Introduction

This chapter focuses on a research project initiated by de Borg (supervised by prof. Nijman, Didden & Embregts). We wanted to gain a better understanding into the role of the autonomic nervous system (ANS) in relation with clients’ aggression and job related stress of staff caring for these clients. Aggression is often studied in treatment facilities because of the impact it has on both patients, other clients and staff members. Research in treatment facilities for people with Intellectual Disabilities (ID) suggests a similar impact and staff members working with clients with ID face a greater risk of burnout symptoms as the severity of aggression accumulates. Several psychophysiological phenomena related to ANS functioning, like heart rate (HR) and skin conductance (SC) have been found to be related to aggression and have been studied extensively, but not in clients with mild to borderline intellectual disabilities. The first objective is to conduct two literature reviews into HR and SC in relation to both aggression and job related stress (JRS).

The second objective is to develop an understanding on how psychophysiological measures correlate with stress and aggression in clients with mild to borderline ID (MBID), and in staff caring for people with MBID, through two observational and quasi experimental studies. In the first naturalistic study, clients with MBID will be followed during 5 consecutive weekdays to assess what the association is between their HR, SC and aggression. In the second, longitudinal study, we want to investigate if there is a relationship between clients’ aggression and current and prolonged job related stress levels of staff members. In addition, information is gathered on emotional intelligence (EI) and personality characteristics of these staff members, as research has shown those constructs to be protective in the development of burnout and were associated to SC in recent research.
**Literature reviews**

Aggression is frequently studied in a variety of settings (Cornaggia, Beghi, Pavone, & Barale, 2011). The reason for this interest lies in the impact of aggression on both patients, other clients and staff members (Woods & Ashley, 2007). Apart from psychological and physical consequences, such as burnout symptoms or injury, exposure to aggressive behaviour is also linked with an increased risk of having to call in sick for work (Nijman, Bowers, Oud, & Jansen, 2005). Research in treatment facilities for people with MBID suggests the same impact (Tenneij, Didden, Stolker, & Koot, 2009), and staff members working with clients with ID face a greater risk of burnout symptoms as the severity of aggression accumulates (Hensel, Lunsky, & Dewa, 2013). Aggressive behaviour also has direct negative consequences for the aggressive clients themselves, as they, for instance, have a higher likelihood to be exposed to coercive measures such as seclusion, which may result in a stagnation of treatment (Nijman, Campo, Ravelli, & Merckelbach, 1999). Several psychophysiological phenomena, like HR and SC (Boucsein, 2012; Lorber, 2004), have been related to aggression and may be promising in explaining and recognizing states of stress and aggression (e.g. see; Kuijpers, Nijman, Bongers, Lubberding, & Ouwerkerk, 2012; Poh, Swenson, & Picard, 2010). Because aggression has a different impact on both the clients and staff members we intend to conduct two systematic reviews.

The first systematic review will be conducted into psychophysiological measures (stress/arousal/skin conductance/electrodermal activity/heart rate/heart rate variability) and aggression. Studies will be included if published between 1990 and 2016. Aim of this review is to provide an overview of the association between the psychophysiological measures of stress (i.e., increased arousal) and its relationship to aggressive behaviour. Results of this review may provide information on the validity and reliability of instruments for measuring stress in individuals with MBID who are prone to developing some sort of aggressive behaviour. A second systematic review will focus on the psychophysiology of job related stress and burnout. Studies will be included if published between 1990 and 2016. The aim of this systematic review is to assess whether SC and HR can be used for the prediction of job related stress or burnout in nurses.

**Observational studies**

The second objective of the project is to develop an understanding on how psychophysiological measures correlate with stress and aggression in patients with MBID and staff caring for clients with MBID through two observational studies. The first study focuses on aggression. Aggressive behaviour of psychiatric patients with mental health problems threatens the safety and well-being of both staff members and fellow-patients (Hensel et al., 2013). A survey study of Nijman, Bowers, Oud and Jansen (2005), for instance, shows that almost all psychiatric nurses working at admission wards, experience verbal aggression (and on an almost daily basis), and about one out of every 6 nurses experience physical aggression by a client on an annual basis. Apart from the potentially adverse physical consequences, violence also has a mental impact, which seems especially evident for staff working in (forensic) psychiatric inpatient settings in which the clients are usually admitted involuntarily. A study done by Hensel et al. (2013) in which 42 matched nursing dyads serving patients with ID participated, showed that nurses who were exposed to high levels of aggression (i.e., those working in a specialized hospital) showed higher scores on emotional exhaustion than the matched control nurses working in an open community residential setting.

Not surprisingly, many researchers have tried to find ways to predict and prevent aggression towards nursing staff or fellow-inpatients, for instance by developing methods for early recognition of potential warning signs of disruptive and aggressive behaviour, usually based on observing the patient’s behaviour (Fluttert, Van Meijel, Bjørkly, Van Leeuwen, & Grypdonck, 2013). Apart from observing and interpreting patient’s behaviours that are assumed to be linked to imminent aggressive behaviour, there is growing interest in the potential of predicting aggression by means of more
objective stress measurements (e.g., arousal in terms of the Skin Conductance Level (SCL) on psychiatric wards (Kuijpers et al., 2012), and in facilities caring for clients with severe mental disabilities (Noordzij, Scholten, & Laroy-Noordzij, 2012). On the basis of a review, Raine, (2002) indeed indicated that HR in particular, and SC to a lesser extent, are important neurobiological predictors of violent and aggressive behaviour. In line with this, Lorber’s, meta-analysis (2004) found small but consistent effects in that low resting HR and high HR variability (HRV) as well as high SC reactivity were associated with aggressive behaviour in general. The evaluated research is mostly done in experimental conditions whereas the aim of the current study is to replicate this in a naturalistic setting (i.e., during day-to-day life on a psychiatric treatment facility).

Although SC and HR to some extent have been studied in aggressive and non-aggressive samples, few studies have been conducted in people with MBID (Morrissey & Hollin, 2011), let alone in patients with a combination of MBID and psychopathy. Psychopathy undoubtedly is one of the most important predictors of offending behaviour (Hare & Neumann, 2009) and an important factor in future violence (Lindsay et al., 2006). In contrast to findings of aggressive subjects scoring low on psychopathy, individuals scoring high on psychopathy, show low SC reactivity to aversive stimuli as well as low resting SC levels. In addition, a Swedish longitudinal study with over 700,000 participants found that lower resting HR was associated with a 39% higher hazard on conviction of violent crimes (Latvala, Kuja-Halkola, Almqvist, Larsson, & Lichtenstein, 2015).

This study

In this study we will extend the research mentioned above on psychophysiological predictors of aggression in clients with MBID, of which a substantial proportion also meet the criteria for psychopathy as diagnosed with the Psychopathy CheckList - Revised (PCL-R; Hildebrand, De Ruiter, de Vogel, & van der Wolf, 2002). Psychophysiological predictors are explored that may differentiate between aggressive clients with high and low levels of psychopathy. We hypothesize that there are different (curvi)linear trajectories leading to an aggressive incident for the two aggression groups. As mentioned earlier, it is expected that aggressive behaviour from non-psychopathic MBID clients is preceded by an increase of HR reactivity, SC reactivity, as well as by an overall increase of the SCL (Lorber, 2004). As far as SC is concerned these findings were replicated in non-MBID forensic psychiatric patients (Nijman et al., 2014). Psychopathic clients, by contrast, are expected to show lower SC reactivity and lesser increase of the SCL preceding aggressive behaviour. Participants for this study are living on (semi) closed or open wards. The main reason for referral to one of the settings is a history of aggression and/or severe behavioural and emotional problems. Only clients that are mentally competent will be included in the study. Data on four variables will be collected: (1) Skin conductance, (2) Heart rate, (3) psychopathy score and (4) incidents of aggression. SC as well as HR are measured with an E4 wrist band (Garbarino, Lai, Bender, Picard, & Tognetti, 2014). This is a device in the form of a wrist watch which allows for measuring both SC and HR and is manufactured by an Italian company called Empatica.

Participants will be asked to wear the Empatica E4 device for 5 consecutive days. Criteria for inclusion are twofold; 1) there are no objections made by the treatment staff and 2) the client is willing to sign informed consent. There are no other or further requirements for the clients other than wearing the E4 wrist band. The assessments of SC and HR are non-invasive and will not restrict patients in their normal daily routines in any way.

The following main research questions will be addressed:

- Is aggressive behaviour associated with higher SC and HR? In case associations between increased SC and HR and aggressive behaviour are found, it will be explored whether and to what extent such increases precede the first behavioural manifestations of aggressive behaviour.
Is there a difference in psychophysiology (SC and HR) leading to aggression in clients with high psychopathy scores versus low psychopathy scores?

The second study focuses on JRS. Recently, it was calculated that JRS just in the first half of 2014 costed the Dutch economy over 800 million euro’s (ArboNed, 2014). Task demands, which vary considerably in frequency and intensity between jobs, are an important cause for JRS (Rose, 1999), and (eventually) burnout (Crawford, Lepine, & Rich, 2010). Staff caring for clients with MBID face a number of specific task demands and challenges, that may threaten their physical and mental well-being. Typical stressful task demands for psychiatric nursing staff are having to work in different shifts (among which nightshifts), understaffing, and having intense relationships with people who may exhibit challenging behaviour, such as aggression (see for instance De Looff, Kuijpers, & Nijman, 2014; Jenkins & Elliott, 2004). In other words, one of the potentially most stressful task demands is dealing with aggression and experiencing negative emotions on a regular basis (Zijlmans, Embregts, & Bosman, 2013). Prolonged exposure to JRS and inadequate coping with this stress can result in burnout (Swider & Zimmerman, 2010). Early detection of high stress levels might aid prevention and may increase the opportunities for giving social support between colleagues, which is known to be an important factor in the prevention of burnout (Rose, 1999; Taris, Houtman, & Schaufeli, 2013). For these reasons, early detection of stress in staff caring for MBID clients, as well as studying the effects of it, are the main aims of this study.

Earlier studies on stress in staff caring for clients with MBID suggest that EI is negatively associated with burnout (Gerits, Derksen, Verbruggen, & Katzko, 2005). Two (clarity and repair) out of the three main dimensions of EI (attention being the third; Augusto Landa, López-Zafra, Berrios Martos, & Aguilar-Luzón, 2008) in particular seem to be related to a reduction in the risk of burnout. Furthermore, a study by Zysberg (2012) suggested that differences in SC exist between subjects scoring high and low on EI in response to a task with positive and negative emotional stimuli. In addition to EI, a meta-analysis of 115 studies by Swider & Zimmerman (2010) revealed that the main so-called big-five personality characteristics also seem to ‘predict’ the development of burnout to a certain extent, with the strongest predictor being neuroticism. As for the link with SC, a study among 61 right-handed undergraduate students found a positive association between electrodermal reactivity (i.e. SC responsivity) and neuroticism (Norris, Larsen, & Cacioppo, 2007). SC apparently is associated with neuroticism and consequently may be associated with JRS and eventually burnout. In line with this, a recent pilot study among 10 psychiatric nurses followed during a day, evening and night shift also suggested a substantial correlation between neuroticism and the average SC while working on a locked psychiatric ward (De Looff et al., 2014).

Because of the specific nature of task demands of staff caring for MBID clients, which among others is the management of aggressive behaviour, we expect to find a relationship between clients’ aggression and JRS in staff caring for people with MBID. In a sample of forty-two matched nursing dyads working in inpatient and community settings, it indeed was found that severity of aggression was positively associated with burnout (Hensel et al., 2013). Earlier cross-sectional research by Chung and Harding (2009) also confirmed this relationship for perceived aggression and found certain personality characteristics such as neuroticism, extraversion and conscientiousness to predict the development of burnout in staff working with clients with ID. Besides EI and personality characteristics, another (protective) factor of interest in preventing JRS in staff caring for MBID is the support that people experience on the job (Rose, 1999).

However, although support is a protective factor, Taris et al. (2013) pointed out that if demands are too high for a prolonged period of time, higher levels of experienced support will eventually not protect against burnout in the long run. In the longitudinal study proposed here, we want to investigate if there is a relationship between clients’ aggression and current and prolonged stress levels of staff members. Note that most of the earlier studies on this topic have used a cross-sectional correlational design, whereas we propose to study the associations between client aggression, JRS
and burnout symptoms during a two-year follow-up study. It is expected that EI (Bulmer Smith, Profetto-McGrath, & Cummings, 2009; Gerits et al., 2005; Schaufeli & Taris, 2005) and personality characteristics of staff members (Boucsein, 2012; Taris et al., 2013) have a moderating role and the amount of support people experience from coworkers and the organization (Rose, 1999) will have a mediating role in dealing with JRS.

In sum, we are interested in the associations between clients’ aggression and SC, personality, EI, JRS and burnout in staff caring for clients with MBID. To be more specific, it will be studied what influence experiencing aggression during work has on the SC of staff caring for clients with MBID. Finally, we want to explore what roles EI, personality traits and support and demands play in developing burnout symptoms.

A naturalistic longitudinal study will be used in which SC, personality characteristics, EI, aggression, JRS and burnout are monitored during two years at four half-yearly time points. Participants are staff members caring for clients with MBID. Participants are working on closed or (semi) open wards where managing (potential) aggressive behaviour can be part of their daily task demands. Data on six variables will be collected: (1) SC, (2) Personality, (3) EI, (4) Aggression, (5) JRS and (6) Burnout. Staff will be asked to participate for a two-year period with four assessments (i.e., 4 time points). When participants enter the study, they are asked to complete personality and EI questionnaires. Staff will wear an E4 in a regular dayshift in order to obtain SC measures during 4 shifts each at half yearly intervals. Questionnaires on burnout symptom scores, JRS and perceived aggression are also obtained during half-yearly computerized versions of the questionnaires which will take approximately 30 minutes to complete. Aggression will be assessed each year for the separate wards on the basis of the MOAS+ scores.

The following research questions will be addressed:
- Is there an association between experiencing aggression and burnout symptoms?
- Is this potential association between experiencing aggression and burnout symptoms moderated by personality and emotional intelligence and mediated by JRS?
- On average, is there a difference in burnout symptoms between staff working on wards with clients with low or no aggression and staff working on wards with clients with high levels of aggressive behaviour?
- Is there an association between (prolonged) JRS and the SC?

Using E4 data in a treatment setting
The analysis of psychophysiological data is somewhat challenging and time intensive, but a few guides are available (Boucsein, 2012; Christie, Jennings, & Egizio, 2011; Electrophysiology, 1996; Society for Psychophysiological Research Ad Hoc Committee on Electrodermal Measures, 2012; Xu, Stokes, & Meredith, 2016). The E4 provides data on HR, SC, movement and temperature, and has to be cleaned first. Data processing tools are available for both HR (Tarvainen, Niskanen, Lipponen, Ranta-aho, & Karjalainen, 2014) and SC (Taylor et al., 2015). We deivced a tool to simultaneously process E4 data in batch, so other researchers can process data as well. We will be working on this software tool and develop a user interface to facilitate easier processing of the data. This might aid the use of the wristband in a treatment setting. For now, the naturalistic study of psychophysiology is an emerging and exciting field with seemingly endless possibilities.


