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Physical Activity and Exercise in Bulimia Nervosa: The Two-Edged Sword

Solfrid Bratland-Sanda^{1,2}

¹*Department of Sport and Outdoor life sciences, Telemark University College, Bø in Telemark,*

²*Research Institute, Modum Bad Psychiatric Centre, Vikersund, Norway*

1. Introduction

Physical activity and exercise has a widely known positive effect on various physiological and psychological variables, and lack of physical activity has been shown as an independent factor for obesity, type 2 diabetes, hypertension, certain types of cancer and other diseases (Pedersen & Saltin, 2006). However, in the Diagnostic and Statistical Manual for Mental Disorders version four (DSM-IV) (APA, 1994) excessive amounts of exercise is listed as one possible weight compensatory behavior among patients with bulimia nervosa (BN). In this chapter I will describe the effects of physical activity, and the motives for physical activity among patients with BN. Furthermore, the two-edged sword aspect of physical activity among patients with BN will be explored. This duality comes to show on one hand because of the excessiveness and the abuse of physical activity, and on the other hand the beneficial and therapeutic effects of correctly dosed physical activity in treatment of BN.

1.1 Definition of physical activity and exercise

Physical activity is defined as any type of bodily movement produced by skeletal muscles which results in an increased metabolism above resting level (Caspersen, Powell, & Christenson, 1985). Exercise is the planned, structured and repeated physical activity performed with the aim to improve performance, fitness and/or health (Bouchard, Blair, & Haskell, 2007). The term physical activity includes occupational physical activity, transport physical activity, housework and leisure time physical activity, whereas exercise refers to leisure time physical activity. Physical activity therefore includes all the terms exercise, work out and sports. In this chapter, the terms physical activity and exercise will be used interchangeably.

1.2 General effects of physical activity

Effects of physical activity can be divided into acute effects and long term effects. The acute effects include physical responses such as increased ventilation and breathing frequency, increased heart rate, stroke volume, systolic blood pressure, body temperature, and reduction in blood lipoproteins and glucose (Bouchard, et al., 2007). The immediate elevations in levels of endorphins, serotonin and dopamine are suggested as a reason why many report a positive impact of physical activity on mood, positive and negative affects

(Martinsen, 2005). These effects are temporary, but persistent physical activity behavior will among others positively affect circulatory and respiratory factors, metabolism, bone mass, and regulation of blood glucose (Pedersen & Saltin, 2006). Physical activity has also shown positive impact on psychological factors such as sleep quality, self esteem, self efficacy and well-being (Meyer & Broocks, 2000).

1.3 Physical activity recommendations

The most recent updates were published by American College of Sports Medicine (ACSM) and The American Heart Association published in 2007 (Haskell et al., 2007). These recommendations state that healthy adults need to perform at least 5 x 30 minutes of moderate intensity physical activity or 3 x 20 min of vigorous intensity physical activity per week to maintain health. For additional health benefits, up to 60 minutes of moderate-to-vigorous intensity physical activity per day is recommended. In addition, the ACSM (2009) published guidelines regarding strength training which state that strength training should be performed at least twice per week with different loading depending upon the main goal of the strength training. For example, individuals who want to increase maximum muscle strength need to perform fewer repetitions with higher loading (e.g. four repetitions of 90% of 1 repetition maximum, 1RM) compared to individuals whose main goal is hypertrophy (e.g. 8-12 repetitions of 80% of 1RM).

For individuals who are overweight or obese, the recommendations for healthy adults are insufficient to achieve significant weight loss. With moderate, but not severe, nutritional restrictions it is possible for obese individuals to achieve adequate weight loss, and maintenance of this weight loss, with about 250 minutes per week of moderate intensity physical activity (Donnelly et al., 2009). Other studies have suggested that the duration of the physical activity can be reduced with increased intensity, but there is a need for studies to examine this by randomized controlled trials with follow up design.

In 2009, Handbook of Activity was published by the Norwegian Directorate of Health (Bahr, 2009). In this handbook, recommendations for physical activity in prevention and treatment of a list of different diseases are provided. Unfortunately, as of today there are inadequate levels of knowledge regarding the effects of physical activity in prevention and treatment of eating disorders, therefore eating disorders are not included in this handbook. Hopefully, the level of knowledge will increase within the next years, and it will then be easier to make recommendations for physical activity in treatment of the different types of eating disorders.

1.4 Physical activity among patients with BN

Several studies have examined physical activity among females with and without eating disorders including BN. Pirke et al. (1991) found no differences in minutes per day of physical activity reported through a physical activity diary. However, the lack of difference can be due to a type II error because the sample size was quite small (BN patients, n=8, controls, n=11). This lack of difference in weekly duration of physical activity among BN patients and controls was also found in Sundgot-Borgen et al. (1998). This study included a larger sample size compared to Pirke et al. (1991), however use of parametric statistics on non-parametric data can have influenced on whether the statistical analysis showed significance differences or not. In a study by our research group, we assessed physical activity both objectively through an accelerometer, and through self report by a seven-days physical activity diary (Bratland-Sanda et al., 2010a). We discovered a mean higher amount

of weekly physical activity among female inpatients across both anorexia nervosa (AN), BN and eating disorders not otherwise specified (EDNOS) compared to non-clinical age-matched controls. Despite this difference, the patient sample showed a large heterogeneity when it comes to weekly amount of physical activity. Although a high mean physical activity level, almost 10 percent of the patients were considered physically inactive (Bratland-Sanda, 2010).

Another important aspect with the self report methods used in the studies by Pirke et al. (1991) and Sundgot-Borgen et al. (1998) is the possibility for response bias. Our study (Bratland-Sanda et al., 2010a) discovered that adult inpatient females with longstanding eating disorders, included BN and atypical BN, tended to underreport physical activity when it was compared to objectively assessed physical activity through a motion sensor or accelerometer. This discrepancy between self reported and objectively assessed physical activity was not found among females without eating disorders. We believe that this underreport can be deliberate due to fear of restrictions of the physical activity or fear of needing to increase energy intake. On the other hand, there is a possibility that the patients define and interpret the term "physical activity" different from us as researchers and clinicians. As previously mentioned, the definition of physical activity include all human movement produced by skeletal muscles, and therefore factors such as intensity and/or duration of the physical activity is irrelevant. However, a clinical experience is that patients with eating disorders, including BN, only consider the very vigorous intensity activity to be defined as physical activity or exercise. To these patients, incidental physical activity (i.e. the physical activity performed as part of the daily routine such as household activities such as vacuuming, or walking as a transport activity) does not count as physical activity. This interpretation of the term physical activity was illustrated by the quote of one of our patients participating in the study: *"I'm not physically active - I only go for walks."* (Bratland-Sanda et al., 2010a:91). This patient, diagnosed with BN, reported that she went for walks every day, and these walks lasted approximately one hour each. Despite this, she was convinced that this was not enough to be defined as physically active. This case is an example of how the underreporting can be unintentional.

In a sample of 29 adult female inpatients with longstanding BN, 39% reported to perform aerobic endurance activities only (e.g. running, walking, cycling and swimming), whereas 50% reported to perform both aerobic and non-aerobic activity forms including strength training (see Figure 1).

2. Motivation for exercise in BN

The motives for being physically active can vary over time and from person to person. The motives are influenced by factors such as age, BMI, mood, personality, knowledge and attitudes (Dishman, Sallis, & Orenstein, 1985). The motives can be extrinsic, intrinsic or a combination of these. In females from both the general population and from eating disordered populations, weight control and/or regulation are perceived as very important reasons for physical activity and exercise (Furnham, Badmin, & Sneade, 2002; Mond & Calogero, 2009). Other motives and reasons for physical activity and exercise are physical fitness, health, well-being, regulation of mood and affects, and socializing (Cash, Novy, & Grant, 1994; Plonczynski, 2000).

Bratland-Sanda et al. (2010a) found no differences in importance of exercise as a weight regulator between patients with eating disorders and age-matched non-clinical controls.

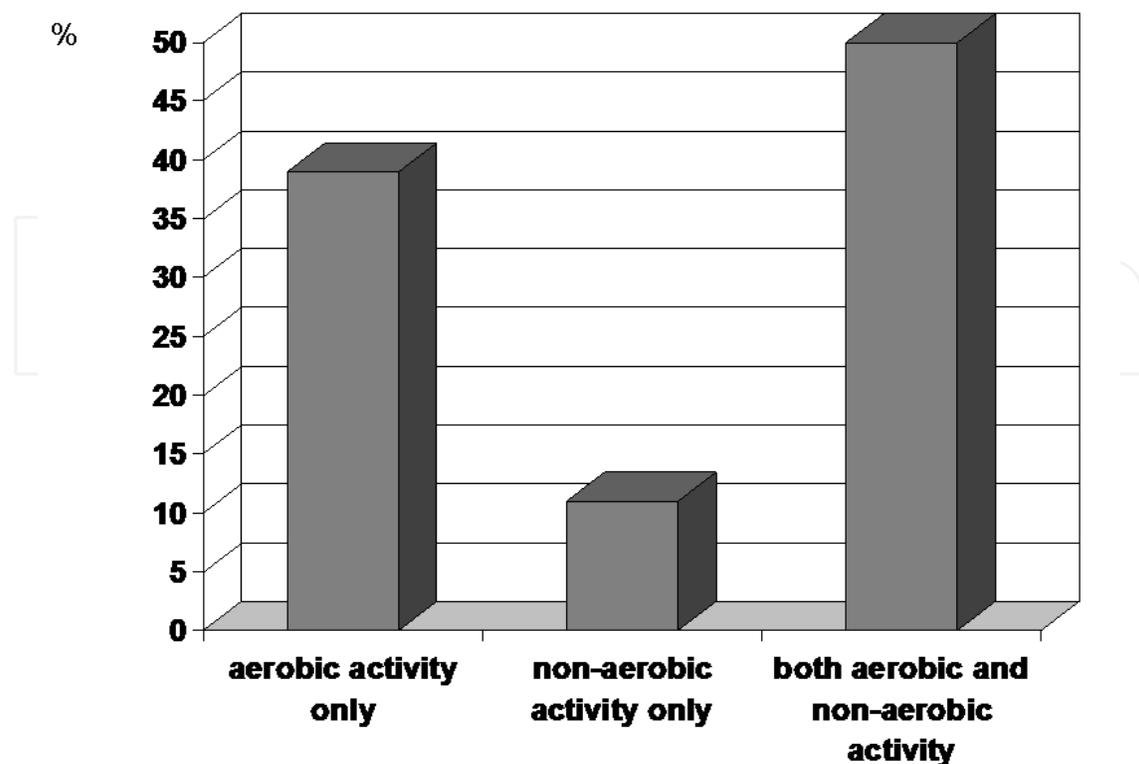


Fig. 1. Frequency of reported aerobic (e.g. running, walking, swimming, cycling) and non-aerobic (e.g. strength training, yoga, pilates) physical activities among a sample of adult female inpatients with bulimia nervosa.

Interestingly, differences did occur in importance of exercise to enhance fitness and health (perceived as less important among the patients) and importance of exercise to regulate negative affects (perceived as more important among the patients). The use of physical activity and exercise as an affect regulator did only occur for regulation of negative affects, no differences in perceived importance of exercise to regulate positive affects was found between patients and controls. One possible explanation for this finding is the high levels of negative affects such as anxiety, depression, shame, guilt etc. among the patients, and therefore the main focus is to down regulate these affects rather than to improve positive affects and well-being. It is important to note that our study was carried out on patients with longstanding eating disorders, and that motives for physical activity and exercise might change during different phases of the disorder. It can be hypothesized that body weight and shape are more important reasons for exercise among patients with short duration of the eating disorders compared to the longstanding eating disorder patients. Future studies need to address this.

3. Excessive exercise and exercise abuse in BN

3.1 When there is too much of a good thing: definition of excessive exercise and exercise dependence

There is no consensus on how to define excessive exercise and exercise dependence. And often these terms, in addition to compulsive exercise, are used interchangeably. In the DSM-IV, excessive exercise is defined under the diagnosis of BN. According to this definition,

exercise becomes excessive when it makes a significant negative impact on other aspects of life, e.g. work, social life and/or family, when it is performed within inappropriate timing and/or setting, and/or the exercise is continued despite injuries, illness or severe complications (APA,1994). Compulsive or obligatory exercise refers to an individual's feeling of being forced to exercise when the motive is no longer performance enhancement, but rather avoidance of the negative feelings that occur with exercise deprivation (Draeger, Yates, & Crowell, 2005). Exercise dependence is defined as the drive to perform leisure-time exercise, and that this drive results in uncontrolled excessive exercise behavior with physiological and/or psychological symptoms of exercise deprivation. The physical withdrawal symptoms are key features of this behavior, and these symptoms did not occur before the exercise behavior pattern started (Hamer & Karageorghis, 2007; Hausenblas & Symons Downs, 2002). The reason why there are several different terms used on what seems to be the same issue, is that destructive and unhealthy exercising has been examined using different disorders and concepts from the field of psychiatry. Mechanisms of substance dependence have been used to explain exercise dependence, and obsessive-compulsiveness has been used to explain compulsive exercising.

To make the concepts of excessive exercise, compulsive exercise and exercise dependence clearer, the differences are pointed out in Table 1.

	Dimension	Main issue	Example
Excessive exercise	Quantitative only (i.e. duration, intensity and frequency)	Too much exercise, but the motives for the exercise can vary. The motives do not have to be compulsive.	BN patients who perform a high amount exercise, but the motive can be to enhance performance in a certain type of sport.
Compulsive exercise	Qualitative only (i.e. motivation and attitudes)	Compulsive motives and behavior, and expression of a need to follow rituals. The behavior does not have to be excessive in amount	BN patients who have to perform 200 sit ups before getting out of bed in the morning. If interrupted, he/she needs to do the whole procedure from the start.
Exercise dependence	Quantitative + qualitative	Avoid withdrawal symptoms.	A BN patient who constantly but unintentionally increases amount of exercise because of increased tolerance, lacks control of the exercise behavior, experiences withdrawal symptoms with exercise deprivation, exercise despite injury and/or illness and that the exercise interfere with other aspects of life.

BN: bulimia nervosa.

Table 1. Differences between the concepts of excessive exercise, compulsive exercise and exercise dependence.

Especially the term exercise dependence has been discussed to be both positive and negative. Some argue that exercise dependence is a positive type of dependence (Morgan, 1979), whereas others believe that the development of a dependency is in itself negative. Cockerill & Riddington (1996) divided between healthy commitment to exercise and a negative dependence to exercise. According to these definitions, the individuals with a healthy commitment to exercise schedule the exercise routines to the more important aspects of life (e.g. work and family life), whereas the individuals with a negative dependency to exercise schedule the rest of their lives around the exercise routines (Cockerill & Riddington, 1996).

A study from 2005 examined whether compulsive exercise would be a better term than excessive exercise for the exercise performed as weight compensatory behavior (Adkins & Keel, 2005). Using a sample of 265 female and male undergraduate students, they found that compulsive exercise score positively predicted disordered eating, whereas quantity of exercise was a negative predictor of disordered eating. They therefore argue that compulsive exercise better describe exercise as a symptom of BN. Unfortunately, this study included a non-clinical sample, and there is a possibility that findings could have been otherwise with a clinical sample of patients with BN.

3.2 Prevalence of exercise dependence among patients with BN

Studies which have examined prevalence of exercise dependence in patients with BN are listed in Table 2. As the table shows, prevalence of exercise dependence in BN ranges from 17% to 57%. This large range can be explained by different definitions of the term exercise dependence, different assessment methods, age of the patient and duration of illness. It is believed that prevalence of exercise dependence is higher among patients in the acute phase of the disorder, and therefore a higher frequency of patients with shorter duration of the illness is classified as exercise dependent (Davis et al., 1997).

3.3 Characteristics of exercise dependence: high intensity activity and affect regulation

Exercise dependent patients show more severe eating disorders psychopathology, more symptoms of anxiety and depression, longer duration of treatment, poorer prognosis for recovery, and higher risk of relapse compared to non-dependent patients (Bratland-Sanda et al., 2010b; Brewerton, et al., 1995; Calogero & Pedrotty, 2004; DalleGrave, et al., 2008; Penas-Lledo, et al., 2002; Shroff, et al., 2006; Strober, Freeman, & Morrell, 1997). Bratland-Sanda et al. (2011) examined explanatory factors for exercise dependence among patients with eating disorders and non-clinical controls. In this study, weekly amount of vigorous intensity physical activity and importance of exercising for regulation of negative affects explained 78% of the variance in exercise dependence score among the patients. Among the non-clinical controls, these two variables explained 53% of the variance.

Affect regulation is the process with the aim of decreasing negative affects and increasing positive affects (Larsen, Prizmic, Baumeister, & Vohs, 2004). Negative affect regulation can both indicate down-regulation of negative affects such as depression and anxiety, and maladaptive affect regulation strategies (Fonagy, Gergely, Jurist, & Target, 2002). Eating disorder can in itself be viewed as a maladaptive affect regulation strategy, because eating disorders symptoms such as bingeing, purging and/or starvation can function as a way to suppress and/or avoid difficult emotions and affects (Harrison, Sullivan, Tchanturia, & Treasure, 2009). Physical activity is an example of a strategy that can be positive for regulation

Study	Patient population (n)	Age	Prevalence
Davis et al. (1994)	AN, BN (n=45)	24.6 (4.8)	AN: 78%
Brewerton et al. (1995)	AN (n=18) BN (n=71)	N/A	AN: 39% BN: 23%
Davis et al. (1997)	AN, BN (n=127)	27.7 (7.8)	AN: 81% BN: 57%
Solenberger (2001)	AN (n=115) BN (n=38) EDNOS (n=56)	20.8 (7.2)	AN: 54% BN: 39% EDNOS: 46%
Penas-Lledo et al. (2002)	AN (n=63) BN (n=61)	18.8 (5.9)	AN: 46% BN: 46%
Abraham et al. (2006)	AN, BN, EDNOS (n=212)	Range: 16-40	AN, BN, EDNOS: 17%
Shroff et al. (Shroff et al., 2006)	AN, BN, EDNOS (n=1857)	26.3 (7.7)	AN: 44% BN: 21% EDNOS: 21%
DalleGrave et al. (2008)	AN, BN, EDNOS (n=165)	26.0 (7.8)	R-AN: 80% B-AN: 43% BN: 39% EDNOS: 32%
Bratland-Sanda (2010b)	AN (n=4) BN (n=17) EDNOS (n=17)	30.1 (8.5)	AN: 50% BN: 6% EDNOS: 47%

AN: anorexia nervosa. BN: bulimia nervosa. EDNOS: eating disorders not otherwise specified.
N/A: not available.

Table 2. Selected studies examining prevalence of excessive exercise, compulsive exercise and/or exercise dependence among patients with bulimia nervosa.

of negative affects into a certain level. When the amounts of physical activity or exercise get excessive, and/or the behavior is compulsive, then this strategy turns maladaptive.

Vigorous intensity physical activity is also a typical sign of exercise dependence. When a female inpatient with EDNOS was asked about her vigorous intensity physical activity, she said: "I can't walk away from the anxiety; I have to run from it." This quote is in my opinion a valuable illustration of the use of physical activity to reduce negative affects, and that sometimes the physical activity has to be of certain intensity for the individual to achieve the intended effect. Therefore, it is a paradox that vigorous intensity physical activity performed in excessive amounts actually can worsen mood (Lind, Ekkekakis, & Vazou, 2008). Why the exercise dependent individuals prefer vigorous intensity physical activity is still not explored adequately. It can however be hypothesized that the vigorous intensity physical activity results in an acute suppression of the negative affects, and that this effect is only temporary. In that way, the level of negative affects can in fact end up being worse after the physical activity session than it was before.

3.4 Management of exercise dependence

As of today, there is no consensus on how to manage and treat exercise dependence. Beumont et al. (1994) and Calogero & Pedrotty (2004) found promising results when using

supervised and health related physical activity in treatment of excessive amounts of exercise and exercise dependence. Other strategies used are motivational interview, cognitive behavioral therapy and psycho-education (Long & Hollin, 1995; Mavissakalian, 1982; Stunkard, 1960).

4. Exercise as a beneficial part of treatment for BN

Although physical activity can be performed with compulsivity and in excessive amounts, properly dosed physical activity can also be beneficial as a part of the treatment for BN. Sundgot-Borgen et al. (2002) randomly assigned young adult females with BN to exercise, cognitive behavioral therapy, nutritional counselling or waiting list control. The exercise program was superior to cognitive behavior therapy and nutritional counselling in improving drive for thinness, body composition and aerobic fitness, and in reducing binge/purge episodes. Unfortunately, this is to my knowledge the only publication that has examined the effect of exercise in treatment of BN using a randomized controlled trial design. It is therefore necessary to carry out more studies to replicate this finding.

Studies on other eating disorders such as binge eating disorder and anorexia nervosa have found physical activity to be beneficial in reducing co morbidity of depression and anxiety, and in enhancing quality of life (Hausenblas, Cook, & Chittester, 2008). In addition, physical activity can help the patients improve social bonding and relations. For patients who undergo heavy psychotherapy etc., the physical activity can be a nice distraction and time off from these exhausting and mentally painful processes. A clinical and practical experience is that the activity needs to be pleasurable and non-competitive. There is a need for studies that examine if a certain type of exercise (e.g. endurance training, strength training, pilates or yoga) is superior to others. Important outcome variables are change in eating disorder psychopathology, general psychopathology, body dissatisfaction and image, self esteem, quality of life, physical fitness, body composition, bone health, exercise dependence and motives for physical activity. As mentioned, we found about 10 percent of the patients to be insufficiently physically active (Bratland-Sanda, 2010), and a significant number of patients with BN are overweight or obese. Therefore, these patients need to increase physical activity level. This issue of inactivity among patients needs to be thoroughly emphasized during the treatment period. However, it must be done in a way that will enhance health and enjoyment without increasing the focus upon body weight and shape. It is therefore my recommendation that personnel with education in exercise physiology and exercise psychology must be in charge for the physical activity as part of BN treatment.

4.1 Contraindications to physical activity and exercise among patients with BN

There are several medical complications related to BN, among others oral, gastrointestinal and electrolyte complications (Mehler, 2011). Especially the electrolyte abnormalities are important to take into consideration when considering physical activity among the patients. The levels of e.g. sodium and chloride can decrease or increase dependent of type of purging method (Mehler, 2011). With both vomiting, use of laxatives and use of diuretics, the levels of potassium in serum and urine will decrease. Low potassium levels, also referred to as hypokalemia, have been found in approximately 5% of the BN population, and this condition can lead to e.g. cardiac arrhythmias. During physical activity, such lethal cardiac arrhythmias can occur (Bouchard, et al., 2007).

5. Future research

Future studies need to examine the mechanisms behind exercise dependence, and different treatment options for exercise dependence. Effects of different types of physical activities in treatment of BN among both male and female patient populations need to be addressed.

6. Conclusion

Physical activity has a number of physiological and psychological effects, and it has been shown effective as a preventive and therapeutic variable in diseases such as type 2 diabetes, cardiovascular disease, osteoporosis, depression, anxiety and certain types of cancer. Among patients with BN, the physical activity is a two-edged sword. On one hand, up to about 50% of patients with BN are classified as exercise dependent, and these patients do need to reduce the amounts of weekly physical activity. On the other hand, a randomized controlled trial found an exercise program superior to nutritional counselling and cognitive behavior therapy among young adult females with BN. Future studies need to further address the possible preventive and therapeutic effects of physical activity in this patient population.

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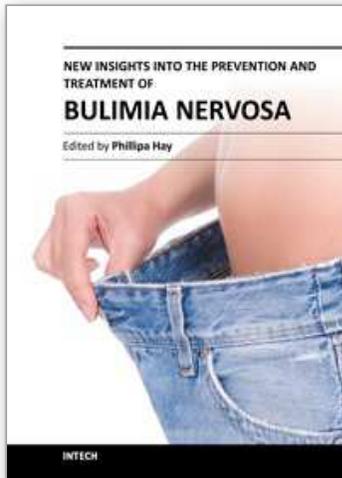
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Bulimia nervosa and eating disorders are common cause of distress and health related burden for young women and men. Despite major advances over the past three decades many patients come late to treatment and find that the therapy is incompletely addressed to the complex psychopathology and co-morbidities of the illness. The present book brings timely and contemporary understandings of bulimia nervosa to aid in current thinking regarding prevention and treatment. It will be read by therapists interested in enhancing their current approaches and those interested in earlier and more effective prevention and closing the gap between illness onset and accessing treatment. They will find practical guidance but also new ideas and ways of thinking about bulimia nervosa and the illness experience in this book.

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University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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InTech China

Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

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