatment).

**Comparing four different treatments**

In a recently published meta-analysis on outcome research spanning over the past four decades, it was argued that almost all available treatments that exist today are effective (Cuijpers, 2017). Therefore, one may conclude
that there is no need for more treatments and that the focus should instead be on streamlining already existing treatments. Studies II and III of this dissertation are aimed at evaluating and comparing existing treatments for depression, AP and CP. This is an attempt to streamline the existing treatment arsenal and increase the understanding of factors that influence the risk of relapse.

The results from Study II showed that all four treatments evaluated had significant antidepressant effects, which was also true for the control group. The fact that even the control group showed a significant decrease in symptoms could be viewed as support for the notion that just doing something, anything that breaks the pattern of sustained behaviours, could have antidepressant properties. In the initial analysis, where we only looked at pre- and post-measures, there were no differences between the treatment groups, even when they were pooled and compared to the control group. However, when all weekly measures were considered, then significant differences were detected between treatment groups and the control group.

A possible explanation for the significant improvements that also were observed in the control group, even though they did not receive any treatment, could be that they knew that, after the initial 12 weeks, they would receive treatment. This knowledge has, in previous studies, been a predictor of treatment outcome (Curry et al., 2006). It could be argued that this knowledge makes it difficult to see them as a proper control group because the mere knowledge that they will receive treatment may have affected the participants. We are well aware of this, but because it is not ethically justifiable not to offer all participants some sort of treatment, especially when they all meet the diagnostic criteria for MDD, it was impossible to avoid. Another factor that could explain the results of the control group is that they also had to complete a weekly assessment of their mood, which could be seen as a kind of intervention per se. The fact that all participants in Study II had a significant decline in depressive symptoms could strengthen the argument posted earlier in this thesis (i.e., that perhaps the most important ingredients in any treatment of depression is change). As the element of this factor (i.e., change) is common to most treatments of depression, it could perhaps be one of the most important agents in the reason why almost all existing depression treatments are found effective, as argued by, for example, Cuijpers (2017). Another possible explanation regarding the decline in symptoms for the
control group could be spontaneous remission. Previous research have reported high rates of spontaneous remission indicating that many depressed individuals achieve remission without treatment (Waugh & Koster, 2015). A prior meta-analysis did, in fact, conclude that as many as 23% of participants from clinical trials, who were randomised to a wait list or control group, experienced spontaneous remission within a 12-week period (Whiteford et al., 2013). With this in mind, it is not inconceivable that spontaneous remission could be part of the explanation for the remission within the control group in Study II.

Importantly though, when the respective treatment groups were compared to the control group, all but one (i.e., PA without rationale) had a statistically greater decline in symptoms than the controls. This suggests that psycho-education (e.g., treatment rationale) is an important ingredient for increasing the effects of the treatment. This goes against previous research that has found that PA alone is an effective intervention for depression (see, e.g., Kvam, Kleppe, Nordhus, & Hovland, 2016; Schuch et al., 2016; Stubbs et al., 2016). There are, of course, many possible reasons why there were no statistical differences in symptom reduction between PA without rationale and the control group. One possible explanation is that we did not allocate pedometers to the control group, which meant that we had no control over how active the control group actually was. They could have been as active as the PA without rationale group, but this is merely speculation. Another possible reason could be that PA, even though proven effective, is not considered “a real treatment” and perhaps those who applied to the treatment were hoping to be randomised into one of the more “traditional treatments” (i.e., Lewinsohn’s model of behavioural activation and BAM). This, in turn, may have influenced their motivation to actively carry out the treatment. In previous research, this observation been referred to as the expectation effect and has been shown to impact treatment outcome (Curry et al., 2006). The expectation effect could, perhaps, also explain the large symptom decline in the control group. They knew they would receive treatment at a later time, so they might have felt hope for “better days to come” which, in turn, could have prompted the decline in symptoms. A further explanation, albeit closely related, could be hopelessness when randomised to just getting physical activity as a treatment. Hopelessness has been shown to be a predictor of poor treatment outcome in earlier treatment studies (Weersing et al., 2016).
Understanding one’s own situation (e.g., thoughts, feelings and behaviours) is one of the cornerstones upon which the entire CBT paradigm is based. It is, therefore, logical to assume that this may be one of the main reasons as to why the outcome for PA without rationale—the only group that did not get a treatment rationale—did not differ from the control group’s results.

It is possible that those who received a treatment rationale could have sensed that they received more support, which in previous research has been shown to affect treatment outcome (Johansson & Andersson, 2012; Richards & Richardson, 2012). If so, then this sense of support, even if imagined, could substitute for a lack of physical support, which could be particularly important for this population because the treatments were administered over the internet. Previous studies have shown that therapist guidance in internet interventions seems to be of vital importance and the effects reported from unguided treatments are usually much smaller (Spek, Cuijpers, Nyklíček, Riper, Keyzer, & Pop, 2007).

This sense of support could function as a sort of therapeutic alliance. However, the literature on the importance of such an alliance in internet-administered treatments is divided. Some researchers argue that it is not as important for ICBT as it is for face-to-face treatments (Andersson et al., 2012), whilst others argue that it is decisive for the treatment outcome (Nordgren et al., 2013; Palmqvist et al., 2007). A recent review concludes that more research is needed because studies on alliances conducted during internet interventions are not performed with the same methodological rigor as is applied to face-to-face treatments (Berger, 2017). Another important issue raised by Berger (2017) pertains to the risk of selection bias as the majority of studies on alliance in internet interventions are conducted on participants that were recruited via different forms of social media. This approach would probably mean that they have prior experience with communicating through this forum which, perhaps, differs from the average care seeker (or at least not to the same extent). To draw any further conclusions on the role of alliance in internet interventions, it is important to conduct effectiveness studies. Perhaps this issue is highlighted even more when it comes to depression treatments because such a big part of the disorder is about withdrawal; then the support than alliance can offer becomes even more significant. However, it is important to point out that the role of alliance most certainly differs
between individuals, treatment forms and populations, which highlights the importance of further studies.

From the results of Study II, it is hard to pinpoint the effect that PA had on symptom decline because the only group that did not have a statistically larger decline in symptoms than the control group were participants who received PA without rationale. This finding could be interpreted as the rationale is what separated the treatment groups from each other as three of the groups received some kind of rationale (even though it was delivered in different forms and sizes) and one did not (i.e., the PA without rationale group).

A trend in the results from Study II is that the decline in depressive symptoms decelerated towards the end of the treatment. This finding was evident in all treatment groups and, to a lesser extent, in the control group, which could mean that the same reduction in symptoms could have been achieved with a shorter treatment period. Perhaps an eight-week treatment—rather than a 12-week program—would have been enough. There are, of course, many possible explanations for this decelerated decline. An example is the chosen population (i.e., mild to moderately depressed individuals). Perhaps the results had looked totally different if we also had admitted severely depressed individuals? Further, we do not know if the 12-week intervention would have been necessary for more severely depressed individuals to reach the same level as the mildly to moderately depressed did in eight-weeks. Another possible explanation could be the natural mood swings (i.e., spontaneous remission) within the diagnosis, which means that people close to the cut-off value for depression can move above and below the cut-off within their natural fluctuation. This interpretation would mean that part of the change credited to treatment might actually be entirely independent of treatment and due to completely natural spontaneous remissions instead. This point will be further discussed.

Additional understanding of this deceleration could be useful in the creation/streamlining of new/existing treatments for this population. By making the treatments shorter, they would also be more efficient, meaning that more people could be offered therapy. It could also be argued that by considering the deceleration (i.e., making the treatment shorter), cost savings can mean that more patients can be serviced by healthcare centres. Treatment adherence will also most likely be positively affected if clients
only need to undergo treatment for six to eight weeks instead of 12 to 14 weeks.

**How to prevent relapse/recurrences**

The prevention of relapse or reoccurrence is, perhaps, the most imminent challenge for the research on depression today (Cuijpers, 2017). It has been argued that today we have enough effective treatments for depression, which also have been proven in effectiveness and efficacy studies that are delivered in person and over the internet (Andersson, 2009; Cuijpers, 2017). The most obvious next step is to find ways to prevent relapse or reoccurring symptoms. The purpose of Study III was just that: to identify the predictors of relapse/recurrence.

Some kind of maintenance therapy after AP treatment is considered the standard of care. Usually the maintenance treatment is based on, or is a continuation of, the AP treatment (i.e., if an ADM was used during the AP treatment, then it is also used during the CP treatment). Prior research has shown that CP treatment that focuses on increasing the patients’ capabilities to use adequate strategies in everyday situations and social contexts decreases the risk of relapse/recurrence (Beshai, Dobson, Bockting, & Quigley, 2011). In line with these reports, Rogers et al. (2012) suggested that brief self-help interventions can be as effective as more extensive CP treatments in preventing relapse. The results from Study III, however, did not support these suggestions, and there were no differences in the number of symptoms reported during the follow-up period between those who received the relapse prevention program and those who did not. This finding could be explained by the fact that patients in the present study had relatively few symptoms after AP treatment, which is in line with previous research that suggests that less symptom-ridden individuals are at a smaller risk of relapse (Nierenberg et al. 2010). Therefore, they are less likely to benefit from CP treatment (Berwian, Walter, Seifritz, & Huys, 2017).

Prior research has tried to identify predictors for relapse/recurrence risk after AP treatment. The most frequently reported predictors are number of previous MDEs and residual symptoms and amount (i.e., number of) and quality of symptom reduction during AP treatment. (Burcusa & Iacono, 2007; Hardeveld, Spijker, De Graaf, Nolen, & Beekman, 2010; Vittengl & Jarrett, 2015). The presence of residual symptoms after AP treatment is seen as a predictor of relapse, which could strengthen the argument.
postulated previously about Study III results. That is, because the participants in Study III had relatively few residual symptoms following AP treatment, they were at a relatively low risk of relapse. Therefore, they did not benefit as much as predicted by the relapse prevention program. This is also consistent with the review by Vittengl and Jarrett (2015) postulating that effects of a relapse prevention program seem to be more effective for individuals at higher risk of relapse (i.e., with more residual symptoms). As a relatively large part of the participants of Study III did reach remission levels post-AP treatment (i.e., a relatively high quality of symptom reduction during AP treatment), the results are not so surprising. This outcome also could have an impact on the participants’ motivation to commit to the relapse prevention program since they already have gotten so much better.

Another possible explanation for the results of Study III is that the treatments, to a large extent, are based on the participants themselves taking responsibility for their treatment (e.g., completing and implementing the weekly modules). The identification of new strategies to deal with everyday life may result in more robust and long-lasting behavioural changes, which could result in a sustained treatment effect and, hence, a reduced risk of relapse. So, by using and repeating what the participants “learned” in the treatment could form new, and more adaptive, ways of handling everyday life and by repeating them, the new strategies can eventually become internalised. By internalising the treatment the risk of relapse is decreased because the participant now has ways of handling potentially relapse-provoking situations (Hollon et al., 2005). Study III was administered over the internet, so an even larger emphasis was placed on the participants themselves to take “responsibility” for their own treatment, which also could affect the outcome of the relapse prevention.

The analysis of Study III indicates that symptom change during AP treatment seemed to affect symptom change during the 24-month follow-up period. If this is true, then it would support the proposed predictive abilities of the quality of symptom reduction during AP treatment for risk of relapse, as suggested by Vittengl and Jarrett (2015). On the other hand, when it comes to predicting the number of symptoms following AP treatment, the results of Study III are not in line with previous research that has suggested that the number of symptoms after AP treatment would predict symptom change during follow-up (Berwian, Walter, Seifritz, &
There could, of course, be a number of reasons for this outcome (e.g., that so many of the participants in Study III were considered to be remitted at treatment termination and, hence, were no longer at any high risk for relapse).

**Statistical considerations**

It is worth noticing that the initial analysis from Study II (pre and post) did not show any statistically significant difference between the treatment group (pooled) and control group. However, when we nuanced the analysis and considered all weekly measures, there was a significant difference, not only between treatment and control, but also between three of the treatment groups individually and the control group. This observation is especially important when measuring a disorder such as depression where a natural fluctuation could be responsible for the results instead of a real change. These differences could easily have been missed if not all measure points were considered, leading to a completely different conclusion.

Another potential problem to consider, when using the diagnostic cut-offs for considering the treatment outcome, is that the cut-off levels do not necessarily say anything about the real change. It could be that because an individual falls below the cut-off for the diagnosis, the individual’s suffering is similar to that of an individual above the cut-off. Perhaps the per cent of change says more about the progress.

It can be problematic if we do not consider the disorder as existing on a continuum and instead only focus on the diagnostic cut-off levels. This realisation becomes particularly important for a diagnosis such as depression, which by definition tends to fluctuate over time, meaning that it can be “the daily shape” that accounts for a large part of the change. It is also true that when a person moved below the limit required for the diagnosis, it does not necessarily mean that the individual’s suffering has ceased (Cuijper & Smith, 2004).

On a similar note, it is difficult to decide when an individual is to be considered recovered and when not. Categorical labels such as relapse and recurrence are problematic to use, which has been highlighted in previous research (Beshai, Dobson, Bockting, & Quigley, 2011; Clarke, Mayo-Wilson, Kenny, & Pilling, 2015). Perhaps it would be better to focus on dimensional symptom change.
Limitations

One potential limitation in any study involving therapists is the amount of feedback they give to their clients. Our therapists in Study II were instructed to limit the feedback they gave each client to no more than 15 minutes per week, but because we had no control over the actual number of minutes of feedback they gave, that feedback amount could have varied amongst therapists. Some clients may have felt that they had more support, which could have had an impact on the outcome, as support has been argued to affect treatment outcome (Johansson & Andersson, 2012). We recognised this potential risk and the therapists, when they were introduced to the project and during each of the weekly supervisions, were continually reminded of the importance of not spending more than 15 min per week on feedback for each participant. On a related note, because the therapists were students in the last four semesters of the clinical psychology program, it is possible that the individual characteristics of the therapists affected the outcome, which previous research has highlighted as a potential risk (Baldwin et al., 2011; Paxling et al., 2013). In this study, however, this observation was taken into account because the majority of therapists treated participants from all groups, and they received clear instructions to minimise the importance of individual differences.

Another possible limitation in studies II and III is the difference in completed modules between the participants, which could indicate that something other than the treatment they received was responsible for the change in symptoms. We did, however, perform a dose-response analysis, which did not point to any significant differences due to the number of completed modules.

An additional potential limitation is that we did not consider previous depressive episodes and just screened for previous experiences of psychotherapy. The assumption is, however, that the randomisation process will control for potential differences between the groups. Nevertheless, this will limit our possibilities to consider one of the most recognised predictors of relapse when we want to identify possible reasons for change in symptom during follow-up. A further limitation was the difficulty in capturing and operationalising the relatively subtle differences between the two BA groups, although efforts have been made to clearly describe and implement the differences.
The use of a self-report for PA could have led participants to report socially desirable responses to project a favourable image of themselves. In an attempt to make it easier for the participants to report their PA, they were given a pedometer, but they still had to report the number of steps that were registered every day. It would have been better and increased the reliability if we had used more objective measures for PA.

**Future directions**

One of the most obvious topics for future study is, as previously mentioned, to identify predictors of relapse/recurrence because such a large part of those affected tend to have additional MDE. Another area of interest is to develop more approaches for effective prevention of the onset of MDD. Furthermore, it is important to continue developing individually-adapted treatments as more and more research shows the effect of this type of treatment. This is particularly true in research on depression because such a diagnosis is so broad. One way to do this could be to identify/develop more specific treatments, which focuses on some of the various subtypes of depression (e.g., MDD with atypical features), rather than on MDD per se.

One potential step in this direction is the enhanced interest in the analysis of individual symptoms, their patterns and casual associations. With this focus it would be possible to gain knowledge that it would not be possible to obtain when only considering the total scores of MDD.

The overarching conclusion of this thesis is the importance of breaking the chain (i.e., the destructive spiral of passivity and inactivity) of the depression. This could be done by introducing some kind of change (e.g., in the form of activity). Whether the activity comes in the form of physical activity or BA does not seem to play a decisive role. The main thing seems to be that one must do *something, anything*, and keep on doing it and it will be effective.
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“At the end of a storm there’s a golden sky, and a sweet silver song of a lark...”

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“Walk on through the wind, Walk on through the rain, Though your dreams be tossed and blown, Walk on, walk on, With hope in your heart”
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