Self-regulation and compliance to type I and type II diabetes medication

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Dissertation submitted in fulfillment of the requirements for the degree *Magister Artium* in Research Psychology at the Potchefstroom Campus of the North-West University

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SUMMARY

Keywords: Self-regulation, patient compliance, non-compliance, diabetes mellitus, medication, script refills.

Diabetes mellitus is a complex disease that requires constant patient compliance to diet, life style, glucose level monitoring and medication. Non-compliance to medication can be associated with the development of complications, avoidable hospitalization, disease progression, premature disability and death. Non-compliance is also very costly and therefore compliance to medication regimens is very important.

A promising, yet under-explored approach to compliance is self-regulation. Self-regulation refers to the process of goal setting and striving. Self-regulation has specifically been associated with success in reaching one's goals. The key self-regulation processes include goal establishment, planning, striving towards a goal and revising it. Although a large number of studies have been conducted on compliance related to diabetes, there is a lack of research findings from a self-regulation perspective. The aim of this study is to investigate the relationship between self-regulation and patient compliance to type I and type II medication. Specific aims are (a) to determine whether there is a significant difference in the mean self-regulation scores for participants high and low in compliance and (b) to determine whether there are significant differences in the mean self-regulation scores between compliant and non-compliant participants within different gender and age groups.

The participants consisted of an availability sample of 50 (31 female and 19 male) type I and type II diabetes patients collecting their medication at the Clicks Pharmacy in Potchefstroom and Trans 50 retirement villages in Pretoria, Bloemfontein and Kimberley. The ages of the participants ranged between 20 and 87 years. Compliance was measured by investigating the participants' repeat scripts as well as the Clicks Medication Therapy Management Questionnaire (MTM-Q), developed in 2009 by pharmacists at Clicks to measure patients' self-report of compliance. Self-regulation was measured with the Shortened Self-Regulation Questionnaire (SSRQ) (Carey, Neal, & Collins, 2004). The study used the factor structure proposed by

Potgieter and Botha (2009), based on a factor analysis of the SSRQ in the South-African context. Data capturing and analysis was done in consultation with the Statistical Consultation Services of the North-West University.

A total number of 28 (56%) participants in this study were classified as compliant, which is lower than compliance figures reported in most international studies. Differences between compliant and non-compliant participants were primarily noted with regard to Mindful Awareness, Monitoring and Decision making. No differences were noted between any of the groups regarding Learning from mistakes, Perseverance, or Self-evaluation. Compliant participants in the total, female and older groups scored higher on Mindful Awareness than non-compliant participants. For older participants, this difference was practically significant. Compliant participants in the female and older group also obtained higher scores on Monitoring, with the difference in the female group practically significant. Surprisingly, non-compliant female participants scored higher on Decision Making than compliant female participants. Compliant and non-compliant male and younger participants, however, did not differ on any of the self-regulation factors.

The study emphasizes the fact that diabetes is perceived as a significant challenge to the current goals of the patient. Subsequently, this study confirms, to a large extent, the importance of self-regulation in compliance to type I and type II diabetes medication, providing support for international studies that emphasise the importance of behavioural factors in diabetes. Mindfulness and Monitoring emerged as important factors in this study, and was explained in relation to compliance as a challenge to one's perceptual awareness and ability to continuously generate feedback regarding one's health status. The reason for gender and age related differences in the relationship between compliance and self-regulation, however, is not totally clear and needs to be explored in further research.

An important limitation of the study is the small sample size that was used. Future research should explore the trends emerging from this study in larger, random samples.

OPSOMMING

Sleutelwoorde: Selfregulering, pasiënt-inskiklikheid, nie-inskiklikheid, diabetes mellitus, medikasie, voorskrifhervullings.

Diabetes mellitus is ‘n komplekse siekte wat konstante pasiënt-inskiklikheid ten opsigte van dieet, leefstyl, glukosevlak monitering en medikasie vereis. Nie-inskiklikheid ten opsigte van medikasie word geassosieer met die ontwikkeling van komplikasies, voorkombare hospitalisasie, siekteprogressie, voortydige ongeskiktheid en dood. Nie-inskiklikheid is ook baie duur en daarom is nakoming van medikasie regimes uiters belangrik.

‘n Belowende maar onverkende benadering tot pasiënt-inskiklikheid is selfregulering, wat verwys na die proses van doelwitstelling en suksesvolle doelwit bereiking. Die belangrikste selfregulerende prosesse sluit in doelwit bepaling, beplanning, die streef na ‘n doelwit en die hersiening daarvan. Alhoewel ‘n groot hoeveelheid studies al gedoen is oor pasiënt-inskiklikheid en diabetes, is daar ‘n tekort aan navorsings resultate vanuit die perspektief van selfregulering. Die doelwit van hierdie studie was om die verband tussen selfregulering en pasiënt-inskiklikheid ten opsigte van tipe I en tipe II diabetes medikasie te ondersoek. Spesifieke doelwitte sluit in (a) om vas te stel of daar ‘n beduidende verskil is tussen die gemiddelde selfregulering van deelnemers met hoë en lae inskiklikheid, en (b) om vas testel of daar beduidende verskille is tussen die gemiddelde selfregulering van inskiklike en nie-inskiklike deelnemers binne verskillende geslags- en ouderdoms groepe.

Die deelnemers het bestaan uit ‘n beskikbaarheid steekproef van 50 (31 vroulik en 19 manlik) tipe I en tipe II diabetes pasiënte wat hulle medikasie by die Clicks Apteek in Potchefstroom en die Trans 50 aftree-oorde in Pretoria, Bloemfontein en Kimberley ontvang. Die ouderdomme van die deelnemers strek tussen 20 en 87 jaar. Inskiklikheid is gemeet deur die deelnemers se herhaalvoorskrifte na te gaan, asook die Clicks Medication Therapy Management Questionnaire (MTM-Q), ontwikkel in 2009 deur aptekers by Clicks om pasiënte se selfrapportering oor inskiklikheid te toets, te gebruik. Selfregulering is gemeet met die Shortened Self-Regulation Questionnaire (SSRQ) (Carey, Neal, & Collins, 2004). In die studie is die faktor struktuur wat voorgestel is deur Potgieter en Botha (2009), gebaseer op ‘n faktor

analise van die SSRQ in die Suid-Afrikaanse konteks, gebruik. Datavaslegging en -analise is gedoen in samewerking met die Statistiese Konsultasie dienste van die Noord-Wes Universiteit.

'n Totale hoeveelheid van 28 (56%) deelnemers aan die studie is geklassifiseer as inskiklik, wat laer is as die inskiklikheid syfers wat in meeste internasionale studies gerapporteer word. Verskille tussen inskiklike en nie-inskiklike deelnemers het veral geblyk met betrekking tot Indagtige Bewustheid, Monitering en Besluitneming. Geen verskille is opgemerk tussen enige van die groepe met betrekking tot Leer uit foute, Deursettingsvermoë of Selfevaluasie nie. Inskiklike deelnemers in die totale, vroulike en ouer groepe het ook hoër tellings behaal met Indagtige Bewustheid as nie-inskiklike deelnemers. Vir ouer deelnemers was hierdie verskil prakties betekenisvol. Inskiklike deelnemers in die vroulike en ouer groepe het ook hoër tellings behaal met Monitering, met die verskil in die vroulike groep prakties betekenisvol. Verrassend genoeg het nie-inskiklike vroulike deelnemers hoër tellings behaal met Besluitneming as inskiklike vroulike deelnemers. Inskiklike en nie-inskiklike manlike en jonger deelnemers het egter nie verskille getoon met enige van die selfregulerings faktore nie.

Die studie benadruk die feit dat diabetes beskou word as 'n uitdaging aan die huidige doelstellings van die pasiënt. Gevolglik bewys die studie tot 'n groot mate die belangrikheid van selfregulering vir inskiklikheid ten opsigte van tipe I en tipe II diabetes medikasie. Dit ondersteun internasionale studies wat die belangrikheid van gedrags faktore in diabetes benadruk. Indagtige bewustheid en Monitering het uitgestaan as belangrike faktore binne die studie, en is verduidelik in verhouding tot inskiklikheid as 'n uitdaging aan 'n persoon se persepsuele bewustheid en die vermoë om voortdurend terugvoer aangaande sy of haar gesondheid status te genereer. Die redevir die geslags- en ouderdoms verwante verskille in die verband tussen inskiklikheid en selfregulering is egter nie heeltemal duidelik nie en moet in verdere studies nagevors word.

'n Belangrike beperking van die studie is die klein steekproef grootte wat gebruik is. Verdere navorsing is nodig om die tendense wat in hierdie studie navore kom in groter, ewekansige steekproewe te ondersoek.

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ACKNOWLEDGEMENTS

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LETTER OF CONSENT

I, the supervisor, hereby give consent for Jeanette Nell to submit the following manuscript for purposes of a dissertation (article format): **Self-regulation and compliance to type I and type II diabetes medication.**

It may also be submitted to the Journal of Psychology in Africa for publication.

_____

Prof. K.F.H. Botha
Supervisor

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LITERATURE STUDY: SELF-REGULATION

Introduction

This section provides a comprehensive literature review on self-regulation to support the article that follows. Whereas self-regulation will be defined and briefly related to compliance in the article, the focus in this section is on i) defining self-regulation; ii) providing a comprehensive description of the phases of self-regulation; iii) discussing some of the most important self-regulation theories; and finally, iv) linking self-regulation to health behaviour in general and compliance in particular.

What is self-regulation?

Self-regulation is essentially a function of the brain's frontal executive attention network that includes the anterior cingulate and lateral prefrontal cortex, areas active in the executive functions. Such functions refer to capacities like planning, resisting distractions, maintaining a goal orientation, organising, judging and decision making (Posner, 2008). Self-regulation is a complex set of behavioural skills, and thus defined and described from many different perspectives. One perspective views self-regulation as the self-directive process through which a person transforms his or her mental abilities into task-related skills (Reid, 2012). Another perspective is that self-regulation is 'a systemic process of behaviour that involves setting personal goals and steering behaviour towards the achievement of these goals' (Maes & Karoly, 2005, p.268). Yet another viewpoint compares self-regulation with overcoming obstacles: the process of goal setting and striving, which includes dealing with a range of challenges that an individual may face trying to achieve something that is important to him or her, but that may be difficult to achieve (de Ridder & de Wit, 2006). Luszczynska, Diehl, Gutiérrez-Doña, Kuusinen and Schwarzer (2004, p.555) define it as 'any effort by an individual to alter his or her own responses, overriding impulses, and substituting them with another response that leads the person's behaviour towards a selected aim'.

Self-regulation can thus be described as an important adaptive skill that a person applies in ensuring goal achievement. It is roughly based on the premise that success is dependent on the individual's ability to change his/her own behaviour appropriately whenever a discrepancy between a goal and current behaviour is

perceived or actually occurs. It is therefore also regarded as an important ability in positive psychology, and has been included as strength along with prudence, forgiveness, and modesty, under the virtue *Temperance*, in the Values in Action Inventory of Strengths (Peterson & Seligman, 2004). In contrast, poor self-regulation is associated with a number of problem-related behaviours like drug addiction, eating disorders, excessive spending, crime and violence, emotional problems, underachievement in work and at school, procrastination, and sexually transmitted diseases (Baumeister, Vohs & Tice, 2007).

Phases of self-regulation

Although a number of other self-regulation theories exist (compare Baumeister & Vohs, 2004; and Forgas, Baumeister & Tice, 2009), they all have in common, to a large extent, the presence of three phases, namely goal establishment, self-monitoring, and self- or goal adjustment. Each of these phases will now briefly be discussed.

Goal establishment. Firstly, central to the model of self-regulation is the concept of goals. Goals may include life tasks (Cantor & Kihlstrom, 1987), personal strivings (Emmons, 1986), self-guides (Higgins, 1987) and personal projects (Little, 1983). Each of these highlights different aspects of goals but have in common the idea that goals energize and direct a person's activities as they give meaning to the person's life. Goals are future orientated and relate to how people perceive their potential and the things they want to achieve in the future (de Ridder & de Wit, 2006).These goals motivate the person to strive towards attaining a specific goal in the future (De Ridder & de Wit, 2006).

According to Reid (2012) the target behaviour has to have value to the patient. It is important to keep in mind that the particular behaviour itself may not be valuable or rewarding, but the effect that the behaviour produces or the individuals' perception of the behaviour may be valuable. The target behaviour needs to be both observable and definable, specifically and objectively. If the behaviour is not defined in detail, it will be difficult to self-regulate.

Another essential aspect of goals is the extent to which a person is intrinsically or extrinsically motivated to achieve their goals. According to Ryan and Deci (2000)

intrinsic motivation refers to the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities to explore, and to learn. In contrast, extrinsic motivation refers to the performance of an activity in order to attain some separable outcome, for example praise, recognition, status or material rewards like financial advantages.

Self-Monitoring. A person may be regarded as an active agent involved in shaping his or her own behaviour (or destiny). They are constantly gathering goal orientated information and integrating it with their prior knowledge to form a subjective assessment of their progress in obtaining their goal (Benyamini, 2009; De Ridder & De Wit, 2006). The way in which information and feedback is gathered is through monitoring one's own behaviour: which is mainly done by attentional processes. Two of these processes, self-reflection and mindful awareness, play a significant role in self-regulation.

According to Zimmerman (2000) self-reflection is a form of self-judgment, which includes self-evaluation (comparing self-monitored information with a standard or goal in terms of mastery and previous performance) and causal attribution (judgment about performances such as whether poor performance is due to limited ability or insufficient effort). Recently, the concept of mindfulness has emerged as an important factor in self-regulation. Mindfulness literally means "to remember" (Brown, Ryan & Creswell, 2007, p.212), but it commonly signifies presence of mind. Brown et al. (2007, p.12) define mindfulness as "a receptive attention to and awareness of present events and experience". Mindfulness thus involves the capacity to be aware of internal and external events and occurrences as they are, as opposed to how they are habitually construed by the individual. When mindful, the individual is therefore allowed to be present to reality as it is rather than how it is perceived through discriminative, categorical, and habitual filters. This presence eventually permits more flexible self-regulation (Brown et al., 2007).

Self-adjustment. The desire to attain a goal must dynamically adapt to changes within the context in which self-regulation takes place (De Ridder & de Wit, 2006). According to Peterson and Seligman (2004) a key aspect of self-regulation is the ability to override or alter one's own responses. Examples include appropriately redirecting thought processes, changing emotional responses away from negative

feelings, restraining the self from carrying out unwanted impulses and desires, or persisting on a task in order to perform better. Most acts of self-regulation involve stopping oneself from certain responses; however, some acts may entail initiating a response. Bandura (1996) states that people react differently to perceived negative discrepancies – some generate better strategies and improve their efforts often even in the face of failure, while others lower their standards and aspirations.

Carver and Scheier (2003) further indicate that one way of improving one's efforts is through perseverance, which is fostered by an interaction between commitment and confidence. Engagement of effort thus requires both a goal that matters enough and also sufficient confidence in its eventual attainment. However, these authors continue (p. 89) to say that at times it is also more appropriate to disengage from certain unobtainable goals. This challenges one's capacity for self-regulation, because it is extremely difficult to disengage from important goals. Types of disengagement include: i) choosing alternative pathways to the goal; ii) developing new pathways or goals; iii) shifting from one activity to another, and (iv) scaling back from a specific goal in a given domain to a less demanding one.

Self-regulation theories and models

A large number of different self-theories exist. However, most of these are complex and often related to specific behavioural domains. For the purpose of this discussion, two approaches will briefly be described in order to provide a simple explanation of self-regulation, namely the cybernetic approach and the social cognitive approach. Later two specific approaches to health-related self-regulation will also be discussed.

Carver and Scheier's Cybernetic model. Carver (2004) describes self-regulation as a process of cybernetic control, in which goal attainment and feedback loops play an essential role. According to this approach, goals act as reference values within feedback loops. When a person is working towards a goal, input is provided by the person's perception about progress toward the goal. The goal itself provides a reference value, which is compared to what the person perceives. If a discrepancy is perceived between goal and current progress, an error is detected. The output is the person's reaction to the perceived discrepancy or error. In this regard, there are two kinds of feedback loops (Carver, 2004) – a discrepancy reduction loop, also

known as negative feedback, elicits behaviour that is aimed at reducing or eliminating the difference between the input and the reference value. A discrepancy-enlarging feedback loop, in contrast, also known as positive feedback, elicits behaviour that avoids some target behaviour (for example, something the individual fears might happen).

Bandura's Social Cognitive Theory. Bandura (1996; 2001) highlights central issues in self-regulation, such as the symbolic representations of goals and self-monitoring of behaviour in the pursuit of goals. People engage in behaviour because of the outcomes they hope to achieve. People strive to gain positive outcomes and to prevent negative outcomes; these strivings are governed by individuals' self-efficacy beliefs. As a general rule people undertake tasks that they judge themselves at being able to perform. Self-efficacy beliefs thus affect the level and type of goals individuals adopt, which in turn influence their performance. Challenging goals raise motivation and goal attainment and individuals with high self-efficacy are more likely to adopt and remain committed to their goals (De Ridder & de Wit, 2006).

It is clear that this approach takes a less mechanistic one than those offered by the cybernetic approach. According to Bandura (2001), self-regulation reflects the agentic nature of human beings. Agency enables people to play a part in their self-development, adaptation, and self-renewal within changing contexts. As agents of their own behaviour, (p. 2) people choose goals and regulate their behaviour in the pursuit of these goals. At the heart of self-regulation is the ability to anticipate or develop expectations – to use past knowledge and experience to form beliefs about future events and states, and beliefs about those abilities and behaviour.

Self-regulation in health behaviour

There are several theories and definitions of self-regulation (Botha, 2013; de Ridder & de Wit, 2006; Mackenzie, Mezo & Franz, 2012) that explain health behaviour. Health behaviours are governed by the same principles as other self-regulating behaviours, because they involve the person as an active agent and draw on volitional processes of goal striving. Illness is a huge challenge or obstacle to one's life goals, and in the context of self-regulation, represents a discrepancy that the

individual needs to adjust to. However, there is a debate about the extent to which goals are true guides of health behaviour. For example, are people really self-regulating; choosing their own goals, or are they being regulated; following doctors' orders, when they decide to be compliant to medication treatments? If they are just following doctors' orders, then a self-regulation perspective would not add much to our understanding of why people succeed or fail in complying with medication treatments (De Ridder & de Wit, 2006). However, the challenge in compliance behaviour is that taking medication could become an extrinsically motivated goal as it is enforced by external factors.

Failures in self-regulation may occur because different goals are in conflict with one another. The failure of self-regulation in health contexts can be explained as follows: In patients with a chronic illness, goals related to self-regulation may interfere with the patients' pursuit of life goals and integrating both goals may be difficult. Successful self-regulation also depends on appropriate goal setting, therefore many failures in self-regulation can be attributed to unrealistic and overly rigid goals, or these goals are focused too much on long term outcomes (De Ridder & de Wit, 2006).

Health-related self-regulation theories

Leventhal's common-sense model (Leventhal, Brisette & Leventhal, 2003) describes a process that begins when a person encounters a health problem. The process involves three stages that occur simultaneously on both cognitive and emotional levels. First, the person forms an (1) illness representation, then (2) implements a coping strategy and finally (3) appraises his or her status in achieving this goal. During the first stage, the patient attempts to understand his or her illness by comparing the current illness experience to existing prototypes of the illness and external information. The patient then forms an illness representation. In the second stage, the illness representations formed in stage one guide the patient to form coping strategies. These include strategies aimed at coping with the stressor as perceived by the person, and strategies aimed at coping with its emotional representation. The third stage involves the patients' assessment of the outcomes of these coping efforts. The results of the assessment guide further actions. If the

outcomes are expected the patient will keep the coping strategy, if the outcome is undesirable the patient will change the coping strategy (Benyamini, 2009).

Kanfer's model of self-regulation, applied to promoting health, states that the regulation of behaviours (for example, medication compliance) is determined by the following self-variables: (1) the patient's motivation to be healthy, (2) the perceived control the patient has over his own health, and (3) the patient's perceived support of health promoting behaviours from significant others (Tucker, et al., 2001). Consistent with Kanfer's model one can assume that motivation to be compliant with medication, perceived control over illness, responsibility to comply, and perceived support received from primary caregivers for medication compliance would be significant predictors of levels of compliance with medication (Tucker et al., 2001).

In conclusion, self-regulation is a complex and dynamic process influenced by a number of factors. Central to self-regulation is the ability, within communities, groups and individuals, to promote goal attainment, to prevent failure and to react to discrepancies between intended and real outcomes in an adaptive way. Self-regulation has specifically been associated with success in reaching one's goals. In health contexts, sickness and illness represent a major obstacle to life goals. Compliance to chronic medication is a good example of behaviour that is extrinsically motivated, and that would therefore challenge self-regulation.

TITLE OF DISSERTATION, AUTHORS AND CONTACT DETAILS

Self-regulation and compliance to type I and type II diabetes medication

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ABSTRACT

Self-regulation and compliance to type I and type II diabetes medication

Keywords: Self-regulation, patient compliance, non-compliance, diabetes mellitus, medication, script refills.

Objective: To explore the relation between self-regulation, compliance and non-compliance to diabetes medication in patients with type I and type II diabetes.
Method: Participants consisted of an availability sample of 50 (31 female and 19 male) type I and type II diabetes patients aged between 20 and 87. Self-regulation was measured with the Shortened Self-Regulation Questionnaire (SSRQ), and compliance with the Clicks Medication Therapy Management Questionnaire (MTM-Q) and script repeats of medication. Data was captured and analysed in consultation with the Statistical Consultation Services of the North-West University.
Results: Fifty six percent of participants were classified as compliant. Differences between compliant and non-compliant participants were primarily noted with regard to Mindful Awareness, Monitoring and Decision making. No differences were noted between any of the groups regarding Learning from mistakes, Perseverance, or Self-evaluation. Compliant and non-compliant male and younger participants did not differ regarding self-regulation. Surprisingly, non-compliant female participants scored higher on Decision Making than compliant female participants.
Conclusions: The study emphasizes the fact that diabetes is perceived as a significant challenge to the current goals of the patient. Subsequently, this study confirms, to a large extent, the importance of self-regulation in compliance to type I and type II diabetes medication.

ABSTRAK

Selfregulering en inskiklikheid ten opsigte van tipe I en tipe II diabetes medikasie

Sleutelwoorde: Selfregulering, pasiënt-inskiklikheid, nie-inskiklikheid, diabetes mellitus, medikasie, voorskrifhervullings.

Doel: Om die verband tussen selfregulering en pasiënt-inskiklikheid ten opsigte van tipe I en tipe II diabetes medikasie te ondersoek.
Metode: Die deelnemers het bestaan uit ‘n beskikbaarheid steekproef van 50 (31 vroulik en 19 manlik) tipe I en tipe II diabetes pasiënte tussen die ouderdomme van 20 en 87 jaar. Selfregulering is gemeet met die Shortened Self-Regulation Questionnaire (SSRQ) en inskiklikheid met die Clicks Medication Therapy Management Questionnaire (MTM-Q) en voorskrifhervullings van medikasie. Datavaslegging en -analise is gedoen in samewerking met die Statistiese Konsultasie dienste van die Noord-Wes Universiteit.
Resultate: Ses en vyftig persent van die deelnemers is geklassifiseer as inskiklik. Verskille tussen inskiklike en nie-inskiklike deelnemers het veral geblyk met betrekking tot Indagtige Bewustheid, Monitering en Besluitneming. Geen verskille is opgemerk tussen enige van die groepe met betrekking tot Leer uit foute, Deursettingsvermoë of Selfevaluasie nie. Inskiklike en nie-inskiklike manlike en jonger deelnemers het nie verskille getoon met enige van die selfregulerings faktore nie. Verrassend genoeg het nie-inskiklike vroulike deelnemers hoër tellings behaal met Besluitneming as inskiklike vroulike deelnemers.
Gevolgtrekking: Die studie benadruk die feit dat diabetes beskou word as ‘n uitdaging aan die huidige doelstellings van die pasiënt. Gevolglik bewys die studie tot ‘n groot mate die belangrikheid van selfregulering vir inskiklikheid ten opsigte van tipe I en tipe II diabetes medikasie.

INTRODUCTION

Diabetes mellitus is a disorder of carbohydrate metabolism in which sugars in the body are not broken down due to the lack of the pancreatic hormone insulin. This leads to the accumulation of sugar, which appears first in the blood and then in the urine. Known symptoms are thirst, loss of weight and the excessive production of urine (Bateman, Hillmore, Jackson, Lusznat, McAdam & Regan, 2005; Beers, Porter, Jones, Kaplan & Berkwits, 2006; Martin, 2003). Diabetes that start in childhood is known as type I (insulin-dependent) diabetes where patients have little or no ability to produce insulin, and are entirely dependent on insulin injections for survival. Type I diabetes is usually more severe than type II (non-insulin dependent), which usually develops after the age of 40 (Martin, 2003). In type II diabetes, the pancreas retains some of its ability to produce insulin, but this is inadequate for the body's needs; alternatively the body becomes resistant to the effects of insulin. In contrast to type I, type II diabetes is treated with oral hypoglycaemic drugs (Bateman, et al., 2005; Beers, et al., 2006; Martin, 2003).

Diabetes is a complex disease that requires constant compliance to diet, lifestyle, glucose level monitoring and medication (Bezie, Molina, Hernandez, Batista, Niang & Huet, 2006; Cramer, 2004; Bennett Johnson, 1992; Sarkar, Fisher & Schillinger, 2006). Research by Cramer (2004), DiMatteo(2004), Grant,Devita, Singer and Meigs(2003), Helmeand Harrington (2004), Hernandez-Ronquill, Tellez-Zenteno, Garduno-Espinosa and Gonzalez-Acevez (2003), Mabuza and Adewale (2010), Pladevall et al., (2004), and Schectman, Nadkarni, and Voss (2002) found that the average compliance in patients with diabetes is between 60 and 75%, which is generally lower than among other conditions. Non-compliance to medication can be associated with the development of complications, avoidable hospitalization, disease progression, premature disability and death (Pladevall et al., 2004). Non-compliance is also very costly and therefore compliance to medication regimens is very important (Ciechanowski, Katon, Russo & Walker, 2001; Pladevall et al., 2004; Lin, et al., 2004). A definition of compliance will contribute to an understanding of its importance in medication regimens.

Compliance can be defined as the act of complying with a wish, demand or request. In medical terms it is defined as the willingness to follow the prescribed course of

treatment. In contrast, non-compliance represents the extent to which patient's behaviour does not follow the medical recommendations (Alexa, et al., 2006; Bennett Johnson, 1992; Cramer, 2004; Grant, et al., 2003; Kaplan, Sallis & Patterson, 1993). Compliance is a complex behavioural process influenced by several factors. These factors can be divided into three main categories: patient-related, environment-related and patient-provider-interaction-related (Kaplan, et al., 1993; Glasgow, et al., 1999).

Patient-centred factors involve the theory that patients intentionally resist medical advice in order to reject authority, because they misunderstand information given, or to control the provider (Alexa, et al., 2006; Helme & Harrington, 2003; Kaplan, et al., 1993). Environmental-related factors involve the theory that social ecology should be considered, as a variety of environmental factors may influence patient compliance. These environmental factors include: cultural variables, family or situational variables, and environmental cues. For example, a diabetic patient is most likely to miss taking their medication when there is a change in their routine, or if they have difficulty opening the container containing their medication. According to these theories compliance to medication can be improved by changing the patient's environment, for example, using reminders or placing medication in easily accessible containers (Kaplan, et al., 1993).

Patient-provider-interaction-related factors involve defects in the patient-provider relationship. It is caused by deficiencies in information exchange between the patient and the medical provider. According to this theory compliance can be increased by improving the interactions between the patient and the provider. Providers must obtain more information about a medical condition and their patients, in order to provide better information and guidance to their patients (Kaplan, et al., 1993). A study by Hernandez-Ronquill et al., (2003) on non-compliance and diabetes found that environmental reasons (being at work and unable to take medication), somatic reasons (blindness, physical restrictions) and economic reasons (medication too expensive) aside, 87% of non-compliance is related to motivational reasons (adverse side-effects of medication, see no improvement). This, together with the afore-mentioned studies, highlights the importance of behavioural factors in diabetes compliance.

A promising, yet under-explored behavioural approach to compliance is self-regulation. Hagger (2010) states that failure to adhere to treatment regimens presents a serious problem, as this is likely to compromise the effectiveness of the treatment. In this regard, the construct of self-regulation has been identified as extremely important and has been incorporated in to various theories and models of health and also as part of interventions aimed at promoting the 'self-regulatory skills' of patients. Self-regulation refers to the process of goal setting and striving (De Ridder & De Wit, 2006; Maes & Karoly, 2005; Reid, 2012), and efforts of altering, overriding and substituting unwanted responses that may interfere with goal attainment (Luszczynska, Diehl, Gutiérrez-Doña, Kuusinen & Schwarzer, 2004). People are seen as active problem-solvers, motivated by goals. They are constantly gathering goal orientated information and integrating it with their prior knowledge to form a subjective assessment of their status in obtaining their goal (Benyamini, 2009; De Ridder & De Wit, 2006; Mackenzie, Mezo & Franz, 2012). In medical contexts, illness is perceived as a significant challenge to current goals; also, managing one's illness becomes a goal in itself.

The process of self-regulating illness includes three stages that occur at emotional and cognitive levels. During the first stage the patient attempts to understand his or her illness. They compare it to previous illnesses to identify the threat, causes of illness, timeline, consequences of illness and controllability or curability of the illness (Benyamini, 2009). The second stage involves developing strategies to cope with the illness. These strategies are aimed at coping with the illness as it is perceived by the patient and address its emotional representation (Benyamini, 2009; Byrne, Walsh & Murphy, 2005). The patient develops a set of goals to obtain and strive for. The third stage involves the patients' appraisal of the outcomes of their coping efforts. The results of the appraisal determine future actions. If the outcomes are as expected, it serves to confirm that the correct coping strategies were used. If the outcomes are undesirable, this can lead to the patient changing their coping strategies to insure a better outcome (Benyamini, 2009). According to these theories compliance to medication can be improved by changing the behaviour of the patient (Glasgow, et al., 1999; Kaplan, et al., 1993; Kuijer, de Ridder, Colland, Schreurs & Spangers, 2007).

A focus on self-regulation thus presents the opportunity to change the passive relationship of the individual with the health care system toward a more independent, self-determining position (compare Maes & Karoly, 2005). This also reflects the change in terminology in the literature (Bandura, 1986, as cited by Maes & Karoly, 2005, p.268) an “evolution from compliance, that reflects obedience to medical advice, to adherence, which reflects adoption of medical advice, and finally to self-regulation, which reflects the capacity to create proximal guides and self-motivators for courses of action that lead to distal outcomes”.

Although a large number of studies have been done on compliance in diabetes, there is a lack of research findings from a self-regulation perspective. In South-Africa, previous research on compliance and self-regulation is limited to hypertension (Botha & Du Plessis, 2009; Botha, Du Plessis, Van Rooyen & Wissing, 2002). This study would therefore like to provide an understanding of compliance to type I and type II diabetes medication from a self-regulation perspective, in order to create a basis for further research and possible interventions in a South African context. The findings may be used by pharmacists, doctors, pharmaceutical companies, psychologists and patients to increase compliance to medication use. The aim of this study is therefore to investigate the relationship between self-regulation and patient compliance to type I and type II diabetes medication. Specific aims are (a) to determine whether there is a significant difference in the mean self-regulation scores for participants high and low in compliance and (b) to determine whether there are significant differences in the mean self-regulation scores between compliant and non-compliant participants within different gender and age groups.

METHOD

Participants

The participants consisted of an availability sample of 50 (31 female and 19 male) type I (n=14) and type II (n=36) diabetes patients collecting their medication at the Clicks Pharmacy in Potchefstroom, as well as the Trans 50 retirement villages in Pretoria, Bloemfontein and Kimberley. The villages are retirement homes where patients can live on their own, in communal or in frail care facilities. Participants were

aged between 20 and 87years, and consisted of 42 Afrikaans speaking, 5 English speaking, 2 Tswana speaking and 1 Zulu speaking participant.

Informed consent was obtained from the responsible pharmacist at the Clicks Pharmacy, managers at Trans 50 retirement villages and all the participants. Participants have been clearly informed that (a) the study might not benefit them directly, but that it will provide valuable information that can be used to develop a technique to ensure the correct use of chronic medication; (b) their participation is voluntary and that the data will be treated with confidentiality; (c) they could withdraw at any stage of the research; and (d) they will have access to results through attending a feedback session if they choose to do so.

Measures

As diabetes patients often overestimate their compliance, (Kuijer, et al., 2007) it was decided to measure compliance by investigating the participants' repeat scripts. Diabetes medication is usually prescribed by a doctor for a period of six months. This is called a repeat script, which the patient collects at the pharmacy on a monthly basis for consecutive months. The extent to which patients collect their medication on a monthly basis was used to ascertain compliance levels (see data analysis).

In addition to the script repeats, the Clicks Medication Therapy Management Questionnaire (MTM-Q), developed in 2009 by pharmacists at Clicks to measure patients' self-report of compliance, as well as information on exactly how the medicine was used and what stumbling blocks, if any, were present. The MTM-Q consists of 26 quantitative YES/NO items and 7 qualitative, exploratory questions. No previous research was done to determine the psychometric properties of the MTM-Q. However, the scale does have face validity and its internal consistency will be measured in this study.

Self-regulation was measured with the Shortened Self-Regulation Questionnaire (SSRQ) (Carey, Neal, & Collins, 2004) which consists of 31 items with seven subtests. The SSRQ is designed to determine a person's average ability to regulate his or her behaviour to achieve a desired goal. The study used the factor structure proposed by Potgieter and Botha (2009), based on a factor analysis of the SSRQ in the South-African context. The seven factors with examples are (i) *Monitoring*:

"When I am trying to change something, I pay attention to how I am doing" (ii) *Decision making*: "When it comes to deciding about a change, I feel overwhelmed by the choices" (iii) *Learning from mistakes*: "I usually only have to make a mistake once in order to learn from it" (iv) *Perseverance*: "I have trouble following through with things once I've made up my mind to do something" (v) *Self-evaluation*: "I set personal standards, and try to live up to them" (vi) *Creativity*: "As soon as I see a problem or challenge, I start looking for possible solutions" and (vii) *Mindful awareness*: "I don't notice the effects of my actions until it's too late" (Potgieter & Botha, 2009). Creativity, however, obtained a low Cronbach alpha coefficient of 0.19 in this study, and was subsequently left out from the rest of the study. The other factors obtained acceptable Cronbach alpha coefficients of between 0.56 and 0.73.

Data analysis

Data capturing and analysis was done in consultation with the Statistical Consultation Services of the North-West University using SAS (SAS Institute Inc., 2005). A patient was classified as compliant or non-compliant based on the number of repeats filled, as well as their response to question 4 of the MTM-Q, "Do you use you medication as prescribed?"Criteria were strictly applied – participants were regarded as compliant if and only if they have filled all their repeat scripts and answered YES to question 4 of the MTM-Q. In contrast, participants were regarded as non-compliant when one or more repeat script in six months was missed, and when either a YES or NO was indicated in response to question 4 of the MTM-Q. Patients who have filled all their repeat scripts, but who answered NO to question 4 of the MTM-Q were also regarded as non-compliant. The reason for having followed these strict criteria is: if a patient skips a month's medication it can have detrimental effects on his or her health, it may lead to further complications, early disability and even death.

The compliant (n=28) and non-compliant (n=22) participants were then compared based on gender and age groups, thus compliant versus non-compliant males; compliant versus non-compliant females, compliant versus non-compliant younger (younger than 65 years of age) participants, and finally compliant versus non-compliant older (65 and older) participants. The small number of participants in compliant or non-compliant other possible groups, for example type of diabetes, was

too small to compare statistically. Descriptive statistics like means and standard deviations were used to describe the socio-demographic variables of the study population. Cronbach alpha reliability coefficients were computed for each measuring instrument's subtest, while confirmatory factor analyses were done to confirm construct validity of subtests. To determine whether a factor analysis may be appropriate, Kaiser's measure of sample adequacy (MSA), which gives an indication of the inter correlations among variables, were computed (Tabachnick & Fidell, 2001) for each confirmatory factor. Guidelines according to Hair, Andersen, Tatham and Black (1998) were used to assure that the MSAs were appropriate.

Since no random sampling was done, interpretation of comparisons between group means was done according to Cohen's effect sizes, d (Cohen, 1988). Effect sizes indicate practical significance, or the extent to which a difference is large enough to have an effect in practice (Steyn, 2009). The following guidelines were used for d-values regarding differences between means (Cohen, 1988):

medium effect (noticeable with the naked eye): $d = 0.5$;

large effect (practically significant): $d \geq 0.8$.

RESULTS

Table 1 shows the descriptive statistics and differences in self-regulation between the total group of compliant (n=28) and non-compliant (n=22) participants. From the table it is clear that the compliant group, in comparison to the non-compliant group, obtained a higher score on Mindful awareness (medium effect).

Table 1 - Descriptive statistics and effect sizes on the subtests of the SSRQ for differences between compliant and non-compliant participants (n=50)

Sub-test	Comp Cat	n	mean	Std	p-value (when random sampling is assumed)	d-value
Monitoring	1	28	14.92	2.93	0.20	0.36
	2	22	13.77	3.16		
Decision making	1	28	16.93	3.71	0.51	0.18
	2	22	17.68	4.19		
Learning from mistakes	1	28	15.71	2.72	0.48	0.19
	2	22	15.09	3.35		
Perseverance	1	28	18.43	3.45	0.95	0.02
	2	22	18.50	4.25		
Self-evaluation	1	28	11.64	2.21	0.95	0.02
	2	22	11.68	2.08		
Mindful awareness	1	28	15.46	2.62	0.07	0.51 $^{\Delta}$
	2	22	14.03	2.83		

Note- Comp Cat = Compliance Category; 1 = Compliant; 2 = Non-compliant; Std= standard deviation

Creativity was left out due to an unacceptably low Cronbach alpha

$^{\Delta}$ Medium effect in practice

Table 2 shows the descriptive statistics and differences in self-regulation between compliant (n=9) and non-compliant (n=10) male participants. It is clear that there were no practical differences between compliant and non-compliant males on any of the subtests of the SSRQ.

Table 2 - Descriptive statistics and effect sizes on the subtests of the SSRQ for differences between compliant and non-compliant males (n=19)

Subtest	Comp Cat	n	mean	Std	p-value (when random sampling is assumed)	d-value
Monitoring	1	9	15.07	3.36	0.69	0.16
	2	10	15.60	1.96		
Decision making	1	9	18.89	2.93	0.48	0.27
	2	10	17.50	5.15		
Learning from mistakes	1	9	14.78	3.38	0.59	0.24
	2	10	15.60	3.03		
Perseverance	1	9	19.22	3.46	0.79	0.10
	2	10	18.70	4.99		
Self-evaluation	1	9	11.33	2.83	0.56	0.24
	2	10	12.00	1.83		
Mindful awareness	1	9	15.44	3.00	0.46	0.34
	2	10	14.40	3.06		

Note- Comp Cat = Compliance Category; 1 = Compliant; 2 = Non-compliant; Std= standard deviation

Creativity was left out due to an unacceptably low Cronbach alpha

Table 3 shows the descriptive statistics and differences in self-regulation between compliant (n=19) and non-compliant (n=12) female participants. The table shows that compliant females obtained higher scores on Monitoring (large effect and practically significant) and Mindful Awareness (medium effect). In contrast, non-compliant females obtained a higher score on Decision Making (medium effect).

Table 3 - Descriptive statistics and effect sizes on the subtests of the SSRQ for differences between compliant and non-compliant females (n=31)

Subtest	Comp Cat	n	mean	Std	p-value (when random sampling is assumed)	d-value
Monitoring	1	19	14.84	2.79	0.03*	0.80 $^{\Delta\Delta}$
	2	12	12.25	3.22		
Decision making	1	19	16.00	3.74	0.17	0.49 $^{\Delta}$
	2	12	17.83	3.43		
Learning from mistakes	1	19	16.16	2.32	0.23	0.41
	2	12	14.67	3.68		
Perseverance	1	19	18.05	3.47	0.84	0.07
	2	12	18.33	3.75		
Self-evaluation	1	19	11.79	1.93	0.65	0.16
	2	12	11.42	2.31		
Mindful awareness	1	19	15.47	2.51	0.08	0.64 $^{\Delta}$
	2	12	13.72	2.72		

Note- Comp Cat = Compliance Category; 1 = Compliant; 2 = Non-compliant; Std= standard deviation

Creativity was left out due to an unacceptably low Cronbach alpha

* Statistically significant at 0.05 level according to t-test results for independent groups

$^{\Delta}$ Medium effect in practice

$^{\Delta\Delta}$Large effect in practice

Table 4 shows the descriptive statistics and differences in self-regulation between compliant and non-compliant younger participants (younger than 65). It is clear that there were no practical differences between the two groups on any of the subtests of the SSRQ.

Table 4 - Descriptive statistics and effect sizes on the subtests of the SSRQ for differences between compliant and non-compliant younger participants (n=30)

Subtest	Comp Cat	n	mean	Std	p-value (when random sampling is assumed)	d-value
Monitoring	1	15	15.07	2.91	0.50	0.23
	2	15	14.27	3.43		
Decision making	1	15	17.07	3.73	0.32	0.35
	2	15	18.53	4.21		
Learning from mistakes	1	15	15.33	3.17	0.74	0.12
	2	15	14.93	3.26		
Perseverance	1	15	18.73	3.39	0.89	0.05
	2	15	18.93	4.43		
Self-evaluation	1	15	11.47	2.29	0.87	0.06
	2	15	11.60	1.96		
Mindful awareness	1	15	15.80	2.83	0.34	0.34
	2	15	14.84	2.56		

Note- Comp Cat = Compliance Category; 1 = Compliant; 2 = Non-compliant; Std= standard deviation

Creativity was left out due to an unacceptably low Cronbach alpha

Table 5 shows the descriptive statistics and differences in self-regulation between compliant and non-compliant older participants (65 and older). The table shows that compliant older participants obtained higher scores on Monitoring (medium effect) and Mindful Awareness (large effect and practically significant).

Table 5

Descriptive statistics and effect sizes on the subtests of the SSRQ for differences between compliant and non-compliant older participants (n=20)

Subtest	Comp Cat	n	mean	Std	p-value (when random sampling is assumed)	d-value
Monitoring	1	13	14.74	3.05	0.12	0.67 $^{\Delta}$
	2	7	12.71	2.36		
Decision making	1	13	16.77	3.83	0.62	0.24
	2	7	15.86	3.80		
Learning from mistakes	1	13	16.15	2.12	0.65	0.19
	2	7	15.43	3.78		
Perseverance	1	13	18.08	3.62	0.79	0.13
	2	7	17.57	3.99		
Self-evaluation	1	13	11.85	2.19	0.99	0.00
	2	7	11.86	2.48		
Mindful awareness	1	13	15.08	2.40	0.05*	1.01 $^{\Delta\Delta}$
	2	7	12.29	2.75		

Note- Comp Cat = Compliance Category; 1 = Compliant; 2 = Non-compliant; Std= standard deviation

Creativity was left out due to an unacceptably low Cronbach alpha

* Statistically significant at 0.05 level according to t-test results for independent groups

$^{\Delta}$ Medium effect in practice

$^{\Delta\Delta}$Large effect in practice

DISCUSSION

Firstly, a total number of 28 (56%) participants in this study were classified as compliant. Even though this is lower than the compliance figures for diabetes, which ranges between 60 and 75% as reported by Cramer (2004), DiMatteo (2004), Grant, et al. (2003), Helme & Harrington (2004), Hernandez-Ronquill, et al. (2003), Mabuza & Adewale (2010), Pladevall et al. (2004), and Schectman, et al. (2002), the sample in the current study is too small to make any definitive conclusions regarding this phenomenon. The strict criteria applied in this study could, however, have been a factor. Differences between compliant and non-compliant participants were primarily noted with regard to Mindful Awareness, Monitoring and Decision making. No differences were noted between any of the groups regarding Learning from mistakes, Perseverance, or Self-evaluation.

Compliant participants in the total, female and older groups scored higher on Mindful awareness than non-compliant participants. For older participants, this difference was practically significant. Monitoring also played an important role – compliant participants in the female and older group obtained higher scores, with the difference in the female group practically significant. Surprisingly, non-compliant female participants scored higher on decision making than compliant female participants. Compliant and non-compliant male and younger participants, however, did not differ on any of the self-regulation factors.

The role Mindful awareness played in differentiating between compliant and non-compliant participants suggests that mindfulness, as “receptive attention to and awareness of present events and experience” (Brown et al. 2007, p.12) may be a critical factor in diabetes compliance. The possible reason for this includes the possibility that accurately following a diabetes treatment regimen challenges the individual to be aware, not only of being diagnosed with diabetes, but also the risk of non-compliance in a more flexible, more objectively informed psychological way, and without discriminative, categorical, and habitual thoughts (compare Brown et al., 2007) that may contribute to denial or anxiety. The two-component model of mindfulness (Bishop et al. 2004) indicates that mindfulness firstly allows for increased recognition of mental events in the present moment, and secondly for

adopting an orientation toward one's experiences in a curios, open, and accommodating way.

Skinner and Edge (2002) indicate that accommodation, as a specific self-regulation strategy, reflects a pattern of willing submission or committed compliance and has been shown to be a critical part of adaptation to uncontrollable or unavoidable events (like being diagnosed with diabetes). Accommodative processes allow people to act according to the maxim: "If you can get out of it, get into it" (Skinner & Edge, 2002, p.318). These are processes that allow people to move beyond self-pity, bitterness, and recrimination to an orientation of acceptance of current constraints. These characteristics of mindfulness imply that the role of cognitive factors in compliance, specifically those cognitions related to flexible and open awareness, should not be underestimated.

Lavender, Jardin and Anderson's (2009) finding that highly mindful individuals experience less distress in response to unwanted thoughts and emotions and are therefore less likely to rely on maladaptive coping strategies, further puts the results of the current study in context. Living with, and compliance to any chronic illness treatment regimen, and diabetes in particular, may be seen an obstacle to achieving important life goals. The risk for chronic distress and non-compliance due to maladaptive coping strategies like denial is therefore a real concern in diabetic patients. In contrast, it appears as if mindful individuals may be better equipped to face the challenges diabetic compliance provide, to flexibly adjust their coping strategies accordingly, and subsequently to be more compliant.

In addition to Mindful awareness, Monitoring also differentiated between compliant and non-compliant subgroups. Although these concepts are related in that both comprise attentional processes, Monitoring is specifically aimed at gathering goal-orientated information and comparing it with current behaviour to form a subjective assessment of progress in obtaining that goal, and introducing appropriate adjustments to maintain goal achievement (Bandura, 2001, Benyamini, 2009; De Ridder & De Wit, 2006). Peterson and Seligman (2004) remind us that attention is crucial to the success of self-regulation, and indeed often constitutes the first step toward either success or failure at self-regulation. Reduced self-monitoring, they indicate, is often a precipitating factor in self-regulation failure because it is quite

easy to lose track of one's status or quit regulating oneself when one is not able to evaluate the distance between current behaviour and the goal one wants to achieve.

It is therefore not surprising, according to Mackenzie et al. (2011), that self-monitoring is an integral part of treatment regimens which can contribute greatly to treatment gains. The current study has provided further support for this view with regard to diabetes patients in particular.

One surprising finding was that non-compliant female participants scored higher on decision making than compliant female participants. Decision making can be linked to problem solving and control. According to Miller and Byrnes (2001), the self-regulated decision maker sets adaptive goals and takes appropriate measures to achieve such goals – this process involves generating, evaluating, selecting, and learning from goal-directed choices while simultaneously managing the challenges that may interfere with the attainment of adaptive goals. Individuals cannot effectively adapt to their environment until they establish a sense of control over their psychological processes and behaviour (Miller & Byrnes, 2001). This sense of control is precipitated by changes in one's understanding of effective and ineffective forms of decision making. So how should this finding be interpreted?

Research by Cramer (2004) reports that 8% of diabetic women admitted to intentionally omitting medication doses due to weight gain. In this instance the female is faced with a problem, if she takes her medication she gains weight and if she does not take the medication she is faced with becoming ill. In Cramer's study some females took an active decision to rather be non-compliant than gain weight. Research by Piette, Heisler and Wagner (2004) found similar results pertaining to decision making and non-compliance. They found that if the patient perceives that the medication is too expensive and they cannot afford it, they take the decision not to take their medication, thus non-complying. Therefore, non-compliant women in this study may be stronger decision makers than compliant women who actively decide or choose to use a specific, but inappropriate coping strategy. This finding should however, be investigated and clarified in further research.

Another interesting finding was that self-regulation did not differ between compliant and non-compliant male or younger participants. Research by Fitzgerald, Anderson

and Davis (1995) and Benyamini (2009) found that there is a difference between male and female attitudes and compliance to diabetes medication. This probably calls for a gendered view of self-regulation, in support of Cloete, Botha and Breytenbach (2012), who found gender differences regarding self-regulation and risk for psychopathology. The fact that weight gain played a role in level of compliance in female participants in this study is already a clear indication of how the gender groups may have different compliance and self-regulatory strategies in response to biological factors and social role expectations. According to Benyamini (2009) females more often comply with treatment due to social pressures. They are also more sensitive to stressors, which affect their psychological well-being and general perceptions of health. In addition, they are better than males at recruiting social support and benefiting from their social environment. This creates the expectation that females are less dependent than males on self-reliance, and by implication, self-regulation to be compliant, as social support may provide them with motivation and a way of monitoring and adjusting their compliance to treatment. In this sense, it is surprising that for males, for whom social support is less readily available; self-regulation did not differ between compliance and non-compliance. Other factors may be at play here, and should be explored in future research.

The same is true for age - a number of researchers have found age-related differences in compliance to diabetes treatment regimens. Research by Cramer (2004) and Currie et al. (2013) for example, found higher levels of non-compliance in younger diabetic patients, while Di Battista, Hart, Greco and Gloizer (2009) indicate that younger patients may be less compliant with medication for reasons such as fear of hypoglycaemia, weight gain and a lack of understanding of the long term complications. According to Bennett Johnson (1992) each stage in human development is associated with different cognitive and social capabilities, biological changes, personal goals and social demands. Children with diabetes show significant skill deficits when injecting insulin or testing their blood glucose levels, as they have not yet developed the necessary cognitive and motor skills to perform these tasks. Adolescents are more knowledgeable and skilful than younger children, but are influenced by their striving for independence, reduced parental supervision and peer influences, causing decreased compliance to treatment. Older patients were found to be more compliant with medication administration and glucose testing,

whereas younger adults were more compliant with exercise. However, the reason that self-regulation did not differ between compliant and non-compliant younger persons (20-65 years) in this study, is difficult to explain. One reason might be that they have more access to social support and other external reminders like health-related media influences, which deem self-regulation less important. In contrast, persons older than 65 years in this study may have less access to social support, and therefore need to rely more on self-regulatory skills to be compliant. This age-related difference in the relation between compliance and self-regulation should also be explored in further research.

CONCLUSION

The aim of this study was to investigate the relationship between self-regulation and patient compliance to type I and type II diabetes medication. Specific aims were (a) to determine whether there is a significant difference in the mean self-regulation scores for participants high and low in compliance and (b) to determine whether there are significant differences in the mean self-regulation scores between compliant and non-compliant participants within gender and age groups. Fifty six percent of participants in this study were classified as compliant – a figure slightly lower than those reported by other researchers. Differences between compliant and non-compliant participants were primarily noted with regard to Mindful Awareness, Monitoring and Decision making. No differences were noted between any of the groups regarding Learning from mistakes, Perseverance, or Self-evaluation.

The study emphasizes the fact that diabetes is perceived as a significant challenge to the current goals of the patient. Subsequently, this study confirms to a large extent the importance of self-regulation in compliance to type I and type II diabetes medication, providing support for Glasgow, et al., (1999) and Hernandez-Ronquill et al., (2003) who emphasized the importance of behavioural factors in diabetes. Although the importance of mindfulness and self-monitoring were emphasized in this study, the reason for gender and age related differences in the relationship between compliance and self-regulation is not totally clear and needs to be explored in further research.

The major limitation of this study is related to the small sample size and the location of the sample. In a larger sample, differences in self-regulation between type I and type II diabetes patients could have been investigated. That is, the two types (groups) of diabetes patients could have been studied separately, in order to ascertain whether it was the mode of delivering medication; injecting insulin or taking pills; which played a role in compliance. A larger sample could also have generated more reliable results and the possible difference between younger and older males could have been investigated.

The findings support those efforts that follow a proactive coping approach to diabetes management, in which anticipation and planning are emphasized to improve self-care (compare Kuijer et al., 2007; Thoolen, De Ridder, Bensing, Gorter, & Rutten, 2009).

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