

Mechanisms of motivational interviewing in HIV medication adherence

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Abstract

Antiretroviral therapy (ART) is an effective treatment for Human Immunodeficiency Virus (HIV), slowing down the progression of the disease and reducing the risk of onward transmission of the virus. The effectiveness of ART requires life-long, strict adherence to the regimen which can be difficult to achieve and maintain. Motivational interviewing (MI) is a goal-focused, person-centred counselling approach to behaviour change which has been shown to improve ART adherence. There have been numerous process research studies which have focused on understanding how and why MI works, however few have been carried out within the context of ART adherence. This study aims to test the relational and technical pathways of the MI model along with exploring constructs outlined in Self-determination Theory, as expressed during an MI session targeting ART adherence with 62 adults living with HIV. Results did not find evidence for the relational pathway as MI spirit was not found to be associated with either change talk or ART adherence change. The technical pathway was partially upheld in that there was a relationship found between therapist use of MI-consistent methods and client change talk, however neither were associated with ART adherence change. There was some tentative evidence to suggest that naturally occurring autonomous motivation speech might have a stronger relationship to ART adherence than controlled motivation speech. The research findings are discussed in relation to previous MI process research studies. Clinical and research implications are outlined along with the strengths and limitations of the study.

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Chapter 1: Introduction

Overview

Human Immunodeficiency Virus (HIV) is a virus that attacks the body's immune system. HIV is treated with medications known as antiretroviral therapy (ART). ART cannot cure HIV but it can slow down the progression of the disease and reduce the risk of onward transmission of the virus. The effectiveness of the treatment requires strict adherence to what are often complex medication regimens. For some people adherence to ART can be difficult to achieve and maintain. One behaviour change intervention which has been employed to try to improve ART adherence is Motivational Interviewing (MI). This intervention has achieved successful outcomes across a variety of target behaviours including drug and alcohol misuse, smoking, diet and exercise (Burke, Arkowitz, & Menchola, 2003; Heckman, Egleston, & Hofmann, 2010). MI has also shown promise in improving medication adherence (Palacio et al., 2016) including ART adherence in people living with HIV (Dillard, Zuniga, & Holstad, 2017; Hill & Kavookjian, 2012).

A model of the mechanisms of change within MI sessions has been developed (Miller & Rose, 2009). This model proposes causal pathways through which behaviour change occurs linking therapist factors (training, interpersonal style, empathy displayed, MI techniques used), client speech during the session and behaviour change outcomes. This study explores the technical and relational components of this model within the context of targeting ART adherence in a sample of people living with HIV. It is a secondary analysis of data collected as part of randomised controlled trial (RCT) investigating MI and ART adherence (Goggin et al., 2013). This study

investigates if client change talk mediates the relationship between therapist use of MI-consistent (MICO) methods (technical component) and change in ART adherence. It also considers if there is a mediation effect of therapist MI spirit (relational component) on ART adherence through client change talk. Finally, self-determination theory (SDT; Deci & Ryan, 1985) is a theory of personality and motivation which proposes that motivation can be divided into autonomous and controlled motivation with autonomous motivation being more self-determined. The relationship between ART adherence and more fine-grained naturally occurring motivational speech than MI specifies (autonomous and controlled motivation) is explored within the context of MI sessions with HIV-positive clients. It investigates if there is a relationship between different types of expressed ART adherence motivation (autonomous and controlled) and ART adherence behaviour.

This chapter will set out an overall context for the study by providing general information about HIV including ART and medication adherence. Next the therapeutic intervention MI will be introduced by detailing its development and what the approach entails. Research into the effectiveness of MI and the mechanisms by which it is hypothesised to work will also be presented along with information about SDT and where it might fit within the framework of MI. Finally, current MI process research within the context of HIV is discussed, including its limitations, thus leading to the study hypotheses.

Human Immunodeficiency Virus

HIV is among the leading causes of death worldwide (Lozano et al., 2012). In 2015 there were an estimated 36.7 million people across the world living with HIV, and 1.1

million died of HIV-related causes (UNAIDS, 2016b). The most recent survey indicates that there are an estimated 1.2 million people living with HIV in the United States (Hall et al., 2015) with men who have sex with men (MSM) and African-Americans being disproportionately affected (Centers for Disease Control and Prevention, 2015). In 2015 in the UK there were an estimated 101,200 people living with HIV with MSM and Black African heterosexual women and men being most affected (Kirwan, Chau, Brown, Gill, & Delpech, 2016). HIV is a virus which targets CD4 lymphocyte cells in the body to act as a host for viral replication (McCune, 2001). These cells are essential for healthy immune function and over time their depletion leads to acquired immunodeficiency syndrome (AIDS), the end stage of HIV (Fauci, 1988). AIDS is typified by a CD4 count of <200 cells/mm³ (the CD4 count of a healthy person who is HIV negative ranges from 500 to 1,600 cells/mm³) and the development of life threatening diseases or infections such as tuberculosis, cancer or toxoplasmosis (Klimas, Koneru, & Fletcher, 2008).

The origins of HIV have been widely debated and has been the focus of research since AIDS was first recognised as a disease in 1981 (Greene, 2007). Current consensus is that HIV is related to the Simian Immunodeficiency Virus (SIV) which is naturally found in African monkeys and apes (Gao et al., 1999). This virus is thought to have passed to humans through hunting and eating infected primates, with the virus eventually adapting to and mutating in the human body to become HIV type 1 and type 2 (Sharp & Hahn, 2011). Research has shown that the first transmutation of SIV to HIV is likely to have happened around 1920 in Kinshasa, the capital of what is now the Democratic Republic of Congo (Faria et al., 2014). HIV is transmitted through contact with contaminated bodily fluid through open cuts or sores on the skin; through

mucous membranes in the vagina, rectum, penis or mouth; or through injection into the bloodstream. The most common modes of transmission include through unprotected sexual contact, sharing needles or syringes with infected drug users and from mother to infant during pregnancy, delivery or through breastfeeding (Shaw & Hunter, 2012). In 2015 there were an estimated 2.1 million new HIV infections worldwide with the largest concentration in Eastern and Southern Africa (UNAIDS, 2016b).

Without intervention, there are broadly four main stages of HIV infection (Fanales-Belasio, Raimondo, Suligoj, & Buttò, 2010; World Health Organization, 2005). The primary infection stage usually lasts for a few weeks and is often accompanied by relatively mild flu-like symptoms such as fever, headache, skin rash, oral ulcers, diarrhoea and sore throat lasting between seven and ten days (Schacker, Collier, Hughes, Shea, & Corey, 1996). As these symptoms are mostly non-specific primary HIV infection is not usually diagnosed at this stage (Weintrob et al., 2003). Through a process called seroconversion the immune system responds to HIV in the body by developing antibodies and cytotoxic lymphocytes to fight off the virus (Kahn & Walker, 1998). Once seroconversion has taken place the body enters the clinically asymptomatic phase which for some people can last 10 to 15 years (Buchbinder, Katz, Hessel, O'Malley, & Holmberg, 1994). During this asymptomatic stage the body is in a state of persistent inflammation and the immune system is chronically activated resulting in the slow loss of CD4 cells, the destruction of the immune system and the aging process appears to be accelerated (Appay & Sauce, 2008; Ford, Puro, & Sereti, 2009). The third stage is symptomatic HIV infection which is the point at which the immune system has begun to fail and the person develops opportunistic

infections and cancers such as pulmonary tuberculosis, oral candidiasis, pneumonia, and unexplained persistent diarrhoea or fever (World Health Organization, 2005). In the final stage of HIV the person has developed an opportunistic disease or cancer which is life-threatening such as HIV encephalopathy, Kaposi's sarcoma, lymphoma or invasive cervical cancer (World Health Organization, 2005) and can be given the diagnosis of AIDS.

Antiretroviral therapy

The development of the first diagnostic HIV antibody test in 1985 (Ward et al., 1986) paved the way for clinical trials for HIV, with azidothymidine (AZT) being one of the initial drugs tested (Furman et al., 1986). AZT (a reverse transcriptase inhibitor) was found to be associated with improved survival for an initial period of 24 weeks and was approved for use in patients with advanced HIV (Fischl et al., 1987). Other similar drugs were developed over the next decade but in retrospect these drugs were highly toxic, produced limited long-term clinical benefits and held a risk of drug resistance (Lundgren et al., 1994; Saag et al., 1993). HIV treatment was revolutionised in the mid-1990s with the recognition of the importance of the quantity of HIV virus present in the blood or viral load (Mellors et al., 1996), the benefits of combined drug therapies being realised (Hammer et al., 1996) and the development of protease inhibitors such as saquinavir which when combined with other drugs, were found to produce a decrease in viral load (Gulick et al., 1997). It is recognised that <50 copies/ml is needed to achieve undetectable levels of HIV virus in the blood (UNAIDS, 2016a). Combining ART drugs is sometimes referred to as combination antiretroviral therapy (cART) or highly active antiretroviral therapy (HAART). Since

then new drug families have been developed including fusion inhibitors, co-receptor inhibitors, and integrase inhibitors (De Clercq, 2009). Continued progress and development across all classes of HIV medications has expanded the number of potential drug combinations available and led to a reduction in adverse effects of the drugs (Fauci, 2003).

Thanks to the advances in antiretroviral therapy HIV has moved from being a terminal illness to a chronic disease particularly when diagnosed and treated early (Mitchell & Linsk, 2004). ART works by inhibiting viral replication and reducing viral load thereby preventing disease progression and reducing the risk of onward transmission (Crum et al., 2006). HIV medications serve to reduce mortality and improve quality of life for those living with HIV and since 2015 it is recommended that all people with a diagnosis of HIV take ART regardless of CD4 count or viral load (World Health Organization, 2016). At the time the RCT that this study derives its data from (Goggin et al., 2013) was conducted, ART was only recommended for people who were displaying clinical symptoms of HIV or had a CD4 count of ≤ 200 cells/mm³, and for those who were asymptomatic, ART was to be considered on an individual basis with CD4 count between 200 and 350 cells/mm³ (Hammer et al., 2006; Yeni et al., 2004).

In the United States, Marcus et al. (2016) found that in 1996 the average life expectancy for a person living with HIV was 39 years, representing a gap of 44 years between the life expectancy of those living without HIV and by 2011 it had increased to 73 years – just 12 years behind HIV-negative individuals. This increase in life expectancy has been attributed to the developments and improvements in ART

treatment (Marcus et al., 2016) and early diagnosis (Nakagawa et al., 2012).

Worldwide, there are an estimated 17 million people (46% of those living with HIV) prescribed ART which is a substantial increase from 7.5 million (23%) in 2010 (UNAIDS, 2016b). In an effort to end the HIV epidemic the joint United Nations Programme on HIV and AIDS (UNAIDS) and collaborators have set a global target (90-90-90 target) aiming to diagnose, provide ART and achieve viral suppression in 90% of all people living with HIV by 2020 (UNAIDS, 2014).

ART adherence

ART involves taking a combination of HIV drugs, often three or more from at least two different drug classes. This is known as a HIV regimen. The drugs come in different forms such as tablets, capsules and syrups (which are usually just for infants and young children) and are taken once or twice a day at a specific time and often with special instructions (e.g., on an empty stomach), for the rest of the person's life. For some regimens, the drugs are combined in a single tablet (known as a fixed-dose combination) to be taken once a day (e.g., atripla) while other regimens are more complex and can involve having to take up to six tablets, at specific times during the day, some with food and some on an empty stomach (Fogarty et al., 2002). The effectiveness of ART depends on strict adherence to the medication regimen (de Olalla et al., 2002). ART requires not only dose adherence (percentage of prescribed doses taken) but also schedule adherence (percentage of doses taken on time) (Nieuwkerk et al., 2001) as it is important to maintain a continuous coverage of ART within the blood to minimise the risk of developing drug resistance. The World Health Organization (2003) define adherence to long-term medication as the extent to which

medication-taking behaviour corresponds to the instructions and advice given by the healthcare provider. Within the context of ART, adherence involves taking all doses at the scheduled times, following any special instructions (e.g., with or without food) and ensuring no other drugs are taken that might interfere with the HIV medications.

Due to the toxicity of the drugs ART comes with both short and long-term adverse effects (Margolis, Heverling, Pham, & Stolbach, 2014). Common short-term adverse effects include bloating, nausea, abdominal pain, diarrhoea, fatigue, rash, toxicity of central nervous system (dizziness, nightmares and balance problems), anaemia, jaundice and pancreatitis (Carr & Cooper, 2000; Hawkins, 2010). One of the most common long-term adverse effects of ART is mitochondrial toxicity which manifests as myopathy (muscle disease), neuropathy (nerve damage), lipodystrophy (peripheral fat loss and central fat accumulation) and, hyperlactatemia and lactic acidosis (abnormal levels of lactate in the body) (Montessori, Press, Harris, Akagi, & Montaner, 2004). Other long-term adverse effects include cardiovascular events (increased risk of heart attack), hepatotoxicity (chemical-driven liver damage), renal adverse events (impaired kidney function), and distal sensory peripheral neuropathy (numbness or pain in the extremities) (Hawkins, 2010).

Correct adherence to ART can suppress HIV viral load to undetectable levels in the blood (Montaner et al., 1998) and this reduced viral load is associated with improved survival (Rodger et al., 2013), prevention of perinatal transmission of the virus in women (Centers for Disease Control and Prevention, 2006), improved clinical outcomes and reduction in sexual transmission of the virus (Rodger et al., 2016). ART adherence is also associated with reduced hospital admissions (Paterson, 2000) and

improved quality of life (Mannheimer et al., 2005). Even when HIV is undetectable in the blood it continues to replicate in the lymphatic tissue in the body in particular the gut and lymph nodes (Fletcher et al., 2014) and once ART is stopped the level of HIV in the blood quickly rebounds (Chun, Davey, Engel, Lane, & Fauci, 1999). It has been found that intermittent use of ART (stopping and starting treatment depending on CD4 counts) is associated with decreased quality of life (Burman et al., 2008), and an increased risk of death and opportunistic infections (Strategies for Management of Antiretroviral Therapy (SMART) Study Group, 2006). This means that it is essential that ART is taken consistently and for life to ensure the viral load is continually suppressed to undetectable levels (viral suppression) to reduce the risk of replication and adaptation of the virus in the body. Non-adherence can result in drug-resistant mutations of the virus being transmitted to uninfected people who are then newly infected with a drug-resistant strain of the virus and thus have less effective treatment options available to them (Wainberg & Friedland, 1998). Consequently, adherence to ART medication has public health implications and achieving viral suppression in those receiving ART is one of the goals set out by the UNAIDS – *Lancet* Commission in their plan to end the AIDS epidemic by 2030 (Piot et al., 2015).

Research has found that adherence rates of less than 95% are associated with the risk of drug-resistance which can lead to the evolution of mutant drug-resistant strains, progression of the disease, and an increased risk of transmission of the virus (Apisarnthanarak & Mundy, 2010; Bangsberg, 2006; Harrigan et al., 2005). There is some research to suggest that moderate adherence levels of an estimated 70 – 80% are adequate for viral load suppression when taking the newer HIV drugs which have longer half-lives and can therefore better accommodate occasional missed doses

(Kobin & Sheth, 2011; Nachega et al., 2007; Shuter, Sarlo, Kanmaz, Rode, & Zingman, 2007). However it has also been demonstrated that adherence levels of 70 – 80% are associated with the highest risk of developing drug resistance (Bangsberg, Moss, & Deeks, 2004; Sethi, Celentano, Gange, Moore, & Gallant, 2003). A recent meta-analysis found that viral load suppression was achieved with newer antiretroviral drugs and adherence rates of at least 80% but that ultimately increased adherence was associated with improved outcomes (Bezabhe, Chalmers, Bereznicki, & Peterson, 2016). Consequently, patients should be advised to aim for at least 95% adherence but that slightly lower levels of adherence (80 – 95%) should not deter clinicians from prescribing ART regimens. The majority of adherence studies focus on percentage of doses taken and as yet there are no guidelines regarding ART scheduling adherence. However, it has been shown that poor scheduling adherence is associated with less viral load suppression (Nieuwkerk et al., 2001). In conclusion, the current advice is that taking ART as prescribed 100% of the time should be the goal of ART adherence (Marcellin, Spire, Carrieri, & Roux, 2013).

Although ART has dramatically improved outcomes for people living with HIV, and the risks associated with non-adherence are substantial, adherence rates are often low. It is estimated that only 62% of ART users worldwide are achieving adherence rates of at least 90% (Ortego et al., 2011) and only 30% of ART users in the United States are achieving viral suppression despite the 90-90-90 targets (Bradley et al., 2014). Systematic reviews and meta-analyses on ART adherence rates have been carried out across different populations. An estimated 74% of pregnant ART users in low and middle income countries achieved adherence rates of over 80% (Nachega et al., 2012). At least 70% of adolescent ART users in Asia and Africa were optimally

adherent in comparison to 50 – 60% adherence rates observed in Europe and North America (Kim, Gerver, Fidler, & Ward, 2014). ART adherence rates were estimated to be 38% among female sex workers across the world (Mountain et al., 2014). An approximate 60% ART adherence rate has been observed in drug users (Malta, Magnanini, Strathdee, & Bastos, 2010) and an estimated 54.6% of incarcerated ART users achieved adherence of at least 95% (Uthman, Oladimeji, & Nduka, 2017).

Ickovics and Meade (2002) have developed a conceptual model of the determinants of ART adherence to guide research. Their model proposes that patient variables, treatment regimen, disease characteristics, patient-provider relationship and clinical setting are interrelated factors of ART adherence. Extensive research has been carried out to identify the factors of ART adherence through systematic reviews and meta-analyses. Some reviews have focused on studies which explore the associations between potential correlates or predictors and ART adherence (Ammassari et al., 2002; Atkinson & Petrozzino, 2009; Bock et al., 2016; Langebeek et al., 2014; Ortego et al., 2011), whilst others have reviewed studies using qualitative (interviews and focus-groups) and quantitative (self-report questionnaires and clinical interviews) methods to gather patient-reported information regarding barriers and facilitators of ART adherence (Mills et al., 2006; Shubber et al., 2016).

Patient variables include sociodemographic factors (such as age, sex, ethnicity, education, socioeconomic status, sexuality, and housing status) and psychosocial factors (such as mental health, substance use, social support, knowledge and beliefs) (Ickovics & Meade, 2002). Patient variables identified as adherence barriers in a systematic review of global ART adherence include; fear of disclosure, substance

misuse, forgetfulness, decreased quality of life and poor understanding of the benefits of ART (Mills et al., 2006). Facilitators of adherence were also identified and they include self-worth and understanding the need for strict ART adherence (Mills et al., 2006). A recent review investigating self-reported ART adherence barriers across the life-span found that the most common patient variables reported were; forgetfulness; being away from home; depression; drug or alcohol abuse (for adults and adolescents); and fear of disclosure of HIV status (Shubber et al., 2016). In a meta-analysis of correlates of ART adherence Langebeek et al (2014) found a strong effect for adherence self-efficacy (belief in one's ability to adhere to ART), and medium effect sizes for substance use, beliefs about needing ART, symptoms of depression, stigma about HIV and social support.

Adherence factors relating to *treatment regimen* include the type of tablets and number prescribed (pill burden), the complexity of the dosing schedule, any special instructions required, and the adverse effects experienced (Ickovics & Meade, 2002). Complicated regimens, the number of tablets prescribed and access to medications have been found to be self-reported barriers to ART adherence across high, middle and low income countries (Mills et al., 2006). Self-reported facilitators of ART adherence are having a simple regimen and experiencing positive effects of ART adherence (Mills et al., 2006). HIV-related symptoms, adverse side effects and complex regimens were found to be predictors of nonadherence (Ammassari et al., 2002). While Langebeek et al (2014) found small effects for pill burden, being prescribed a protease inhibitor-containing regimen, and daily dosing frequency being associated with increased ART adherence.

Disease characteristics include the stage and duration of the disease, the presence of opportunistic infections and HIV-related symptoms (Ickovics & Meade, 2002).

Adherence rates of at least 90% are associated with earlier stages of the disease (Ortego et al., 2011). High baseline viral load and CD4 count has been found to be associated with nonadherence (Atkinson & Petrozzino, 2009). Feeling sick is a stronger barrier to ART adherence than feeling well (Shubber et al., 2016). A systematic review and meta-analysis comparing baseline CD4 count and ART adherence has found that higher CD4 count was associated with lower chances of being ART adherent however the evidence is not consistent across studies and further research is needed before any definitive claims can be made (Bock et al., 2016).

Patient-provider relationship factors include patient satisfaction with care received, perception of the clinician's competence, how patient-centred the clinician is, level of positive affect expressed within the patient-provider relationship and adequacy of the referrals (Ickovics & Meade, 2002). Trust in and satisfaction with the HIV care provider were also found to be associated with ART adherence with medium effect sizes observed (Langebeek et al., 2014). Shared-decision making has been associated with increased odds of correct adherence (Atkinson & Petrozzino, 2009).

Characteristics of the clinical setting include pleasant clinic environment, availability of a specialist adherence program, access to transportation and convenience of clinic location (Ickovics & Meade, 2002). Meta analytic research has shown that greater distance to the health clinic and a lack of stock were both found to be significant barriers to ART adherence in low and middle-income countries (Shubber et al., 2016).

Measuring adherence

Medication adherence for long-term health conditions in high and middle-income countries around the world is estimated to be 50% with low-income countries seeing even lower rates of adherence (World Health Organization, 2003). Poor medication adherence is associated with increased healthcare costs and hospital admissions (Sokol, McGuigan, Verbrugge, & Epstein, 2005), poor clinical outcomes (Cramer, Benedict, Muszbek, Keskinaslan, & Khan, 2008) and even death (Simpson et al., 2006). Vrijens et al. (2012) have described the process of medication adherence or taking medication as prescribed, as occurring in three distinct phases: initiation, implementation and discontinuation. Initiation encapsulates the first time the person takes their prescribed medication, for example when a person takes ART for the first time. Implementation is the extent to which the person is following the prescribed instructions given by their healthcare provider such as how close the actual doses of ART taken is to the prescribed regimen. The final stage is discontinuation and this happens when the person stops taking the prescribed medication.

Adherence can be measured in a variety of ways incorporating subjective and objective measures (Brown & Bussell, 2011). Subjective measures of adherence include patient-report diaries, clinical interviews where the clinician asks the patient direct questions about their adherence, and clinician or carer/family report on the adherence behaviour of the patient. There are also numerous patient self-report questionnaires and scales to measure adherence with specific measures developed for different health conditions and medications (Nguyen, Caze, & Cottrell, 2014). Subjective measures are inexpensive and easy to administer but they have some

limitations. Healthcare professionals often overestimate the ART adherence levels of their patients (Bangsberg et al., 2001) while patients have been shown to underreport missed doses (Norell, 1981) possibly due to a bias in recall or social desirability.

Examples of objective adherence measures include pill counts, prescription refill data, drug concentration, biochemical measures, directly observed therapy and electronic medication devices (Osterberg & Blaschke, 2005). Pill counts involves counting the medications and assuming any surplus medication to the amount expected represents missed doses. Pill counts can be time consuming and can overestimate adherence as it does not account for the patient disposing of medication rather than taking it (Liu et al., 2001). Pharmacy refill data presumes that prescription filling corresponds to medication taking and is a simple yet effective way of collecting adherence data (Osterberg & Blaschke, 2005). Although superior to self-report (Sangeda et al., 2014), like pill count, pharmacy refill data does not guarantee that the medication was ingested by the patient and it is a less sensitive measure of adherence for medications such as ART where the time of dose taken is a key indicator of level of adherence achieved. It is often possible to test the presence of the level of the drug in the body, while biochemical methods involve adding a nontoxic marker to the medication and then tracking its levels in either blood or urine. Both methods are limited in measuring ART adherence as they cannot provide information on adherence patterns and are influenced by individual variations in metabolism, diet and other drugs taken (Lam & Fresco, 2015). Directly observed therapy (DOT) methods involves patients being observed taking their medications as prescribed. This method is expensive and carries the risk that patients may feign drug taking and hide the medication under their tongue (Farmer, 1999). The most common electronic device used is the Medication Event

Monitoring System (MEMS) cap. These are lids that are placed on medication bottles and they record the date and time that the bottle is opened. The benefit of this measurement tool is that it generates detailed adherence information which can help track patterns of non-adherence. It is limited by the fact that it is bulky and therefore less convenient and discrete for patients to use. It is also expensive and does not guarantee that the patient ingested the medication when they opened the bottle (Farmer, 1999).

Electronic methods are currently recognised as the gold standard in adherence measurement and have even been shown to improve adherence by helping the patient to identify patterns in their medication taking behaviour (Vrijens, Urquhart, & White, 2014). It has also been demonstrated that MEMS caps are mostly consistently associated with viral load in studies of ART adherence compared with other methods of measuring adherence (Farley, Hines, Musk, Ferrus, & Tepper, 2003; Müller, Bode, Myer, Roux, & von Steinbüchel, 2008).

Model of ART adherence

Psychological models have been developed to help understand the complexities involved in adhering correctly to prescribed medication. The Information-Motivation-Behavioural Skills (IMB) model (Fisher, Amico, Fisher, & Harman, 2008) has been developed as a framework for understanding the multifaceted process of ART adherence and is based on the Theory of Planned Behaviour (Ajzen, 1991). This model proposes that adherence information and motivation are associated with adherence-related behavioural skills which then predicts ART adherence (Fisher et al., 2008). Adherence in turn can lead to positive health outcomes which influence future

behaviour by strengthening motivation and reinforcing adherence skills. The client must possess accurate ART related information including the specifics of the ART regimen, any potential side-effects or drug interactions, and decision rules regarding medication adherence (Fisher et al., 2008). Adherence motivation encompasses personal attitudes towards ART adherence such as holding the belief that it is important to adhere to the medication regimen or having the attitude that non-adherence is the wrong thing to do, and perceived social support involves the person feeling supported by friends and family to adhere to the ART (Fisher et al., 2008). Finally, behavioural skills comprise the objective ability and perceived self-efficacy to adhere correctly to the medication regimen (Fisher et al., 2008). The model also proposes factors which moderate adherence including substance misuse, chaotic home environments, psychological distress and limited access to services. Several empirical studies have found support for the IMB model of ART adherence (Amico et al., 2009; Amico, Toro-Alfonso, & Fisher, 2005; Starace, Massa, Amico, & Fisher, 2006).

ART adherence interventions

The current global consolidated guidelines for the use of ART recommend the following adherence support interventions for people being prescribed ART: peer counsellors; reminder text messages; reminder devices; behaviour skills and medication adherence training; fixed-dose combinations and once-daily regimens; and cognitive-behavioural therapy (World Health Organization, 2016). The guidelines are informed by a recent systematic review and network meta-analysis (Kanters et al., 2016, 2017). Interventions were compared to standard care which involved the care provider giving instructions on how to take the medication and the importance of

adhering to the ART (Kanters et al., 2017). Adherence interventions were found to be especially successful when used in combination with one another. Peer counsellors involve any interventions where adherence is enhanced through involving other people (family, friends or professionals) such as directly observed therapy, patient support groups or involving family or friends in adherence counselling session (Kanters et al., 2016). Text messaging encompasses sending a patient reminder messages to take their ART medication while reminder devices include calendars, alarms, or pagers (Kanters et al., 2017). Behaviour skills and medication adherence training is any intervention where the patient learns practical skills for how to manage their medication and is educated on the specifics of ART adherence. Kanters et al. (2017) used cognitive behavioural therapy as an umbrella term to include several psychologically-based interventions such as cognitive-behavioural therapy (CBT), cognitive-behavioural stress management, counselling with a trained professional and motivational interviewing. CBT focuses on changing unhelpful patterns of thinking and behaviour which may be maintaining current difficulties. Cognitive behavioural stress management combines aspects of CBT with stress management techniques such as relaxation and breathing techniques. Within the adherence literature the term counselling refers to both pharmacist or nurse led education and support sessions (adherence counselling) and supportive counselling based on psychological principles. Motivational interviewing (MI) is a goal focused person-centred counselling approach to behaviour change and will be described in more detail in the subsequent section.

Motivational Interviewing

MI is a both a philosophical approach to counselling and a collection of therapeutic techniques. It developed organically through William Miller's work with people with substance misuse problems. Miller (1983) recognised that ambivalence is a universal human experience and he viewed it as a normal process on the journey towards change. When faced with behaviour change we can see both reasons to change and reasons to maintain the status quo. MI is a way of relating to people with the aim of helping them to work through ambivalence and commit to behaviour change (Miller, 1983). Miller went on to collaborate with Stephen Rollnick to further clarify and extend the therapeutic approach. Together they define MI as a goal-focused, person-centred counselling style that aims to elicit and strengthen the client's own motivation for behaviour change (Miller & Rollnick, 2012).

MI is heavily influenced by the work of humanistic psychologist, Carl Rogers, and adopts a supportive and empathic approach towards the client. In contrast to person-centred therapy (Rogers, 1980) MI is transparent about its goal-oriented and directive nature. MI is also influenced by self-perception theory (Bem, 1972) which proposes that people become more committed to that which they hear themselves talk about or defend. Applying this theory to a therapeutic context, it suggests that the more a client talks about their reasons for changing a behaviour the more likely it is that behaviour change will occur. Hence a focus of MI is to elicit the client's own arguments for change or 'change talk' and reduce arguments for maintaining the status quo or 'sustain talk' (Miller & Rollnick, 2012).

Miller and Rollnick (2012) have divided the process of conducting MI into four main stages; engaging, focusing, evoking and planning. The first step is to engage the client

and create a strong therapeutic relationship. Once this has been achieved the therapist moves to focusing the client on change by developing and maintaining the direction of the conversation towards behaviour change. Next the therapist aims to elicit the client's own arguments for behaviour change. The final stage is planning the specific steps that the client will take towards behaviour change. Client resistance is possible at any stage of the process and is understood as an indicator to the therapist that they need to do something different. Within psychotherapy, resistance is understood as unconscious or conscious ways in which the client resists or obstructs therapeutic change in an attempt to maintain the status quo, which is usually a safer and more familiar position for the client to occupy (Blatt & Erlich, 1982). The aim within MI is to sidestep the resistance thorough using reflective statements to show the client their arguments have been heard or emphasising that it is the client's decision to change or not. Sidestepping resistance is advised rather than confronting it as direct confrontation usually just results in an escalation in resistance (Moyers & Rollnick, 2002).

The therapist sets the scene for eliciting change talk by embodying the 'spirit of MI' which involves adopting an accepting, compassionate and collaborative communication style while encouraging client autonomy and evoking motivation to change (Miller & Rollnick, 2012). The therapist does not take an expert position and instead the client is viewed as a collaborator. From an MI perspective, change is only possible once a person has been fully accepted for who they are. The therapist demonstrates this acceptance through unconditional positive regard for the client; accurate empathising or attempting to view the world from the client's perspective; believing that the client is free to make their own decisions; and focusing on the

client's strengths rather than their weaknesses. Rather than instilling change the MI approach suggests that all people possess the necessary resources to bring about change and they just need support in unlocking this potential (Miller & Rollnick, 2012). The MI therapist also employs several techniques with the aim to elicit change talk (Miller & Rollnick, 2012). Techniques include exploring the pros and cons of behaviour change, reflecting change talk, and imagining extremes such as discussing the worst and best thing about making a change. Change talk is also elicited by discussing past behaviour and looking to the future, using confidence rulers (rating the importance of change and confidence in ability to change) and exploring the client's values and highlighting the discrepancy between current behaviours and identified values.

The therapist moves between and within the process of MI by employing several core skills; open questioning, affirming, reflective listening, summarising and informing (Miller & Rollnick, 2012). Open questioning encourages reflection and enables the therapist to gain access to the client's internal world and thus allows for more accurate empathising. Affirming involves highlighting the client's existing resources and previous successes with regards to behaviour change. Reflective listening comprises statements of understanding which help to foster the therapeutic relationship, reduce defensiveness and facilitate deeper exploration. Summarising allows the consolidation of change talk and can lead to an increase in understanding. Finally, with the client's permission, the therapist provides information and advice relating to the targeted behaviour.

MI is rarely employed as a “pure” approach and almost all published studies have modified the basic MI approach in some way (Burke et al., 2003). MI can be delivered as a prelude to treatment, a standalone treatment or in combination with other interventions. The most common adaptation of MI is motivational enhancement therapy (MET; Miller, Zweben, DiClemente, & Rychtarik, 1992) which combines a MI counselling style with personalised normative-based feedback on the target behaviour and is usually delivered over four sessions. MET is typically used within the context of substance misuse where the person receives feedback on how their current drug or alcohol use compares to that of the general population. MI is often combined with other treatments such as cognitive-behavioural therapy, education, stress management, skills training or pharmacological interventions which can result in an additive effect (Anton et al., 2006; Hettema, Steele, & Miller, 2005). As MI is typified as a way of being with the client it is suitable for integration with other interventions and delivering MI as an adjunct to other effective behaviour change therapies is more desirable an approach than pitting them against one another (Miller & Rollnick, 2012).

Effectiveness of MI

Several systematic reviews and meta-analyses have been conducted to investigate the effectiveness of MI. They have demonstrated that MI is associated with small to medium effect sizes across a variety of target behaviours including alcohol and drug use, diet and exercise, eating disorders and smoking (Burke et al., 2003; Heckman et al., 2010; Hettema et al., 2005; Lindson-Hawley, Thompson, & Begh, 2015; Lundahl, Kunz, Brownell, Tollefson, & Burke, 2010). MI has also been applied in physical

healthcare settings. A medium effect size was found for the association between MI and reduction in body mass in overweight and obese patients when compared to control interventions (Armstrong et al., 2011). A modest effect was found for MI and health outcomes such as dental outcomes, death rate, body weight, alcohol and tobacco use, and HIV viral load in a meta-analysis which included 49 trials of MI in healthcare settings (Lundahl et al., 2013). A review of MI and medication adherence found that MI improves medication adherence in adults when compared to controls who had received treatment as usual or an educational intervention (Palacio et al., 2016). The majority of studies included in the review focused on ART adherence.

Reviews have demonstrated that studies where there was no specific treatment manual yielded double the effect size in comparison with studies where a strict protocol was followed (Hettema et al., 2005). It is suspected that a proscriptive MI manual results in less flexibility on the part of the therapist to be responsive. For example research has shown that implementing a change plan (as instructed by the manual) before the client is ready to make a plan for changing behaviour results in poorer outcomes and an increase in sustain talk (Amrhein, Miller, Yahne, Palmer, & Fulcher, 2003). Burke et al. (2003) found that better outcomes for substance abuse were associated with higher doses of treatment (more minutes of MI) and using MI as a precursor to further treatment. It has also been found that MI is particularly effective for those with low levels of motivation to change the target behaviour (Hettema & Hendricks, 2010). MI is best delivered on a one-to-one basis rather than in a group format (Lundahl & Burke, 2009). MI takes on average 100 minutes less treatment time than comparable interventions such as cognitive-behavioural therapy or 12-step addiction programmes such as Alcoholics Anonymous, but can produce equal effects (Lundahl et al., 2010).

In a systematic review of ten RCTs of MI interventions targeting HIV risk behaviours such as unprotected sex and substance misuse in a population of men who have sex with men, Berg et al. (2011) found that MI produced outcomes that were equivalent to other treatments or standard care. Another systematic review of MI and HIV risk behaviours found that MI had the potential to reduce risky sexual behaviours but the effect on substance misuse was inconclusive (Naar-King, Parsons, & Johnson, 2012). A systematic review of young people with HIV found evidence to support the effect of MI on viral load and condom use but mixed evidence for substance misuse (Mbuagbaw, Ye, & Thabane, 2012). A systematic review of MI and ART adherence found that three of the five clinical trials studied reported a significant increase in adherence rates suggesting that MI holds potential as an intervention to improve ART adherence but that further research is needed before definitive claims can be made (Hill & Kavookjian, 2012). A recent integrative review of the effectiveness of MI on health behaviours in people living with HIV aimed to build on the reviews outlined above by focusing on studies published in the previous six years, and by including people of all ages and broader measures of health outcomes than just CD4 count or viral load (Dillard et al., 2017). MI was shown to have stronger effects when integrated with other treatments such as DOT, cognitive-behavioural therapy or follow up telephone calls. They found promising evidence for MI (16 out of 19 studies demonstrating positive effect for MI), either as a standalone or adjunctive treatment with regards to reducing symptoms of depression, enhancing adherence to ART and reducing risky sexual behaviour in people living with HIV (Dillard et al., 2017). As can be surmised from these reviews the evidence for the effectiveness of MI within the field of HIV is equivocal and further research is needed. However,

these reviews also demonstrate that there is evidence to suggest that MI is a promising intervention for increasing adherence to ART.

There are several factors which contribute to MI being an appropriate intervention for use in ART adherence. Firstly, MI explicitly focuses on developing a client's self-efficacy using confidence rulers, identifying and affirming strengths, and by positively reframing past failures at behaviour change (Miller & Rollnick, 2012). Self-efficacy is recommended as one of the key predictors to target in adherence enhancing interventions (Langebeek et al., 2014). MI has been shown to have larger effects in ethnic minority populations in comparison to non-minority white populations (Hettema et al., 2005). HIV disproportionately affects certain ethnic minorities such as African-American and Hispanic populations in North America (Centers for Disease Control and Prevention, 2015) and Black-African populations in the UK (Kirwan et al., 2016) hence MI may be an especially effective intervention for these minority groups. ART adherence is a complex behaviour and may require a multipronged approach to treatment and MI is suitable for integration with other interventions such as CBT and reminder devices. Finally, MI is recommended as an intervention for enhancing motivation, a key hypothesised determinant of ART adherence in the IMB model (Chang, Choi, Kim, & Song, 2014).

One of the main criticisms that has been levelled at MI is that it lacks a theoretical basis (Draycott & Dabbs, 1998). MI was developed organically and intuitively through working with people with substance misuse problems and did not arise from any particular theory or empirical research (Miller, 1996). Attempts have since been made to address this limitation by linking MI to existing psychological theories such

as self-determination theory (SDT; Markland, Ryan, Tobin, & Rollnick, 2005; Resnicow & McMaster, 2012) and through process research investigating the mechanisms of MI.

Self-determination theory

SDT is a theory of personality and motivation (Deci & Ryan, 1985). SDT argues that humans have an inbuilt need for personal growth and are driven by the desire to achieve a unified sense of self and to integrate the self into wider social groups (Deci & Ryan, 2002). The theory proposes that to achieve personal growth and well-being our innate psychological needs for competence, relatedness and autonomy must be met (Deci & Ryan, 2000). Competence refers to a need to feel that it is possible to effectively influence the outcome of a situation and experience the opportunity to demonstrate this capacity. Relatedness refers to having a sense of belonging or connectedness to people and a need to feel cared for and to provide care to others. Autonomy refers to feeling that one's behaviour is volitional and self-endorsed. The fulfilment of these psychological needs is necessary for self-motivation (Ryan & Deci, 2000).

Deci and Ryan (2008) propose that motivation lies on a continuum from fully self-determined to non-self-determined action and the more self-determined a behaviour is the more likely a person is to initiate and persist with it. They distinguish between different types of motivation: autonomous and controlled, as well as describing the absence of motivation or intention to act which they refer to as 'amotivation'.

Autonomous motivation lies at the self-determined end of the spectrum where the person has chosen and endorsed the behaviour. It is comprised of intrinsic motivation

and two forms of extrinsic motivation; integrated and identified. Intrinsic motivation involves engaging in a behaviour because it is inherently enjoyable or interesting. This type of motivation does not apply to most health-related behaviours including medication adherence which is neither interesting nor enjoyable (Patrick & Williams, 2012). Integrated motivation is where the person identifies with the importance of a behaviour and this behaviour is in line with their core values and beliefs. Identified motivation is where the person accepts the behaviour as being essential to the achievement of personally valued outcomes. Controlled motivation is where behaviour is coerced in some way and consists of introjected and external motivation. Introjected motivation is where a person is motivated by some internalised self-esteem related judgement. The person is viewed as self-controlling by putting pressure on themselves to comply with the behaviour to avoid feeling unwanted emotions such as anxiety, guilt or shame or to increase feelings of self-worth and pride. External motivation is the most controlled form of motivation and is where the person engages in the behaviour to gain a reward or avoid punishment. Amotivation represents a lack of intention to act and the person fails to recognise the link between action and its outcome.

Empirical studies have tested SDT across different domains including health, education, work and sport. It has been shown that autonomous motivation is linked to attendance, engagement with and completion of an alcohol treatment programme (Ryan, Plant, & O'Malley, 1995). An RCT found a positive relationship between increased autonomous motivation and abstinence from tobacco (Williams, Niemiec, Patrick, Ryan, & Deci, 2009). A systematic review has demonstrated that autonomous motivation predicts exercise participation (Teixeira, Palmeira, & Vansteenkiste,

2012). Hagger et al. (2014) tested the relative contribution of autonomous and controlled motivation across different health related behaviours such as having a low sodium diet, exercising regularly, drinking alcohol in accordance with healthy guidelines and wearing a seat belt. They found that regardless of individual differences, autonomous motivation had a larger effect on behaviour across multiple health related behaviours than controlled motivation. With regards to medication adherence it has been shown that autonomous motivation is linked to successful adherence to long-term medication (Williams, Rodin, Ryan, Grolnick, & Deci, 1998) and diabetes medication (Williams, Patrick, et al., 2009). Autonomous motivation has also been shown to be associated with adherence to ART (Kennedy, Goggin, & Nollen, 2004; Lynam et al., 2009).

In the studies outlined above autonomous and controlled motivation was measured through self-report questionnaires such as the Treatment Self-Regulation Questionnaire (TSRQ; Williams, McGregor, Zeldman, Freedman, & Deci, 2004), the Self-Determination Scale (Sheldon & Deci, 1996), the Behavioural Regulation In Exercise Questionnaire (Mullan, Markland, & Ingledew, 1997), and the Integrated Regulation Scale (McLachlan, Spray, & Hagger, 2011). While self-report measures have the benefit of being economical – saving time and money as they are typically easily administered and scored – they do possess limitations and can be unreliable (Schwarz & Oyserman, 2001). Self-report measures are vulnerable to the social desirability response bias or the tendency for respondents to present a favourable image of themselves which can lead to measurement error (Crowne & Marlowe, 1960). Self-report measures of motivation are limited by the fact that they measure motivation to engage in a particular health-related behaviour and ignore the effect of

competing goals and the motivation for avoidance of the behaviour (Houston, McKirnan, Cervone, Johnson, & Sandfort, 2012). Self-report measures are also vulnerable to biases in memory (Schwarz, 2007) and demand characteristics where the participant anticipates what the researcher might be expecting to find in the study and may bias answers in response (Orne, 1962). Questionnaires are also influenced by context and participants' mood or mental state (Schwarz & Oyserman, 2001). Self-report measures typically impose a vocabulary or narrative on the participant and thus do not allow for exploration of the idiosyncratic motivations a person might have for engaging in a behaviour (Houston et al., 2012). Finally, the above SDT questionnaires were developed using an expert led top-down process whereby questionnaire items were developed from definitions in the literature or by modifying items from existing measures. This deductive approach may have limited the content validity of these measures and it is argued that participants' experience should be considered when measuring psychological constructs (Brod, Tesler, & Christensen, 2009). Considering the extensive limitations of self-report measures and the deductive approach used in developing existing measures there is a need to explore alternative inductive ways to measure autonomous and controlled motivation.

SDT has been proposed as a theoretical lens through which the mechanism of MI can be better understood for several reasons. Firstly, it is proposed that MI provides support for each of the psychological needs for growth proposed by SDT; competence, relatedness and autonomy. Competence is supported by MI through helping the client to build self-efficacy and confidence by identifying and affirming strengths, using confidence rulers, and by positively reframing past failures. The need for relatedness is supported within the MI therapy session through the therapist

communicating empathy and genuine interest in the client. Finally, MI supports the need for autonomy through the therapist adopting a non-expert position, 'rolling with resistance', eliciting change talk and emphasising that it is entirely the client's decision to change or not (Vansteenkiste & Sheldon, 2006). Both SDT and MI are influenced by humanistic psychology with Rogerian concepts such as unconditional positive regard and patient-centeredness at the heart of both approaches (Patrick & Williams, 2012). A final link between the approaches is both assume that humans possess a fundamental inclination for personal growth and that this growth emerges from within the person rather than being coerced (Markland et al., 2005).

Process research

The variability in outcomes across MI research studies has prompted investigations into the mediating and moderating processes of this intervention. It is argued that understanding more about the active ingredients of MI will allow for appropriate adaptations of this intervention across different populations and will improve clinical outcomes, MI training, practice and research (Moyers et al., 2007). Due to the relational nature of the MI model both therapist and client responses are viewed as key to understanding the processes through which therapeutic change or the mechanisms of change occurs within MI sessions (Romano & Peters, 2016). Several different process rating systems have been developed to code both therapist and client responses during MI sessions (Dobber et al., 2015). The first one to be developed was the Motivational Interviewing Skill Code or the MISC (Miller & Mount, 2001). This tool has seen various revisions with the most recent version being the MISC 2.5 (Houck, Moyers, Miller, Glynn, & Hallgren, 2010). It is a numerical coding

instrument specifically developed to capture therapist interpersonal style and produce frequency counts of specific client and therapist behaviours during MI sessions. The MISC 2.5 is superior to other coding systems as it provides detailed categorisations of both therapist and client language and incorporates features of two existing coding frameworks the MISC 2.1 (Miller, Moyers, Ernst, & Paul C. Amrhein, 2008) and the Motivational Interviewing Sequential Code for Observing Process Exchanges (SCOPE; Martin, Moyers, Houck, Christopher, & Miller, 2005).

The language used by both client and therapist has received much attention and psycholinguistic analyses of MI sessions form the basis of the MI process research studies. It has been shown that the emergence of commitment language (“I am going to stop drinking tomorrow.”) is predicted by preparatory change talk namely the expression of the desire, ability, reasons and need for change and subsequent behaviour change is predicted by the strength of that commitment language particularly towards the end of the session (Amrhein et al., 2003). It has also been found that MI-consistent responses (“You’re a very resourceful person”) tend to be followed by change talk whereas MI-inconsistent responses (“You’re going to relapse if you don’t get out of this relationship”) were more likely to be followed by sustain talk (Moyers et al., 2007). It also followed that change talk elicited further MI-consistent utterances from the therapist thus setting up a symbiotic relationship.

A number of studies have focused on analysing therapist interpersonal style during the session and the impact on outcomes. It has been found that therapists who are more client-centered and less confrontational experience less client resistance during sessions which was associated with long-term reductions in alcohol use (Miller,

Benefield, & Tonigan, 1993). High levels of therapist empathy has been demonstrated to be associated with a reduction in alcohol use in a group of hazardous drinkers (Gaume, Gmel, & Daeppen, 2008). Baird et al. (2007) found that therapists who focused on fostering an emotionally supportive relationship with the client were less likely to have clients drop out of treatment and consequently experienced better outcomes. It has also been shown that therapist displays of MICO methods directly facilitate client engagement in the therapeutic process as demonstrated through expression of affect, disclosures made and cooperation during the session (Moyers, Miller, & Hendrickson, 2005).

Causal model of MI

A hypothesized causal model of MI (see Figure 1) was developed by Miller and Rose (2009) and informed by MI process research. This model proposes relational and technical pathways through which behaviour change occurs within the context of MI sessions (Miller & Rose, 2009). The relational component focuses on the therapist conveying MI spirit and empathy. MI spirit encapsulates adopting a compassionate and collaborative communication style while encouraging autonomy and evoking motivation to change (Miller & Rollnick, 2012). The technical component hypothesises that the therapist use of MICO methods (such as empathising, reflective listening and evoking reasons for change) will elicit and reinforce client change talk, which has been shown to predict behaviour change (Apodaca & Longabaugh, 2009) while overlooking instances of sustain talk where the client favours maintaining the status quo. The model also suggests that training in MI is directly related to therapist empathy and MI spirit, therapist use of MICO methods, client expression of change

talk and diminished resistance during MI sessions. The model proposes that both the relational and technical components of MI can either have a direct or mediated (by client change talk) impact on targeted behaviour change.

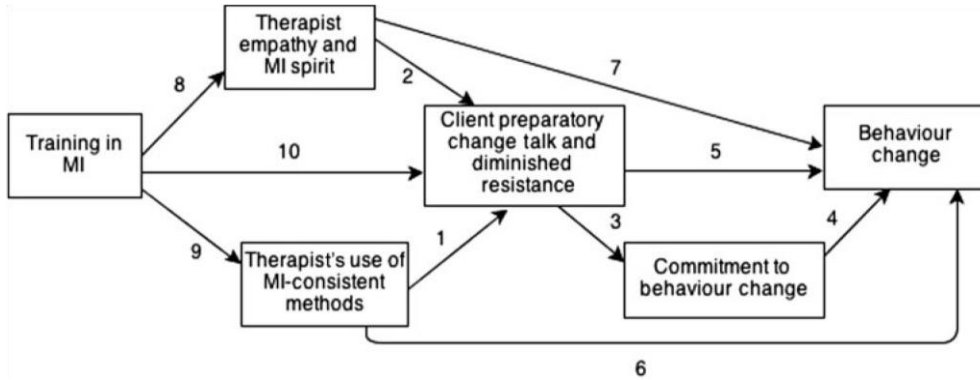


Figure 1 Causal model of MI adapted from Miller and Rose (2009)

Several reviews of the MI model (Miller & Rose, 2009) have been undertaken and evidence has been found in support of parts of the model (Apodaca & Longabaugh, 2009; Copeland, McNamara, Kelson, & Simpson, 2015; Magill et al., 2014; Romano & Peters, 2016). Apodaca and Longabaugh (2009) were the first to review the process research evidence, focusing on substance misuse. Due to a paucity of full causal studies they were only able to identify potential mediators. They found strong evidence for the hypothesised relationship between increase in change talk and behaviour change. Magill et al. (2014) carried out an aggregate test of the technical pathway using meta-analytic methods within the context of addiction (substance misuse and gambling). The *a* path (therapist MI skills in relation to client change talk) and *b* path (client change talk in relation to behaviour outcomes) of the mediational chain was tested. Evidence for the relationship between therapist use of MICO methods and client change talk was found but contrary to the model there was no

significant relationship observed between MICO methods and client sustain talk. As expected therapist use of MI-inconsistent methods was associated with less client change talk and an increase in client sustain talk. In contrast to Apodaca and Longabaugh (2009) there was no evidence found to support the hypothesised relationship between increased client change talk and behaviour outcome. However true to the model there was an association found between increased client sustain talk and worse outcomes. All effect sizes reported in the meta-analysis were small.

A review of the MI model within the context of health behaviours (Copeland et al., 2015) found that MI spirit was associated with increased client change talk which in turn was found to be related to improvement in health outcomes such as healthy diet, exercise, weight loss and medication adherence. Due to the small number of process research studies existing within the context of health behaviours it was not possible to draw conclusions about any other aspects of the MI model. Romano and Peters (2016) systematically reviewed the existing evidence for each pathway in the MI model across a range of target behaviours (substance misuse, exercise, diet, medication adherence, intimate partner aggression, and smoking). They found that evidence was strongest for the technical component namely that therapist use of MI-consistent methods was positively associated with client change talk; with therapist use of reflections being particularly instrumental. It was found that client change talk was unlikely to occur following MI-inconsistent therapist behaviours. With regards to the relational pathway the results were inconsistent across studies which the authors conclude may link to challenges in accurately measuring MI spirit and empathy. Replicating other review studies (Apodaca & Longabaugh, 2009; Copeland et al., 2015), client change talk was found to be associated with behaviour change outcomes.

Considering the results from these reviews together, there is consistent evidence to confirm the technical pathway of the MI model namely that therapist use of MI-consistent methods is associated with increased client change talk and therapist use of MI-inconsistent methods is associated with reduced client change talk. The evidence regarding the relational component of the model is inconclusive, although it is possible that MI spirit might be a promising active ingredient particularly in the context of health behaviours. The majority of these reviews support the proposed relationship between increased client change talk and behaviour change. Given the inconsistent findings further process research is needed, particularly within the context of health behaviours, to gain a better understanding of the causal model of MI.

Methodological issues of process research

There are important methodological issues that must be considered when reviewing the process literature. MI process research typically relies on human raters who often do not agree with one another. Disagreement between coders results in measurement error within the ratings (Holsclaw, Hallgren, Steyvers, Smyth, & Atkins, 2015).

According to Kazdin and Nock (2003) to demonstrate that a variable does indeed act as a mechanisms of change certain criteria must be fulfilled. A strong association is necessary to show that there is a causal mechanism existing between variables. The second criterion is specificity or demonstrating that the proposed mechanism accounts for the change while showing other conceivable variables do not act as mediators.

Another important criterion is showing that increasing the identified change mechanism will result in a greater change in the linked outcome. The use of an experiment through which the mechanisms can be manipulated and potential

confounding variables can be controlled, is necessary to infer causality. It is also important to show that the relationship is temporal whereby the alteration in the change mechanism preceded the change in the targeted outcome variable.

Demonstrating consistency and replicability of the change processes across different contexts and samples is essential. The final criterion is that the proposed mechanism is plausible within the context of the existing knowledge base. The more criteria satisfied the stronger the argument for causality (Kazdin & Nock, 2003). It is a near impossible task to achieve all of these criteria with just one study and instead it is recommended that findings are aggregated across studies so that all criteria are met (Nock, 2007).

MI process research & HIV

Investigation of the mechanisms of MI outside the context of substance misuse remains limited (Romano & Peters, 2016). Given the variety of effect sizes reported across studies and behaviour outcomes it is possible that the mechanisms of change differ across targeted behaviours. As MI has been shown to be a promising intervention to enhance ART adherence and reduce risky sexual behaviour in people living with HIV (Dillard et al., 2017) it is important that we conduct process research to gain a better understanding of the actions of change within a HIV context. There have been only two process research studies published with this population.

Grodensky et al. (2017) examined if the quality of MI was related to risky sexual behaviour in adults attending a HIV clinic in North America. The MISC 2.0 (Miller, Moyers, Ernst, & Amrhein, 2003) was applied to an MI session of 32 participants who were randomly selected from a larger RCT. The behaviour outcome was the

number of times a participant had unprotected vaginal or anal intercourse in the previous three months and this was collected using a self-report survey at the 8-month follow-up. The relational pathway was partially upheld as therapist acceptance, MI spirit and empathy were all positively correlated with fewer incidents of unprotected vaginal/anal intercourse. With regards to the technical component of the model only the ratio of therapist reflections to questions was found to be associated with behaviour outcome. The study was limited by the small sample size and the fact that baseline rates of unprotected anal/vaginal intercourse do not appear to have been factored in to the analysis. Also, this study did not take client change language into account, which has been shown to be a key aspect of the causal MI model (Miller & Rose, 2009).

One published study has explored MI processes within the context of ART adherence (Thrasher et al., 2006). One of the aims of this study was to investigate the relationship between ART adherence outcomes and measures of MI session quality and therapist behaviours. Baseline adherence as measured by pill counts was an average of 56% of doses taken across the study. There were 35 participants for whom adherence data was available for both weeks 4 (pre-MI session) and 12 (post-MI session/study exit). Spearman's correlational coefficients showed a significant positive association for week 12 ART adherence and both number of affirming statements made and a higher ratio of reflections to questions asked (indicators of MI-consistent therapist methods). There was a negative association found between ART adherence and closed questions (indicator of MI-inconsistent therapist methods). However there were a number of limitations to this study. Client behaviours, a key aspect of the MI model (Miller & Rose, 2009) was not taken into account as part of

this study. The influence of pre-MI session adherence data (week 4) was not accounted for in the statistical analysis. There was an increase in the possibility of type 1 errors due to the fact that a variety of different therapist MI measures were tested for associations. Finally, the sample of participants with full outcome data was relatively small (n= 35) thus limiting the generalisability and power of the study. Thrasher et al. (2006) call for future research to build on their research by investigating the potential mediating role of client change talk in a larger research sample.

Research aims & hypotheses

This study aims to build on the study carried out by Thrasher et al. (2006) by testing both the relational and technical pathways of the MI model in relation to ART adherence taking both client and therapist factors of the model into account. This study will improve on the Thrasher et al. (2006) study by taking pre-MI session adherence data into account and by testing the MI model in a larger sample. This study will look at schedule adherence as it is important to maintain a continuous coverage of ART within the blood to minimise the risk of drug resistance. This study also aims to use an outcome variable that is measured close to the MI session (one week later) as advised by Longabaugh (2007).

A secondary aim of the study is to explore the relationship between ART adherence and more fine-grained naturally occurring motivational speech than MI specifies; namely autonomous and controlled motivation (Deci & Ryan, 2008). Autonomous motivation has been shown to have a stronger relationship with health related behaviours than controlled motivation does (Hagger et al., 2014) therefore it is

predicted that ART adherence will be more closely associated with autonomous than controlled motivation. Autonomous motivation is usually measured using self-report measures however as noted previously these questionnaires can be unreliable measurement tools and do not always consider the perspective of the participant. This study aimed to measure autonomous and controlled motivation using an inductive approach through the observational method of coding naturally occurring speech. Existing observational coding tools such as the MISC only identify broad categories of change language and do not capture information relating to the motivations for behaviour change hence it will be necessary to develop a novel coding tool to capture autonomous and controlled motivation to adhere to ART.

The research hypotheses are:

1. Client change talk during MI session 1 will mediate the relationship between therapist use of MICO methods in MI session 1 and post-session change in ART adherence (see Figure 2).

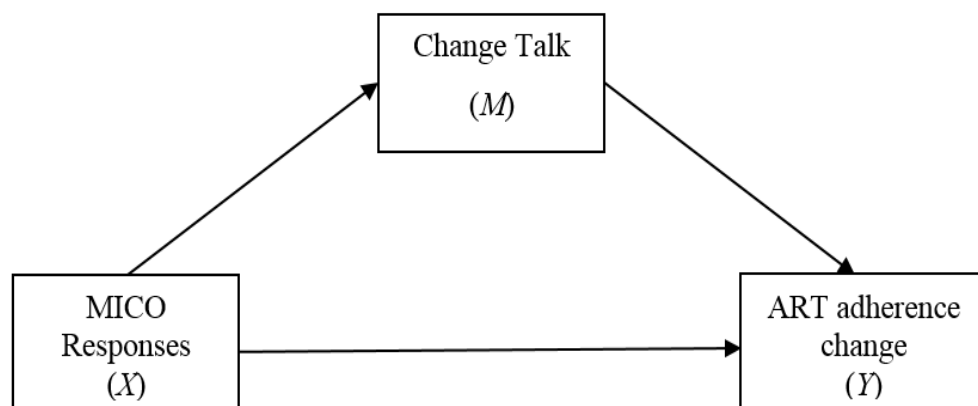


Figure 2 Research hypothesis 1

- Client change talk during MI session 1 will mediate the relationship between therapist MI spirit in MI session 1 and post-session change in ART adherence (see Figure 3).

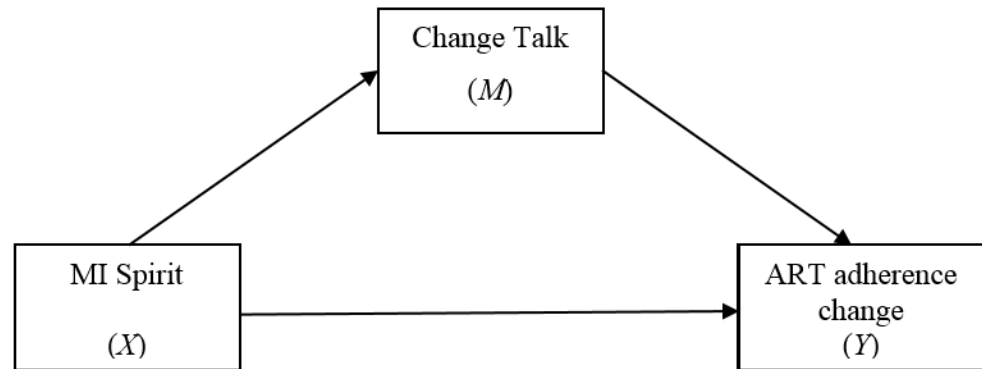


Figure 3 Research hypothesis 2

- Higher levels of ART adherence will be more closely associated with naturally occurring autonomous motivation talk than controlled motivation talk expressed during MI session 1.

Chapter 2: Method

Research design

This study is a secondary analysis of the relationship between ART adherence and client and therapist speech within motivational interviewing therapy sessions. It employs both a cross-sectional and longitudinal design. The therapy sessions were collected as part of Project MOTIV8, an RCT exploring the use of MI alone and in combination with another treatment (outlined below) to increase ART adherence in adults living with HIV (Goggin et al., 2013). Therapy sessions were analysed (cross-sectional component) using two separate coding systems; the Motivational Interviewing Skills Code (MISC) 2.5 (Houck et al., 2010) and a novel coding system the SDT & Medication Adherence Coding System (SMACS) which was developed specifically for this study. ART adherence data was gathered at various points throughout the study (longitudinal component) using an electronic medication monitoring device.

Overview of project MOTIV8

Participants enrolled in the 48-week research trial ($n=204$) were randomised to one of three arms: 1) a standard care (SC) group receiving usual medical care ($n=65$, 32%); 2) an enhanced counselling (EC) group receiving 10 sessions of MI-based adherence counselling ($n=70$, 34%) and 3) an enhanced counselling/observed therapy (EC/OT) group receiving 10 sessions of MI-based adherence counselling alongside the supervision of a portion of daily medication doses ($n=69$, 34%) for 24 weeks.

Participants of MOTIV8

Participants for the MOTIV8 study were recruited from six outpatient clinics in a mid-West city in the United States of America. Eligible participants were HIV positive, over the age of 18, English-speaking, and taking ART for the first time, changing their ART regimen or having self-reported or doctor suspected ART adherence difficulties as evidenced by clinical viral load (HIV RNA >1,000 copies/ml). Participants were excluded if they lacked the cognitive capacity to consent, were pregnant, did not self-administer their medication, had an acute illness, planned a move that might interfere with participation in the study, or lived outside the specified catchment area.

Procedure of MOTIV8

Informed consent was obtained for eligible participants who expressed interest in taking part in the MOTIV8 study. Baseline assessment of demographic, adherence, psychosocial and physical health indicators was conducted by different project staff from those providing interventions using an Audio Computer Assisted Self Interview which presents information both on-screen and as an audio recording.

After completing baseline assessments, participants were randomised into one of the three groups. Those randomised for MI-based adherence counselling (EC and EC/OT groups) were scheduled for six one-to-one sessions (baseline, weeks 1, 2, 6, 11, and 23) and four telephone sessions (weeks 4, 9, 15, and 19). Therapy sessions lasted, on average, 25 minutes. The baseline session consisted of information provision regarding the importance of correct adherence and subsequent therapy sessions used one of a selection of 11 skill-building modules (e.g., motivation enhancement, self-

monitoring, goal setting, and problem solving). MI for motivation enhancement was always the focus of the week 1 therapy session and consecutive sessions either repeated the MI module or focused on one of the other skill-building modules (Goggin et al., 2013).

Counsellors

Master's degree level professionals received training in MI, behavioural skills building through cognitive-behavioural techniques, HIV and medication adherence. MI training was delivered by a licensed clinical psychologist with expertise in MI through a day-long workshop and supervised role-plays. Before delivering therapy sessions all counsellors were required to demonstrate proficiency in MI skills alongside other study protocol elements. All sessions were audio recorded and counsellors received regular supervision throughout the study in which random tapes were selected and assessed for fidelity to MI principles using a 26-item coding scheme adapted from an earlier study (Harris et al., 2010).

Measures of MOTIV8

All participants completed a number of measures at various time-points throughout the study including at baseline (before randomisation occurred). This secondary analysis includes the following measures:

Demographic & health information.

Baseline demographic information included; age, gender at birth, education level, employment status, sexual orientation and ethnicity. Clinical characteristics specific

to HIV were gathered at baseline and included; CD4 cell count, viral load copies, and if the participant was starting ART for the first time or not.

Depressive symptoms.

Participants' depressive symptoms (behavioural, emotional, cognitive and somatic) over the previous week were collected at baseline using the 20-item self-report Centre for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Each item is rated on a 4-point scale ranging from 0 = *rarely or none of the time (less than 1 day)* to 3 = *most or all of the time (5 – 7 days)*. Higher scores indicate greater levels of depressive symptoms with scores above 16 indicating the likelihood of clinical depression being present. Radloff (1977) demonstrated that the CES-D has sufficient reliability (Cronbach's alpha = .85 – .90, split-half and Spearman-Brown = .77 – .92) and validity (concurrent with other depression scales and discriminates between psychiatric inpatient and general population). Item response theory has been used to demonstrate that the CES-D is suitable for use as a measure of depression (Olino et al., 2012). The CES-D has also been shown to be appropriate for use in a population of people living with HIV (Cockram, Judd, Mijch, & Norman, 1999).

ART adherence.

ART adherence data was collected using an electronic pill-cap known as a Medication Events Monitoring System or MEMS cap. This device captures the date and time when a medication bottle is opened allowing for more accurate data regarding ART adherence in comparison to other methods such as self-report and pharmacy refills (Farley et al., 2003; Müller et al., 2008). Participants were required to keep one of their ART medications in the MEMS cap bottle. Those taking more than one ART

medication choose the medication with the most complex dosing schedule for the MEMS cap bottle or the drug anticipated to cause the most severe side effects when the dosing schedule was identical across all ART medications. Adherence data was downloaded and cleaned to safeguard against any participants registering an adherence value of greater than 100% in any 24-hour period. Data was excluded if a participant was unable to use the MEMS cap due to being in hospital, in prison or on a period of strategic treatment interruption as advised by their healthcare provider. Two measures of ART adherence data were calculated as follows: 1) the percentage of prescribed ART doses taken (number of doses taken divided by the number of doses prescribed) and 2) the percentage of prescribed ART doses taken on time (within 2 hours either side of the scheduled dose time). For the purpose of this study, ART adherence percentages were calculated at three separate intervals: 1) week 1 (the 7 day period before the first MI session); 2) week 2 (the 7 day period after the first MI session); and week 12 (30 days of adherence data prior to 12th week of the trial).

Motivation to adhere.

A brief self-report measure capturing baseline motivation to adhere to ART was devised for the MOTIV8 study. This measure required participants to rate on scales from 0 = *not at all* to 10 = *extremely* their need, reasons, readiness, wish and commitment to adhere strictly to the ART schedule. This measure was informed by the work of Amrhein et al. (2003) on language reflecting commitment or motivation to change. Following an investigation of the factor structure and reliability of the measure, one item (wish/want to adhere) was dropped and the remaining four items

achieved good internal consistency ($\alpha = .83$). Therefore, the mean response to the four-item version of the measure was used for the current study.

Autonomous and controlled motivation.

Baseline autonomous and controlled motivation was assessed using the TSRQ (Williams et al., 2004) which is a self-report measure of motivation to engage in a health-related behaviour, for example medication adherence. Responses are captured on a 7-point Likert-type scale, ranging from 1 = *not at all true* to 7 = *very true*. The items are divided into two subscales measuring autonomous and controlled motivation (6 items each). Both subscales have demonstrated sufficient internal consistency within the context of diabetes medication adherence. The autonomous subscale demonstrated good internal consistency ($\alpha = .86$) while the internal consistency of the controlled subscale was adequate ($\alpha = .75$). A validation study in a group of adults in North America across smoking, diet and exercise has shown the TSRQ to be a valid and reliable tool (Levesque et al., 2007) demonstrating sufficient internal consistency across all subscales and populations ($\alpha > .73$), confirmatory factor analysis supported subscales and significant correlations were achieved with related health measures. The autonomous subscale of the TSRQ has been used in a study of ART adherence in adults living with HIV (Kennedy et al., 2004) and achieved good internal consistency ($\alpha = .81$). As per usual practice the TSRQ items were modified to reflect the health behaviour of interest, namely ART adherence.

Sample

Power calculation

The number of participants required for the current study was calculated using an a priori power analysis. The study was powered to test for the indirect effect of therapist use of MICO methods on ART adherence via client change talk (hypothesis 1) using bootstrapping approaches to mediation analysis. As this hypothesis tests components of the causal model of MI (Miller & Rose, 2009) in a new population, it was not possible to anticipate precisely what the mediated effect sizes might be. However, a power analysis was informed by considering the model and results reported for substance misuse population in a study using a similar design (Moyers, Martin, Houck, Christopher, & Tonigan, 2009). In Moyers et al. (2009) the relationships between both therapist use of MICO methods and drinks per week and client change talk were medium. Therefore, a medium effect size for both the *a* path (therapist use of MICO methods and client change talk) and *b* path (client change talk and ART adherence change) was anticipated for the current study. A power calculation was informed by Fritz and MacKinnon (2007), giving an estimated sample size of between 71 (bias-corrected bootstrap) and 78 (percentile bootstrap) participants to provide 80% power, at an alpha level of $p = .05$ with a medium effect size for both *a* and *b* pathways. A sample size of 75 participants was chosen as it is the mid-point between the two estimated sample sizes.

Sample selection

This study focused on coding the first MI counselling session given that this was delivered to all participants in the MI arms of the RCT. Focusing on the first MI session brings this study in line with other MI process research allowing for

comparison across studies and reduces the risk of selection bias that may have been introduced through study attrition.

One hundred and thirty-nine participants were randomised to receive the MI intervention. Due to the ceiling effect noted in the data whereby participants reported high motivation to adhere to ART, this secondary analysis focuses on those participants with lower baseline adherence motivation (mean motivation to adhere < 10, n = 65). Ten participants with high baseline motivation to adhere (mean motivation to adhere = 10) were randomly selected to achieve a sample size of 75 required to sufficiently power the study.

Of this identified sample of 75, two audio files were missing and in one session the client spoke in both Spanish and English throughout. Therefore, these three participants were excluded from the study. Due to time constraints, it was not possible to code all remaining 72 sessions leaving a final sample size for analysis of 66 sessions. Twelve sessions were randomly selected from the remaining sessions not selected for inclusion in this study – those who reported higher baseline levels of motivation – for coding training and the development and piloting of the SMACS.

Sample characteristics

Baseline demographic (age, gender at birth, ethnicity, education level, employment status and sexual orientation) and clinical (depression symptoms, first time taking ART, baseline viral load and CD4 count) information for the final sample included in the current study (n=62) are presented in Table 1.

Table 1 Participant demographic information

Variable	All Participants	
	Mean (SD)	No (%)
Age, years	40.06 (10.10)	
Male gender at birth		46 (74.2)
<u>Ethnicity</u>		
African-American		33 (53.2)
White		23 (37.1)
Mixed		5 (8.1)
Other		1 (1.6)
<u>Education</u>		
High School Degree or Less		31 (50.0)
More than High School Degree		31 (50.0)
<u>Sexual Orientation</u>		
Heterosexual		27 (43.5)
Homosexual		26 (41.9)
Bisexual		6 (9.7)
Other		1 (1.6)
Choose not to answer		2 (3.2)
<u>Employment</u>		
Full-time		9 (14.5)
Part-time		6 (9.7)
Not currently employed		47 (75.8)
<u>Depressive symptoms</u>		
Above clinical threshold		36 (58.1)
First time taking ART		18 (29.0)
Viral Load (copies/ml) – Baseline	121925.51 (156203.67)	
CD4 count (cells/mm ³) – Baseline	264.11 (177.71)	

Participants ranged in age from 19 to 61 years with a mean age of 40 years. There was diversity in the sample with regards to sexual orientation with the majority of the sample (51.6%) identifying as either homosexual or bisexual. A large proportion of the sample (58.1%) scored above the clinical threshold (>16) for depression as measured by the CES-D (Radloff, 1977). The average baseline disease indicators (CD4 count and viral load) were poor. Healthy CD4 counts are between 500–1,600 cells/mm³, whereas the mean level in this samples was just 264.11 cells/mm³. The mean viral load was 121,925.51 copies/ml and <50 copies/ml is required to achieve undetectable levels of HIV virus in the blood.

This sample is representative of the population of people living with HIV in North America with men who have sex with men and African-Americans being disproportionately affected by HIV (Centers for Disease Control and Prevention, 2015).

Ethical approval

Approval for the original RCT (project MOTIV8) was obtained from the Institutional Review Boards at each recruitment clinic and at the North American University leading the research study. The consent form for the original study (Appendix 1) advised participants that the audio tapes from the counselling sessions would be saved indefinitely and could be used on future projects investigating the effectiveness of the counsellors and the style of counselling. The principal investigators who collected the original data gave additional permission for the data to be used for the purpose of this study. The current study was granted ethical approval from Royal Holloway, University of London Research Ethics Committee (REC) in May 2016 (Appendix 2).

The study was informed by relevant research ethics guidelines including the Code of Human Research Ethics (BPS, 2014) and the Royal Holloway University of London Research Ethics Guidelines (2010). As this study was a secondary data analysis of a research study which had been previously granted full ethical approval the main ethical issue to consider was confidentiality. Due to the sensitive nature of the data all audio files and existing transcripts were transferred using a secure method of file transfer. The participants were not identifiable. All transcripts were anonymised during the parsing stage and prior to double-coding by research assistants. All data were stored securely on the Royal Holloway University of London Psychology Department network drive and files were transferred to research assistants using encrypted USB flash drives.

Coding process

Coding tools

All transcripts were parsed (separated into speech units) and coded by the researcher and any queries were resolved through discussion with the research supervisor who is a clinical and research psychologist and an expert in HIV and MI. Two undergraduate psychology students were recruited as research assistants to support with establishing the inter-rater reliability of both coding tools. The coding systems used in the current study are described in detail below.

Motivational Interviewing Skills Code (MISC) 2.5

The MISC 2.5 (Houck et al., 2010) incorporates features of two existing coding frameworks the MISC 2.1 (Miller et al., 2008) and the Motivational Interviewing

Sequential Code for Observing Process Exchanges (MI-SCOPE; Martin et al., 2005) and aims to capture more accurately the subtleties of both therapist and client speech. Coding is conducted in a series of three separate coding passes. In the first pass, the coder listens to the MI session straight through and records global ratings of the therapist on six dimensions; acceptance, empathy, direction, autonomy support, collaboration and evocation (See Table 2). Global ratings are made on a 5-point Likert scale, with the coder instructed to assume a beginning score of “3” and to move up or down from there. The value for MI spirit is derived by calculating the mean value across the global ratings of autonomy support, collaboration and evocation.

Table 2 Global codes as defined by the MISC 2.5

Global Code	Definition
Acceptance	The extent to which the therapist communicates unconditional positive regard for the client.
Empathy	The extent to which the therapist demonstrates accurate understanding of the client’s perspective.
Direction	The degree to which the therapist maintains focus on the targeted behaviour for change.
Autonomy Support	The extent to which the therapist supports and fosters the client’s perception of choice to change or not.
Collaboration	The degree to which the therapist acts as if the session is occurring between two equal partners
Evocation	The degree to which the therapist conveys that motivation resides in the client and focuses to elicit this motivation during the session.

In the second pass, the therapy session is parsed into separate speech utterances or thought units (Gottman, Markman, & Notarius, 1977) so that the individual utterance

can be assigned the appropriate code. Once parsing is complete, the coder carries out a final pass which involves listening to the session and assigning both therapist and client utterances a behavioural code as described in the coding manual. Before this process begins the target behaviour must be clearly defined. In the case of the current study taking ART as prescribed was the target behaviour. Each speech utterance can only be assigned one code. During the coding process, the audio of the session may be paused as often as necessary to determine the appropriate code to be assigned to each speech utterance.

The MISC 2.5 offers 25 possible codes for therapist language which can be grouped into broader categories. The focus of this study was MICO responses which is comprised of the following codes; advise with permission, affirm, emphasise control, open question, simple reflections, complex reflections, support, and raise concern with permission. See Table 3 for definitions and examples of each code.

Client language is coded into three broad and mutually exclusive categories; change talk, sustain talk and follow/neutral/ask. Change talk and sustain talk are made up of specific categories of change language either towards or away from change (desire, ability, reason, need, taking steps, other and commitment language) reflecting the client's current or future state of mind. All other client speech is coded as follow/neutral/ask. See Table 4 for definitions and examples of each code.

Table 3 Codes for MICO responses

Code	Definition	Example
Advise with permission	With permission therapist gives advice or offers a solution.	“Would it be all right if I suggested something?”
Affirm	Statements that are positive or complementary.	“You’re a very resourceful person”
Emphasise control	Emphasises client’s freedom of choice, autonomy and personal responsibility.	“It’s your decision”
Open question	Questions that allow clients to expand on their response.	“How might you be able to do that?”
Simple reflection	Statements that rephrase or restate what the client has said.	C: “I want to, but I don’t want to” T: “You want to change, but you don’t want to”
Complex reflection	Statements that restate what client said with added meaning	C: “I want to, but I don’t want to” T: “You want to change, but the comfort of old habits also has a strong pull”
Support	Sympathetic, compassionate or understanding responses.	“That must have been difficult”
Raise concern with permission	With permission therapist points to a possible problem or negative consequence that they are concerned about.	C: “What do you think about that idea?” T: “Well, frankly it worries me”

Table 4 Codes for client speech

Code	Definition	Example
<u>Change Talk</u>		
Commitment	Explicit expressions of intention to change behaviour.	“I am going to take my meds on time today”
Reason	Statements about reasons for changing behaviour.	“Life will be better if I take my ART”
Desire	Statement of desire to change behaviour.	“I don’t want to live like this anymore”
Ability	Expresses confidence in ability or capacity to change behaviour.	“I know that I can take my ART on time”
Need	Statement of need to change behaviour.	“I need to take my meds”
Taking Steps	Refers to recent changes the client has made.	“I took my meds on time two days last week”
Other	Language related to change but does not fit other categories.	“If I were to get pregnant I would take my ART”
<u>Sustain Talk</u>		
Commitment	Explicit expressions of intention to maintain status quo.	“I’m not going to take my meds at all”
Reason	Statements about reasons to maintain status quo.	“I get terrible side-effects from my meds”
Desire	Statement of desire to maintain status quo.	“I don’t like taking my ART”
Ability	Explicit expression of inability to change behaviour.	“I cannot swallow the pills”
Need	Statement of need to maintain status quo.	“I don’t need to take my meds”
Taking Steps	Refers to recent behaviour in the direction away from change.	“I’ve haven’t bothered picking up my meds”
Other	Statement of maintaining status quo that does not fit other categories.	“It’s not important to change”
Follow/ Neutral/Ask	Responses not related to the target behaviour, asking questions or reporting information or history.	“I was first prescribed ART a decade ago”

For the purpose of this study the MISC 2.5 was used to derive the sum of MI-consistent responses, change talk and sustain talk for each session as this related to the hypotheses of the study.

SDT & Medication Adherence Coding System (SMACS)

For the purpose of the current study a novel coding system was developed to quantify naturally occurring speech in MI sessions which encapsulates autonomous and controlled motivation to adhere to ART medication. The initial stage of developing the manual involved a review of the relevant SDT literature to gain a deeper understanding of the differences between autonomous and controlled motivation. Following this, eight transcripts which had been excluded from the main analysis were reviewed to identify all references to the clients' motivation to adhere to their ART. These reasons for wanting to adhere were categorised as being either autonomous or controlled motivation and were used as examples for each category in the coding manual. Additional examples were generated following a review of the literature and existing measures of autonomous and controlled motivation. There were eight reiterations of the manual as it went through extensive piloting and consultation. The researcher and supervisor piloted the manual by independently coding four further excluded transcripts using the SMACS. The ratings were compared and codes were agreed to produce gold-standard transcripts for the purposes of training. The manual was further refined and extended on the basis of coding meetings following this piloting process. Feedback was sought from service user representatives (n=2; male and female) from CHIVA (Children's HIV Association; a national UK charity for children and young adults living with HIV) who were over the age of 18, living

with HIV and currently taking ART. The manual was further refined and targeted examples were added to the manual such as this example of controlled motivation “I take my medication because I have no choice”. The final SMACS manual (see Appendix 3) requires the coding of all parsed client speech (as parsed using the MISC 2.5) as either autonomous motivation, controlled motivation or non-motivational client speech. The construct validity of this coding scheme will be explored by correlating the results with baseline scores on the TSRQ (Williams et al., 2004).

Coding training

MISC (2.5) training

The main researcher spent 30 hours training in the use of the MISC 2.5 while the research assistant spent 15 hours in training. Training followed the procedures outlined in Moyers and Martin (2006) and included identifying therapist questions and reflections, client questions, then moving to classifying the content of therapist and client speech, identifying different categories of change and sustain talk and MI-consistent and inconsistent responses. Dr Jon Houck (MISC 2.5 author) provided five sample gold-standard coded transcripts to the researcher which were used for training purposes. Parsing training was based on these transcripts. Coding was carried out using NVivo qualitative data analysis software version 11 (QSR International, 2015). The main researcher achieved a mean Cohen’s (1960) kappa result of .8 (almost perfect agreement; Landis & Koch, 1977) across all three higher order categories of interest (MICO responses, change talk, sustain talk) while the research assistant achieved at least .7 (substantial agreement; Landis & Koch, 1977).

SMACS training

The second research assistant received 10 hours of training in the SMACS. This involved reading key SDT literature and one-to-one teaching on using the coding manual. The excluded transcripts used during the piloting phase of the SMACS development where the codes had been agreed between the researcher and supervisor ($n = 4$), served as gold-standard transcripts for the purposes of training. Coding was carried out using Excel 2016. The research assistant achieved a mean Gwet's (2008) AC_1 of .9 (almost perfect agreement; Landis & Koch, 1977) across the three categories before commencing reliability-testing.

Reliability-testing

As the MISC 2.5 has never been applied to a HIV population and the SMACS is a novel coding tool it was necessary to establish the inter-rater reliability of both coding systems. A proportion of the research sample were randomly selected for double coding using a random number generator. Twelve sessions (22%) were double coded using the MISC 2.5 and 15 sessions (28%) were double coded using the SMACS. It is recommended that at least 20% of the sample should be double-coded when establishing inter-rater reliability for MI process research studies (Dobber et al., 2015). To prevent coding drift, coding meetings were held following every three sessions coded using the MISC 2.5 and every five sessions with the SMACS. Consultation was provided by the research supervisor for any outstanding disagreements following coding discussions. Inter-rater reliability estimates were interpreted using standard criteria. Both Kappa and Gwet's AC_1 statistics were interpreted according to Landis and Koch (1977) guidelines with values from .0 to .20

indicating slight agreement, .21 to .40 indicating fair agreement, .41 to .60 indicating moderate agreement, .61 to .80 indicating substantial agreement, and .81 to 1.0 indicating almost perfect or perfect agreement. ICC results were interpreted according to guidelines by Cicchetti (1994) whereby results less than .40 are poor, between .40 and .59 are fair, between .60 and .74 are good and results above .75 indicate excellent levels of inter-rater reliability.

Cohen's kappa (1960) was used to test the inter-rater agreement for the client and therapist speech on the MISC 2.5 as it is commonly used for assessing agreement between categories and is suitable for use with two coders and for fully-crossed designs which is where all coders code the data to establish inter-rater reliability (Hallgren, 2012). See Table 5 for the inter-rater reliability estimates for therapist and client speech as coded using the MISC 2.5 which indicated substantial agreement (Landis & Koch, 1977). The percentage agreement is also reported for reference.

Table 5 Inter-rater reliability of therapist & client speech using MISC 2.5

Variable	Kappa	Percentage Agreement
Change Talk	.69	92.21
Sustain Talk	.65	96.67
Follow/Neural/Ask	.71	90.70
MICO Responses	.77	91.55

As the global coding section of the MISC 2.5 produces continuous data the inter-rater reliability for MI spirit was calculated using intra-class correlations (ICC; McGraw & Wong, 1996). There are a number of ICC variants to choose from (Hallgren, 2012).

As it was a fully-crossed design, a two-way mixed ICC was most appropriate. The coding required perfect agreement between the two raters therefore an absolute agreement ICC was necessary. As a subset was being double coded and the remaining sessions were to be rated by one coder single-measures was more appropriate than average-measures ICC. Finally, as the coders were not randomly sampled from the population a mixed effects model was chosen over a random model. Therefore, the inter-rater reliability for MI spirit was calculated using a two-way mixed, absolute agreement, single-measures ICC. The resulting ICC was in the fair range, $ICC = .53$ (Cicchetti, 1994), indicating that coders had a fair degree of agreement but that there was some disagreement between coders. This result is comparable to reliability estimates achieved for MI spirit in other studies. For example, Gaume, Gmel and Daepfen (2008) achieved an ICC of .53 while Apodaca et al. (2013) report an ICC of .48.

Due to the nature of the SMACS whereby one code (non-motivational client speech) accounted for the majority of client speech (87%) a measure of inter-coder agreement such as Cohen's kappa (1960) or Krippendorff's alpha (1970) is not advised as these indices are affected by skewed distributions of categories (Di Eugenio & Glass, 2004; Feinstein & Cicchetti, 1990). One statistic which has been developed to overcome this prevalence problem and is demonstrated to be superior for use with skewed data is Gwet's (2008) AC_1 statistic (Wongpakaran, Wongpakaran, Wedding, & Gwet, 2013). Gwet's (2008) AC_1 statistic was used to investigate the inter-rater reliability of the SMACS (see Table 6). The overall inter-rater reliability as calculated by Gwet's AC_1 statistic was .89 indicating near perfect agreement (Landis & Koch, 1977). When considering the level of each code Gwet's AC_1 statistic of .95 (perfect agreement) was

achieved for non-motivational client speech, .45 (moderate agreement) was achieved for controlled motivation and a value of .32 (fair agreement) was reported for autonomous motivation. The lower reliability-estimates for autonomous and controlled motivation appeared to be due to difficulties in distinguishing between controlled and autonomous motivation in relation to ART adherence. Extensive coding meetings were held and further training was provided in an attempt to improve reliability. As the reliability was low the research supervisor checked all SMACS coding.

Table 6 Inter-rater reliability using SMACS

Variable	AC ₁	Percentage
		Agreement
Overall	.89	90.09
Autonomous Motivation	.32	32.81
Controlled Motivation	.45	31.19
Non-motivational client speech	.95	98.79

Validity-testing of the SMACS

The convergent validity of the SMACS was tested by correlating it with baseline results on the TSRQ (Williams et al., 2004) which is an established self-report measure of autonomous and controlled motivation. Pearson's product-moment correlation coefficients were used to explore the relationships between both autonomous and controlled motivation as measured by the SMACS and the autonomous and controlled motivation subscales on the TSRQ. There was no

relationship found between autonomous motivation as measured by the SMACS and the autonomous subscale of the TSRQ, $r(60) = .07$, $p = .64$, 95% BCa CI [-.42, .23]. There was no relationship found between controlled motivation as measured by the SMACS and the controlled subscale of the TSRQ, $r(60) = .06$, $p = .69$, 95% BCa CI [-.13, .43]. Consequently, the convergent validity of the SMACS was not established.

Analysis procedure

Data were analysed using IBM Statistical Package for the Social Sciences (SPSS) software version 21.0 (IBM, 2012). Alpha levels were set at $p < .05$ and all hypothesis testing was two-tailed to minimise the possibility of Type I errors. The data were screened for missing data and the normality of the data were tested. Pearson's product-moment correlation coefficients were used to explore the associations between the continuous variables. Mediation analysis was used to investigate the proposed indirect effect of therapist use of MICO methods and MI spirit on ART adherence as mediated by client change talk. The mediational models were tested using the bootstrapping approach to mediation (Preacher & Hayes, 2004) which was carried out using the PROCESS macro for SPSS (Hayes, 2012). These analyses are described in more detail in the results chapter.

Chapter 3: Results

Data screening

Following the procedures outlined by Tabachnick and Fidell (2013) the data were screened prior to the main analyses being conducted. This screening involved checking the accuracy of the data by ensuring that the minimum and maximum values for each measure fell within expected ranges.

Missing data

The only missing data was with the week 1 and week 2 ART adherence data. One participant had missing adherence data across both week 1 and week 2, another had no adherence data for week 1 and two lacked adherence data for week 2. As this study is investigating the relationship between client and therapist speech and ART adherence change it was decided to omit these cases from the study ($n = 4$; 6.1%) rather than impute the missing data.

Normality

Normality of the variables relevant to study hypotheses was assessed by inspecting histograms with normal curves and calculating standardised skewness and kurtosis statistics (z-scores). Given the sample size ($n = 62$) variables with skewness and kurtosis z-scores which exceeded 2.58 ($p < .01$) were considered to be significantly non-normal (Field, 2013). All variables were found to be non-normally distributed (see Table 7). The adherence data (percentage of doses taken on time at week 1, week 2 and week 12) was negatively skewed which was expected given the high level of

motivation to adhere to ART medication reported at baseline and the data reported in Goggin et al. (2013). MI spirit was also negatively skewed reflecting the high standard of the MI delivered. As the remaining data were derived from frequency counts the positively skewed distributions were expected (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013).

Table 7 Skewness & kurtosis z-scores

Variable	Skewness z-scores	Kurtosis z-scores
Week 1 percentage of doses taken on time	-4.48	1.25
Week 2 percentage of doses taken on time	-3.90	0.88
Week 12 percentage of doses taken on time	-3.00	-0.58
MI Spirit	-5.08	1.89
Change Talk	7.30	3.38
Sustain Talk	5.32	2.14
MICO Responses	3.54	1.97
Autonomous Motivation Talk	4.77	2.08
Controlled Motivation Talk	12.18	5.56

Transformations

Transformations of the data were explored in an attempt to improve normality (Tabachnick & Fidell, 2013). As some of the variables were negatively skewed with most scores being higher up the range it was necessary to reflect the variable first before carrying out the transformations. This was achieved by finding the largest score in the distribution adding 1 and subtracting each score from this (Tabachnick &

Fidell, 2013). The square root (SQRT) transformation was applied to the data in the first instance (see Table 8). Skewness and kurtosis z-scores below 2.58 ($p < .01$) were only achieved for the adherence data, sustain talk, MICO responses and autonomous motivation talk. A log 10 transformation was carried out on the remaining variables; MI spirit, change talk and controlled motivation talk. This transformation was successful for all variables but one (MI spirit). Additional transformations (inverse, squared, cubed) were applied without success to MI spirit (see Table 8).

Table 8 Skewness & kurtosis z-scores for transformed variables

Transformed Variable	Skewness z-scores	Kurtosis z-scores
Sqrt Week 1 (% doses taken on time)	1.82	-1.18
Sqrt Week 2 (% doses taken on time)	2.02	-1.32
Sqrt Week 12 (% doses taken on time)	0.90	-1.27
Sqrt MI Spirit	4.60	1.74
Sqrt Change Talk	4.26	2.10
Sqrt Sustain Talk	1.22	1.16
Sqrt MICO Responses	1.55	1.06
Sqrt Autonomous Motivation Talk	-0.28	-0.65
Sqrt Controlled Motivation Talk	4.55	2.83
Log 10 MI Spirit	4.27	1.60
Log 10 Change Talk	1.64	0.91
Log 10 Controlled Motivation Talk	-0.02	1.43
Inverse MI Spirit	-2.77	1.43
MI Spirit squared	-4.44	1.68
MI Spirit cubed	-3.78	1.50

Univariate outliers

An outlier is a case that has an extreme value on one variable (univariate) or a combined extreme score on two or more variables (multivariate) when compared with other observations within the dataset (Tabachnick & Fidell, 2013). Outliers can be a source of statistical bias (Field, 2013). Univariate outliers were identified by

inspecting the boxplots of both the raw and transformed data and noting any outliers identified. An inspection of z -scores was used to bolster and confirm the graphical identification of outliers. Three cases were identified across both methods of identifying outliers in the raw data but none were identified in the transformed data. The three cases were checked to ensure no errors were made in calculation or data entry. These cases were kept in the dataset as there was no theoretical bases for them to be removed or adjusted.

Robust methods

Alternative methods for dealing with non-normal data were explored seeing as a suitable transformation for MI spirit was not found and there was no justification to remove the outliers from the dataset.

With the increasing computational power of statistical software there are now more options available with regards to alternative statistical tests which do not rely on the assumption of normally distributed data (Field, 2013). One such robust method is bootstrapping. This is a statistical method of resampling and replacement whereby smaller samples of the same size are repeatedly drawn from and replaced in the original sample thus generating a bootstrap distribution with the aim that repeated sampling allows for an estimation of the true population (Efron & Tibshirani, 1993). The bootstrap procedure is used to estimate standard errors and confidence intervals of parameters of the distribution such as odds ratios and correlation coefficients (Efron & Tibshirani, 1993). Where sophisticated software is available, a minimum of 1,000 replications is advised to increase the chance of achieving confidence intervals which represent the population (Efron & Tibshirani, 1993). Bootstrapping methods

require fewer assumptions than traditional parametric tests (Hesterberg, Moore, Monaghan, Clipson, & Epstein, 2006). No assumptions about the population, normality of error terms or equal variance are made, therefore bootstrapping methods can be safely used with both parametric and non-parametric models (Efron & Tibshirani, 1993). One of the main limitations of bootstrapping methods is the fact that if the initial sample is biased then the bootstrapping will just replicate those biases (Hesterberg et al., 2006). Bootstrapping methods are also sensitive to sample size and a sample of at least fifty participants is advised (Sideridis & Simos, 2010).

Bootstrapping has been demonstrated to be a superior method for correcting for assumption violations (than transforming data) and controlling for Type I errors, particularly where the data is not normally distributed (Berkovits, Hancock, & Nevitt, 2000; Delucchi & Bostrom, 2004; Russell & Dean, 2000). Therefore, all analyses were conducted on the raw data with bootstrapping methods applied. As the data were skewed, the bootstrap bias-corrected accelerated (BCa) method (Efron, 1987) was used to control for the limitations of biases and sample size that are present in standard bootstrapping procedures. Confidence intervals were set at 95% and when interpreting these results a range that did not contain 0 denoted a significant effect at $p < .05$.

Descriptive statistics

Descriptive statistics for MI spirit, change talk, sustain talk, MICO responses, autonomous motivation talk, controlled motivation talk and ART adherence are presented in Table 9.

Following the recommendations given by Tabachnick and Fidell (2013) for reporting central tendency in skewed data the median and interquartile range are reported along with the mean and standard deviation.

Table 9 Descriptive statistics of coding and adherence data

Variable	Median	Interquartile Range	Mean	SD
Week 1 (% doses taken)	96.43	71.43 – 100.00	84.35	22.67
Week 2 (% doses taken)	100.00	76.79 – 100.00	86.28	25.71
Week 12 (% doses taken)	89.27	70.23 – 99.18	78.17	27.36
Week 1 (% doses taken on time)	85.71	62.50 – 100.00	76.05	29.85
Week 2 (% doses taken on time)	89.29	57.14 – 100.00	74.25	33.49
Week 12 (% doses taken on time)	78.57	53.00 – 95.21	69.42	29.38
MI Spirit (1 – 5)	4.00	3.92 – 4.00	3.88	0.28
Change Talk (count)	38.00	30.75 – 55.75	45.87	24.69
Sustain Talk (count)	13.00	8.00 – 18.25	16.00	12.65
MICO Responses (count)	62.50	48.00 – 76.00	63.95	22.07
Autonomous Motivation Talk (count)	3.00	1.75 – 6.00	4.26	3.94
Controlled Motivation Talk (count)	6.50	4.00 – 10.00	8.48	8.55

Exploratory bivariate analysis

Exploratory bivariate analyses were conducted to inform the interpretation of the hypothesis-driven analysis. The associations between therapist (MICO responses and MI spirit) and client (change talk and sustain talk) variables were explored using Pearson’s product-moment correlation coefficients. Pearson *r* values indicate the

magnitude and direction of a relationship. An r value of 0 indicates no relationship at all, a value of 1 indicates a perfect positive correlation, and a value of -1 indicates a perfect negative correlation. The strength of the relationship can be interpreted as small ($r = .10$), medium ($r = .30$), or large ($r = .50$) (Cohen, 1988). As the variables were skewed the bootstrap bias-corrected accelerated (BCa) method (Efron, 1987) was used to calculate 95% bootstrap confidence intervals. The number of bootstrap replications was set at 1,000.

There was a significant strong positive correlation between MICO responses and both change talk and sustain talk (see Table 10). There was also a significant medium correlation observed between change talk and sustain talk. There was no relationship found between MI spirit and change talk, $r(60) = .09$, $p = .47$, 95% BCa CI $[-.27, .44]$, sustain talk, $r(60) = .02$, $p = .91$, 95% BCa CI $[-.26, .25]$ or MICO responses, $r(60) = .01$, $p = .95$, 95% BCa CI $[-.32, .33]$.

Table 10 Pearson product-moment correlation coefficients (r) between Change Talk, Sustain Talk, MICO Responses and MI Spirit

Variable	1	2	3	4
1. MICO Responses	— .01			
2. MI Spirit	$[-.32, .33]$.66**	— .09		
3. Change Talk	$[-.36, .81]$.57**	$[-.27, .44]$.02	— .41**	
4. Sustain Talk	$[-.34, .76]$	$[-.26, .25]$	$[-.05, .68]$	—

Note. BCa 95% confidence intervals are contained in parentheses below each r value.
** $p < .001$

Pearson’s product-moment correlation coefficients were used to explore the relationships between both therapist variables (MICO responses and MI spirit) and client variables (change talk and sustain talk) and ART adherence (pre-MI session and post-MI session). BCa 95% confidence intervals were estimated. There were no significant associations found (see Table 11).

Table 11 Pearson product-moment correlation coefficients (r) between ART adherence (week 1, 2) and Change Talk, Sustain Talk, MICO Responses and MI Spirit

Variable	Pre-MI session	Post-MI session
	adherence Week 1	adherence Week 2
MICO Responses	-.01 [-.28, .26]	.01 [-.26, .27]
MI Spirit	.17 [-.16, .43]	.19 [-.06, .41]
Change Talk	.03 [-.23, .28]	.07 [-.13, .27]
Sustain Talk	.15 [-.07, .33]	.15 [-.10, .33]

Note. BCa 95% confidence intervals are contained in parentheses below each *r* value.

Partial correlations were performed to explore the relationship between both therapist variables (MICO responses and MI spirit) and client variables (change talk and sustain talk) and ART adherence post-MI session (week 2) whilst controlling for pre-MI session adherence levels (week 1). BCa 95% confidence intervals were estimated. After controlling for pre-MI session ART adherence (week 1) there were no associations found between post-MI session ART adherence (week 2) and MICO responses $r(59) = .03$, $p = .848$, 95% BCa CI [-.26, .36]; MI spirit $r(59) = .11$, $p =$

.397, 95% BCa CI [-.14, .38]; change talk $r(59) = .06$, $p = .629$, 95% BCa CI [-.14, .24]; or sustain talk $r(59) = .07$, $p = .575$, 95% BCa CI [-.24, .32].

Hypothesis driven analysis

Mediational analysis was used to investigate the proposed indirect effect of MICO responses and MI spirit on ART adherence as mediated by client change talk. The bootstrapping approach to mediation (Preacher & Hayes, 2004) was taken as unlike the widely used causal steps approach (Baron & Kenny, 1986) it does not rely on the assumption of normality in the distribution of the variables and therefore was more appropriate for the study data. Bootstrapping holds advantages over other mediational approaches as it is more statistically powerful and the risk of making Type I errors is reduced (MacKinnon, Lockwood, & Williams, 2004). Specifically bias-corrected bootstrapping has been found to be the most powerful bootstrapping method to use when carrying out mediational analyses (Hayes & Scharkow, 2013). A simple mediational model was employed to test hypothesis 1 and 2 (Preacher & Hayes, 2004). Simple mediation allows for the addition of covariates to the model (Hayes, 2012) which assists in removing potential sources of spurious relationships between the variables. To account for the temporal aspects of mediation analyses the pre-MI session ART adherence data (week 1) was entered as a covariate into both mediational models.

Bootstrapping mediational analyses were carried out using the PROCESS macro V2.16 as an add-on to SPSS (Hayes, 2012). As recommended by Hayes (2009) 5,000 bootstrapped replications were performed and the bias-corrected approach was used to estimate the 95% confidence intervals.

Hypothesis 1: client change talk during MI session 1 will mediate the relationship between therapist use of MICO methods in MI session 1 and post-session change in ART adherence

A simple mediational model was employed to test hypothesis 1 which consisted of estimating the indirect effect of an independent variable X (MICO responses) on the dependent variable Y (ART adherence change) via an intervening or mediating variable M (change talk) (Preacher & Hayes, 2004). The independent variable (MICO responses) and the mediator variable (change talk) were both counts of speech during the MI session. The dependent variable (ART adherence change) consisted of the percentage of doses taken on time in the week following the MI therapy session. The covariate (pre-session ART adherence) consisted of the percentage of doses taken on time in the week preceding the MI session. See Table 9 for descriptive statistics of the variables entered into the model. Figure 4 shows the simple mediational model with the regression coefficients.

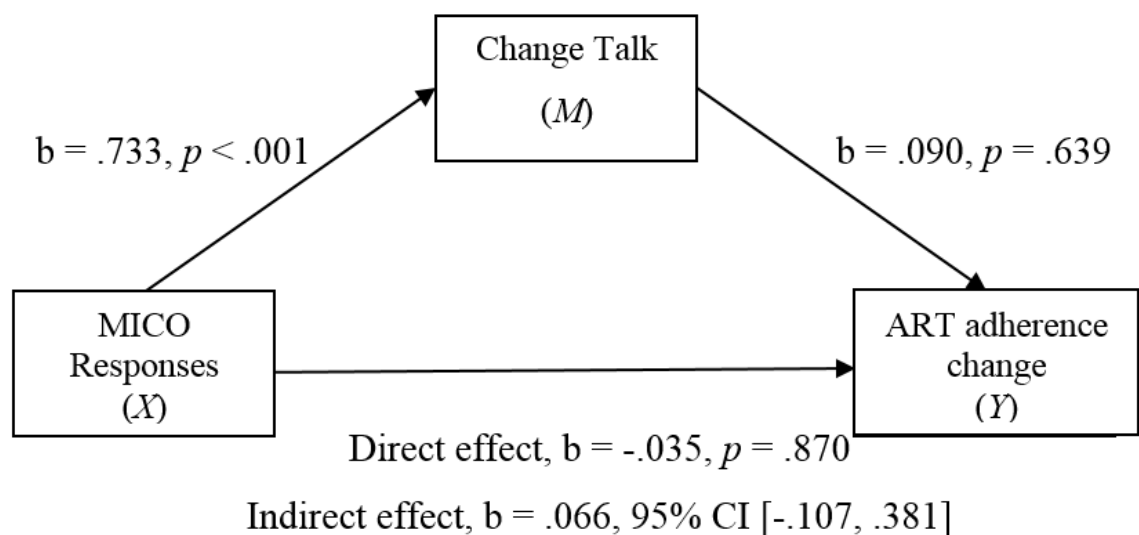


Figure 4 Simple mediation model of hypothesis 1

The regression coefficients, standard errors and significance values for the simple mediation model as displayed in Figure 4 are shown in Table 12. As shown in both the table and figure there was a significant positive relationship between MICO responses and change talk (path *a*) however the association between change talk and ART adherence (path *b*) was non-significant. The direct effect of MICO responses and ART adherence (path *c*) was also found to be non-significant; $b = -.035, p = .870$, 95% CI [-.460, .390]. The results indicate that higher levels of MICO responses were associated with higher levels of client change talk. No other associations were found.

Table 12 Mediation model coefficients for MICO Responses on ART adherence via Change Talk

Antecedent		Consequent						
		M (Change Talk)			Y (ART adherence change)			
		Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	
X (MICO)	<i>a</i>	0.733	.110	<.001	<i>c'</i>	-.035	.213	.870
M (Change Talk)		—	—	—	<i>b</i>	.090	.190	.639
constant	<i>i</i> ₁	-3.364	9.716	<.001	<i>i</i> ₂	22.280	14.210	.122

Note. SE= Standard error. *i*₁ and *i*₂ = regression intercepts. Coeff. = coefficient.

The indirect effect of MICO responses (*X*) on ART adherence (*Y*) via change talk (*M*) was estimated. This is quantified as the product of the regression coefficient estimating path *a* (relationship between MICO responses and change talk) and the coefficient of path *b* (association between change talk and ART adherence). There was no significant indirect effect of MICO responses on ART adherence through change talk found; $b = .066$, 95% BCa CI [-.107, .381]. Therefore, the data are inconsistent with the hypothesis of mediation.

Hypothesis 2: client change talk during MI session 1 will mediate the relationship between MI spirit in MI session 1 and post-session change in ART adherence

Hypothesis 2 was also explored using mediational analyses. A simple mediational model was developed which consisted of estimating the indirect effect of MI spirit (independent variable X) on ART adherence change (dependent variable Y) through the effect of change talk (mediating variable M). Again, pre-session ART adherence data (week 1) was entered as a covariate. The bias-corrected approach to bootstrapping was taken and 5,000 bootstrapped replications were carried out to estimate the 95% confidence intervals. The new variable in this model – MI spirit – was a global measure of the level of MI spirit demonstrated by the therapist during the session. Descriptive statistics for the variables in the model are shown in Table 9.

The simple mediational model to investigate hypothesis 2 is shown in *Figure 5*, along with the regression coefficients from the analyses.

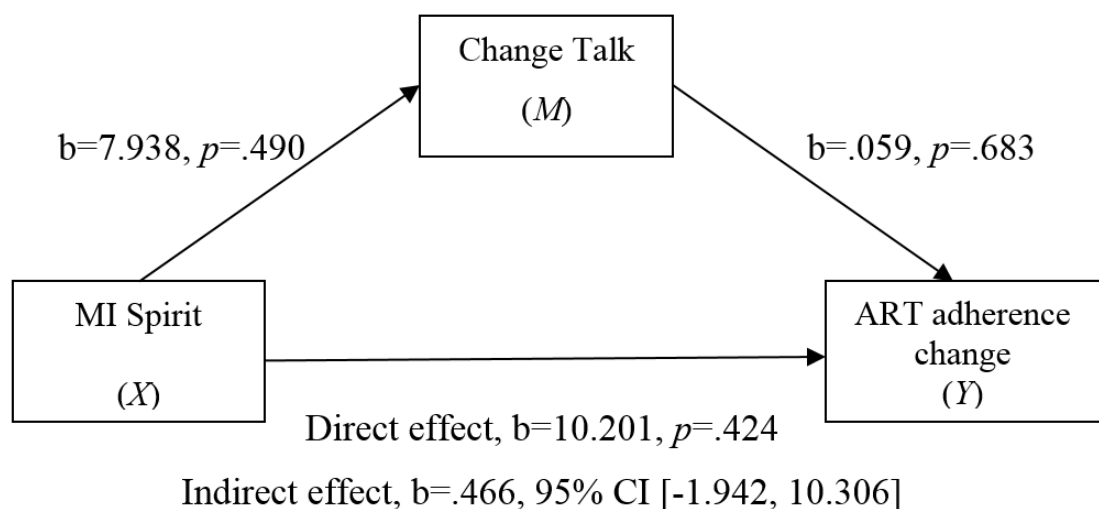


Figure 5 Simple mediational model of hypothesis 2

The regression coefficients, standard errors and significance values for the simple mediation model depicted in *Figure 5* are displayed in Table 13. There were no significant associations found between MI spirit and change talk (path a) or between change talk and ART adherence (path b). The direct effect of MI spirit and ART adherence (path c') was also found to be non-significant; $b = 10.201, p = .424, 95\%$ CI [-15.133, 35.534].

Table 13 Mediation model coefficients for MI Spirit on ART adherence via Change Talk

Antecedent		Consequent						
		M (Change Talk)			Y (ART adherence change)			
		Coeff.	SE	<i>p</i>	Coeff.	SE	<i>p</i>	
X (MI Spirit)	<i>a</i>	7.938	11.438	.490	<i>c'</i>	10.201	12.656	.424
M (Change Talk)		—	—	—	<i>b</i>	.059	.144	.683
constant	<i>i</i> ₁	14.110	43.899	.749	<i>i</i> ₂	-16.988	48.418	.728

Note. SE= Standard error. *i*₁ and *i*₂ = regression intercepts. Coeff. = coefficient.

The indirect effect of MI spirit (*X*) on ART adherence change (*Y*) via change talk (*M*) was estimated. There was no significant estimated indirect effect of MI spirit on ART adherence through change talk found; $b = .466, 95\%$ BCa CI [-1.942, 10.306]. Hence the findings shown no support for hypothesis 2.

Hypothesis 3: higher levels of ART adherence will be more closely associated with naturally occurring autonomous motivation talk than controlled motivation talk expressed during MI session 1

Pearson’s product-moment correlation analyses were carried out to test the relationship between both autonomous and controlled motivation talk and percentage of doses taken before (week 1) and after the first MI session (week 2, week 12). As the data were skewed BCa 95% confidence intervals were estimated. Across the three time points for ART adherence data the correlation coefficients were larger for autonomous motivation talk than for controlled motivation talk (see Table 14). There was a medium significant positive correlation between autonomous motivation talk and ART adherence in the week following the MI session (week 2), $r(60) = .28$, $p < .05$, 95% BCa CI [.06, .45]. There were no other significant correlations observed.

Table 14 Pearson product-moment correlation coefficients (r) between ART adherence (week 1, 2, 12) and Autonomous and Controlled Motivation Talk

Variable	Autonomous Motivation Talk	Controlled Motivation Talk
	.08	-.01
Week 1 (% of doses taken on time)	[-.15, .27]	[-.29, .31]
	.28*	-.10
Week 2 (% of doses taken on time)	[.06, .45]	[-.31, .11]
	.20	.03
Week 12 (% of doses taken on time)	[-.06, .39]	[-.13, .23]

Note: BCa 95% confidence intervals are contained in parentheses below each r value.

* $p < .05$.

Follow up tests for dependent correlations were carried out to investigate if the correlation coefficients were significantly different from one another. The correlation coefficients were converted to z -scores using Fischer’s transformation and established equations were applied to compute the asymptotic covariance of the estimates. Then an asymptotic z -test was performed (Lee & Preacher, 2013; Steiger, 1980).

The association between autonomous motivation talk and ART adherence after the MI session (week 2) was significantly larger than the association between controlled motivation talk and ART adherence at week 2; $z = 2.37$, two-tailed, $p = .018$. The association between autonomous motivation talk and ART adherence at week 1 was not significantly larger than the association between controlled motivation and week 1 ART adherence data; $z = 0.51$, two-tailed, $p = .61$. The association between autonomous motivation talk and week 12 ART adherence data was also not significantly different from the relationship between controlled motivation and ART adherence at week 12; $z = 1.03$, two-tailed, $p = .30$.

The fact that association between autonomous motivation talk and ART adherence after the MI session (week 2) was significantly larger than the association between controlled motivation talk and ART adherence at week 2 offers partial support for hypothesis 3. Higher levels of ART adherence were more closely associated with naturally occurring autonomous motivation talk than controlled motivation talk.

Chapter 4: Discussion

In this final chapter, the aims of the study are revisited. The findings are summarised and discussed within the context of existing empirical studies and theoretical frameworks. The strengths and limitations of the study are considered and potential directions for future research are offered. Finally, the clinical implications of the study are outlined.

Research aims

The main aim of the study was to investigate MI mechanisms of change within the context of ART adherence in adults living with HIV. Based on the causal chain model of MI developed by Miller and Rose (2009) it was predicted that both therapist use of MICO methods and therapist MI spirit would have an indirect positive effect on improving ART adherence by eliciting client change talk. Therefore, it was hypothesised that MI spirit, MICO responses and client change talk would act as mechanisms of change for ART adherence.

A secondary aim of the study was to explore the relationship between ART adherence and more fine-grained naturally occurring motivational speech than MI specifies.

SDT proposes that motivation lies on a continuum from fully self-determined to non-self-determined action with autonomous motivation being more self-determined than controlled motivation (Deci & Ryan, 2008). Autonomous motivation has been shown to have a stronger relationship with health related behaviours than controlled motivation does (Hagger et al., 2014). Autonomous motivation has also been shown to be associated with ART adherence (Kennedy et al., 2004). Autonomous motivation

is typically measured using self-report questionnaires however self-report measures can be unreliable measurement tools as they are subject to biases in memory, context and mood (Schwarz & Oyserman, 2001). The existing measures of autonomous and controlled motivation were developed using a deductive top-down approach to item generation. It is argued that an inductive bottom-up approach to the measurement of psychological constructs which considers the perspective of the participant is necessary to establish construct validity (Brod et al., 2009). This study aimed to measure autonomous and controlled motivation using an inductive approach through the observational method of coding naturally occurring speech and it is argued that this may be a more valid measurement process than using self-report measures. It was predicted that naturally occurring autonomous motivation talk was more likely to be related to ART adherence levels than controlled motivation talk.

Overview of findings

Three hypotheses were tested in the study and the findings for each hypothesis will be presented and discussed in turn.

Hypothesis 1

Client change talk during MI session 1 will mediate the relationship between therapist use of MICO methods in MI session 1 and post-session change in ART adherence

The findings of the study were inconsistent with regards to the hypothesis that change talk mediates the relationship between therapist use of MICO methods and change in ART adherence. This contradicted previous MI studies investigating the technical pathway of the MI model. Pirlott et al. (2012) found evidence that client change talk

mediated the relationship between therapist use of MICO methods and change in fruit and vegetable consumption. However this study relied on difference scores (difference between fruit and vegetable intake at baseline and 1 year follow up) which are thought to be inherently unreliable (Edwards, 1994). The technical component of MI was also upheld in research by Moyers et al. (2009) who found an indirect effect of MICO responses on alcoholic drinks per week through client change talk. This study used multilevel modelling to control for baseline level of drinks per week. In contrast to the current study both studies which found evidence for the technical pathway demonstrated large changes in target behaviour. For example, in Moyers et al. (2009) the mean drinks per week pre-MI session was 76.3 and this had reduced to 6.8 by week 5 (time-point used for mediation analysis) and Pirlott et al. (2012) reported that almost half of the sample had increased their fruit and vegetable intake by at least 50% following MI sessions.

Similar to the current research study Vader et al. (2010) in a sample of heavy-drinking college students, did not find evidence that client change talk mediated the relationships between therapist use of MICO methods and drinking outcomes (using multilevel modelling) but did find an association between therapist use of MICO methods and client change talk. In contrast to Moyers et al. (2009) and Pirlott et al. (2012) the mean change in target behaviour was relatively small for example mean baseline drinks per week for the MI group was 16.05 and this had reduced to 12.43 by the 3 month follow up. This mirrors the current study where the change in ART adherence following the MI session was relatively small.

The current study provides some evidence in partial support of the technical pathway of the MI model in that there was a relationship found between therapist use of MICO methods and client change talk. Higher levels of MI consistent therapist responses were associated with higher levels of client change talk. These findings replicate other studies which have shown a positive relationship between therapist use of MICO methods and client change talk in the context of MI sessions targeting smoking behaviour (Catley et al., 2006) and alcohol use (Apodaca et al., 2013). Sequential analyses which offer additional support for the temporal nature of the mechanism have also found a stronger association for MICO responses eliciting client change talk than vice versa (Gaume, Gmel, Faouzi, & Daepfen, 2008; Moyers et al., 2007).

The absence of a relationship between overall therapist use of MICO methods and outcome as observed in this study diverges from Moyers et al. (2009) who found a relationship between therapist use of MICO methods and fewer alcoholic drinks in a group of problem drinkers. Similar to the findings of the current study an absence of a direct relationship between overall therapist use of MICO methods and outcome has also been observed with partner aggression in a group of physically aggressive young adult college student couples (Woodin, Sotskova, & O'Leary, 2012). However, this study also explored each MICO method separately and found a relationship for one technique namely ratio of reflections to questions. The absence of a relationship between therapist use of MICO methods and ART adherence stands in contrast to the study carried out by Thrasher et al. (2006). They found an association between both ratio of reflections to questions and affirming statements and ART adherence levels in a sample of HIV positive patients in the United States, although they did not control for baseline adherence levels. It is possible that only certain MICO methods such as

ratio of reflections to questions may be related to change in ART adherence however the current study focused on an aggregate measure of MICO methods and did not explore relationships at the level of individual techniques in an effort to limit type I errors.

The absence of a mediation effect was unexpected considering the results from existing process research studies as outlined above. One explanation for the null findings in the current study is the fact that the sample reported high levels of depressive symptoms and depression has been shown to be associated with poor adherence to ART (Langebeek et al., 2014). This is less likely to explain the findings in this case as participants achieved relatively high levels of pre-MI session ART adherence despite experiencing high levels of depressive symptoms. Another possible explanation was the lack of variability in the dependent variable. Both Moyers et al (2009) and Pirlott et al. (2012) observed large variability in the target behaviour before and after the MI intervention. The restricted range observed in change in ART adherence may have limited the effect size observed (Goodwin & Leech, 2006).

Another possible contributor to the null findings in this study is that the dependent variable was only based on one session of MI. It is possible that MI may have a dosage effect. Pradier et al. (2003) found that ART adherence was superior for those who completed at least three sessions of MI in comparison to those who had just had one or two sessions. This is a possibility as both studies which found evidence in support of the mediated effect of the technical component (Moyers et al., 2009; Pirlott et al., 2012) were based on more than one session of MI, whereas the other study to fail to find evidence for the indirect effect of therapist use of MICO methods on

behaviour change via change talk was also based on only one session of MI (Vader et al., 2010).

Another likely explanation for the null findings observed were the high levels of baseline motivation reported by participants. MI is an intervention which has been developed to target ambivalence and has been shown to be most effective for people who are experiencing low levels of motivation for behaviour change (Hettema & Hendricks, 2010). The sample in this study were highly motivated. Baseline motivation was not measured in the other studies outlined above thus comparisons cannot be made. However, it is unlikely that the sample in the current study would benefit from or require an intervention which targets motivation. Any low adherence observed in the sample was more likely to have related to a different aspect of the IMB model of ART adherence and an intervention targeting adherence-related information (adherence education training) or behaviour skills (using reminder devices) for those who were struggling to adhere to ART may have been more suitable.

Hypothesis 2

Client change talk during MI session 1 will mediate the relationship between therapist MI spirit in MI session 1 and post-session change in ART adherence

There was no evidence found in support of the relational pathway of MI within the context of improving ART adherence levels; namely change talk was not found to mediate the relationship between MI spirit and ART adherence. In fact, there were no significant associations found between any of the variables both with and without controlling for baseline adherence. This result was in contrast to other research

studies. Pirlott et al. (2012) found an indirect effect of MI spirit on daily fruit and vegetable consumption (without controlling for baseline intake) via client change talk in a group of firefighters. Catley et al. (2006) found a relationship between MI spirit and increased client change talk in a smoking cessation trial for African-American smokers. Grodensky et al. (2017) reported an association between MI spirit and fewer instances of unprotected anal/vaginal intercourse at 8-month follow up in a group of American adults attending a HIV clinic. Baseline rates of unprotected anal/vaginal intercourse do not appear to have been factored in to the analysis.

The non-significant associations found when testing the relational pathway of the MI model have been noted in other studies. In a sample of people receiving medical treatment at an emergency department following the consumption of alcohol Apodaca et al. (2013) did not find a significant relationship between MI spirit and client change talk during an MI session targeting alcohol use. An absence of a relationship between MI spirit and outcome has been demonstrated for partner aggression in a group of physically aggressive college student couples (Woodin et al., 2012) and alcohol use outcomes in a group of hazardous alcohol drinkers attending the emergency department of a Swiss hospital (Gaume, Gmel, & Daeppen, 2008).

The absence of a mediation effect was not anticipated and neither were the lack of statistically significant associations between variables. As with hypothesis 1 the null findings might be accounted for by the high levels of depressive symptoms in the sample or the possible dosage effect of MI may explain the lack of associations found. The absence of a relationship between client speech or therapist MI spirit and ART adherence change may also be explained by the scripted nature of the therapy

sessions. In an attempt to control for variation between therapists the MI was manualised and each therapy session followed the same general structure.

Manualised MI has been associated with poorer outcomes when compared to non-manualised MI (Hettema et al., 2005). The manualised nature of the session may have also led to reduced variability in therapist performance which is indicated by the high MI spirit scores observed across the sample. Measurement error may have also contributed to the research findings. The inter-rater reliability estimates for MI spirit although in line with other studies (Apodaca et al., 2013; Gaume, Gmel, & Daeppen, 2008) are only fair and indicate considerable disagreement between raters which may represent measurement error. There was little variability in the scores for MI spirit with all the therapists achieving high scores. This may reflect a lack of sensitivity in the scale to detect difference in levels of MI spirit in therapists who are proficient in MI. A restricted range in both variables (MI spirit and ART adherence change) is a situation where low variability is most likely to influence a correlation (Goodwin & Leech, 2006). Consequently, the null findings between MI spirit and ART adherence may be explained by low variability observed in both variables.

As with hypothesis 1 the most likely explanation for the null findings for hypothesis 2 is the high levels of baseline motivation observed. MI is an intervention which aims to increase motivation to change a target behaviour and unsurprisingly it has been found to be most effective with those experiencing ambivalence or low motivation to change (Hettema & Hendricks, 2010). Therefore, the high baseline motivation levels limit the possibility of MI producing an effect. Another ceiling effect which may explain the null findings for both hypotheses is the high level of adherence to ART observed prior to the delivery of the MI session. High levels of ART adherence left little opportunity

for improvement in ART adherence and would have reduced the chances of finding a relationship between the proposed mechanisms of change and ART adherence.

Hypothesis 3

Higher levels of ART adherence will be more closely associated with naturally occurring autonomous motivation talk than controlled motivation talk expressed during MI session 1

The results of this study offer tentative support for hypothesis 3 as there was a significant medium strength relationship found between autonomous motivation talk and ART adherence in the week following the MI session (week 2) and there was non-significant associations found between controlled motivation talk and percentage of ART doses taken on time. The association between autonomous motivation and ART adherence at week 2 was significantly larger than the association between controlled motivation and ART adherence at the same time-point. These results are in line with previous research which has shown that autonomous motivation has a larger effect on health behaviour outcomes than controlled motivation does (Hagger et al., 2014) and that autonomous motivation is related to successful long-term medication adherence (Williams et al., 1998). The results also offer support for research carried out by Kennedy et al. (2004) which found a small association between autonomous motivation and doses of ART taken on time. However, these results must be interpreted cautiously as there were no significant relationships found between either autonomous or controlled motivation and ART adherence at weeks 1 and 12 and had Bonferroni correction been applied the results would no longer be significant.

The absence of relationships found between autonomous motivation and ART adherence at weeks 1 and 12 may be explained by limitations in the validity and reliability of the SMACS as a measurement tool. Convergent validity could not be established as there was no associations found between scores on the SMACS and an established measure of autonomous and controlled motivation namely the TSRQ (Williams et al., 2004). The reliability estimates of the SMACS at the level of autonomous motivation talk and controlled motivation talk were fair and moderate respectively.

This study is the first to measure naturally occurring within-session autonomous and controlled motivational talk. Previous studies which have related autonomous and controlled motivation to behaviour outcome have relied on self-report measures such as the TSRQ (Williams et al., 2004) or the Behavioural Regulation In Exercise Questionnaire (Mullan et al., 1997). Although the validity and reliability of the SMACS may be limited in the current study it is promising that it detected a medium effect size in the relationship between autonomous motivation and ART adherence given a previous study using the TSRQ was only able to find a small effect ($r = .15$) between these two variables (Kennedy et al., 2004). The development of the SMACS and its use within this study offers encouragement for future research to explore the measurement of autonomous and controlled motivation within the context of naturally occurring speech.

Limitations

There are several limitations to the current study which must be taken into consideration when interpreting the findings.

Research design

This study employed a predominantly cross-sectional design whereby there was no manipulation of variables. The session coding data was measured at one-time point. However, ART adherence was measured at different time-points across the study. Cross-sectional designs represent an economical and time efficient way to collect research data. The data is collected at a specific point in time allowing for the tracking of patterns in the data which can then be used to build evidence in support of theoretical models (Howitt & Cramer, 2011). However cross-sectional designs are limited by the fact that they cannot be used to establish causality as they do not allow for the manipulation of the mechanisms (Tabachnick & Fidell, 2013). There have been some process research studies within MI which have taken an experimental approach. Miller et al. (1993) randomly assigned participants to counselling in line with the principles of MI and directive-confrontational counselling before coding therapist behaviours. Glynn and Moyers (2010) manipulated the intervention offered within-session by instructing the therapist to alternate between delivering MI and a non-MI behaviour change intervention (functional analysis) every 12 minutes. Finally, a recent study randomised therapists to two types of MI training one of which emphasised eliciting and selectively reinforcing client change talk (Moyers, Houck, Glynn, Hallgren, & Manuel, 2017). As this study was a secondary data analysis it was not possible to influence the planning of the design of the study.

Cross-sectional designs do not account for the timeline of change. Kazdin (2007) points out that many process research studies use language which implies that a timeline has been established, for example that therapist use of MICO methods

precedes or predicts client change talk. However, it is argued that the timeline of change can only be truly established by building it in to the research design through the use of experimental approaches and multiple assessments of proposed mechanisms and outcomes throughout the treatment (Kazdin & Nock, 2003). It is possible to examine the temporal changes within a session through sequential analysis (e.g., Gaume, Gmel, Faouzi, et al., 2008; Moyers et al., 2007). As this study was the first test of the technical and relational pathways within the context of ART adherence a less-resource intensive method than sequential analysis is advised as a first step to establish promising candidates for the MI model in a new population (Miller & Moyers, 2015).

Another limitation of the design of the study is that it is vulnerable to the risk of reverse causation which can limit the internal validity of the study (Elliott, 2010). Correlational studies which show a relationship between x and y usually assume a direction namely that x causes y , or in the case of this study that therapist use of MICO methods increases client change talk. However reverse causation where y causes x or client change talk increases therapist use of MICO methods is also possible. Previous sequential analyses of therapist and client exchanges during MI sessions suggest that therapist use of MICO methods elicits client change talk more strongly than client change talk elicits therapist use of MICO methods (Gaume, Gmel, Faouzi, et al., 2008; Moyers et al., 2007). This temporal evidence reduces the risk of reverse causation affecting the finding in this study that higher levels of therapist use of MICO methods were associated with higher levels of client change talk.

It is worth noting that although the research design may limit some of the conclusions that can be drawn, this research study has been modelled on a number of other key process research studies within the MI field such as Moyers et al. (2009) and Pirlott et al. (2012). Findings from process research studies which employ a cross-sectional design can be combined with experimental process studies (e.g., Glynn & Moyers, 2010; Miller et al., 1993; Moyers et al., 2017) to demonstrate that a variable does in fact act as a mechanisms of change (Nock, 2007).

Methodological issues

The internal validity of the study is impacted by the fact that potential extraneous variables such as demographic or clinical information were not taken into consideration as part of the analysis of the study. It is possible that variables such as levels of depression, problems with substance misuse and the side effects of ART could have had an impact on the outcome of the study as these factors have been shown to be associated with ART adherence (Langebeek et al., 2014) and to be moderating variables in the IMB model of ART adherence (Fisher et al., 2008). These patient-level factors of adherence were not factored into the analyses as the addition of potential covariates or moderators would have required a larger sample which was not possible given the time constraints of the project. It is also possible that demographic information such as ethnicity may have affected the internal validity of the study. MI has been shown to have larger effects in ethnic minority populations in comparison to non-minority white populations (Hettema et al., 2005) although not necessarily African-Americans (Lundahl et al., 2010). To limit both type I and type II errors being made it was decided to limit the study to variables which have been

shown to be associated with the clinical MI model (Miller & Rose, 2009). Given the weak univariate relationships observed it is unlikely that controlling for the above variables would have resulted in significant relationships between the hypothesis-driven variables.

This research study is vulnerable to non-response bias whereby characteristics of the participants who consent to take part in the study are different from those who refuse to take part which can result in a sample that is not representative of the population under study (Mann, 2003). In the original RCT 31% ($n = 97$) of eligible participants declined to take part in the study and the most common reasons for refusal were being too busy, having a lack of interest in research or planning to move out of the catchment area of the study (Goggin et al., 2013). It is possible that non-response bias may affect the external validity of this study and must be taken into consideration when interpreting the findings.

It is possible that the varying length of the sessions and the natural verbosity of the therapist or client may have potential confounding effects among behaviour count variables for coding data (Holsclaw et al., 2015). The longer the session or certainly the more talkative the therapist or client the greater the chance of the relevant coding variables (change talk, MICO responses, autonomous and controlled motivation talk) being observed thus increasing the likelihood of a type I error being made (Holsclaw et al., 2015). It is possible that the positive association found between MICO responses and change talk may be influenced by the length of the session. The fact that MI spirit – a global measure and therefore not as influenced by session length – and change talk were found to be unrelated makes it more likely that session length

may have acted as a potential confounding variable. The potential confounding nature of session length and verbosity of speech during the session must be held in mind when interpreting the results of the study.

Another factor relating to the external validity of the study was the fact the therapists delivered the MI session according to a semi-structured script whereby each therapist had a list of questions or topics that they were required to cover during the session. Each session included in the current study broadly followed the same structure. The session commenced with a recap of the previous meeting, clarification whether the participant had read the ART education information given to them, review of MEMS data and a check of what were the positive and negatives that the participant had noticed due to taking the medication. Participants were then asked to identify any personal barriers or facilitators to ART adherence. The participants were asked to rate on a scale from 1 – 10 the level of importance and confidence they felt in relation to their ART adherence. Follow up questions were asked relating to where they placed themselves on the scale. The therapist then presented a list of values and asked the participants to pick their top two from the list. Participants were also invited to choose a value that was not on the list. Participants were then invited to think about how their values linked to their ART adherence. Finally, the session ended with the client being invited to set an adherence goal which would be followed up at the next session. An intervention script or protocol was deemed necessary to ensure that comparable MI treatment was delivered across the RCT. However, review studies have shown that manualised MI is less effective than non-manual guided MI (Hettema et al., 2005) particularly when compared to treatment as usual (Lundahl et al., 2010). It is argued that the reduction in responsiveness and flexibility that can accompany the delivery of

protocol driven MI interventions can result in increased resistance and sustain talk making behaviour change less likely (Amrhein et al., 2003) .

Another limitation is that outcome adherence rates used in the study are only based on one session of MI and it is possible that one session might not have been sufficient to positively influence ART adherence. Much of the MI process research has been carried out with substance misuse. Meta-analytic research has shown that one session was the minimum effective dose to reduce alcohol use whereas studies showing an effect of MI for target behaviours associated with diet and exercise and medication adherence consisted of between four and eleven MI sessions (VanBuskirk & Wetherell, 2014). Pradier et al (2003) found that ART adherence was significantly higher for the participants who completed three sessions of MI compared to those that only completed one or two sessions.

Use of historical data

One key limitation of the study is that the data for the original RCT was collected between December 2004 and August 2009 (Goggin et al., 2013). This is important to factor in when considering the clinical implications of this study. At the time of the RCT the guidelines for prescribing ART advised that ART was only recommended for people who were displaying clinical symptoms of HIV or had a CD4 count of ≤ 200 cells/mm³, and ART was to be considered on an individual basis with CD4 count between 200 and 350 cells/mm³ for those who were asymptomatic (Hammer et al., 2006; Yeni et al., 2004). Since 2015 it is now recommended that all people living with HIV should be prescribed ART regardless of CD4 count or viral load (World Health Organization, 2016). This is an important change as now there is likely to be

more variation in HIV-related indices and thus potentially adherence motivation among those who are prescribed ART than was observed in the current sample. For example, many of the people taking part in the study were experiencing negative effects of the disease such as symptoms of HIV or low CD4 counts which may have increased their levels of motivation to adhere to ART. This is in contrast to the present where many people being prescribed ART may have healthy CD4 counts and be symptom free and thus may be less motivated to adhere to ART.

Measurement

Measurement error is a common methodological issue which applies to all psychotherapy process research (Hill & Lambert, 2004). Both process measurement tools used in this study (MISC 2.5 and SMACS) have certain limitations which must be considered when interpreting the results.

For the MISC 2.5 one potential source of measurement error is the mediocre levels of inter-rater reliability observed for MI spirit. The ICC between the main coder and the second coder was .53 which according to the criterion guidelines (Cicchetti, 1994) represents a fair level of inter-rater reliability. The ICC results suggests that there was some disagreement in coding between raters and this disagreement could represent measurement error. Consequently, it is possible that the null findings observed when testing hypothesis two may be partially explained by measurement error. Existing process research which has tested MI spirit used earlier versions of the MISC to measure MI spirit and report inter-rater reliability statistics ranging from fair to excellent. Catley et al. (2006) report an ICC value of .79 for MI spirit in the context of MI sessions targeting smoking behaviour, Gaume, Gmel and Daeppen (2008)

achieved an ICC of .53 while Apodaca et al. (2013) report an ICC of .48 with both studies targeting alcohol use.

The lack of variability observed in the scores for MI spirit might indicate that the global rating scale of the MISC 2.5 is not sensitive enough for use with therapists who adhere correctly to the MI model. The initial items on the scale were redundant with all therapists scoring at least 3 which may reflect a lack of sensitivity in the scale to detect difference in levels of MI spirit in proficient MI therapists. This may represent a measurement limitation of the MISC 2.5.

The parsing of the transcripts is another area of potential measurement error. The MISC 2.5 manual advises that coding of a session should not be carried out by the same person who parsed the session (Houck et al., 2010). Moyers and Martin (2006) found that simultaneously parsing and coding a transcript resulted in difficulties in assessing reliability. It is suggested to use different coders for the parsing and coding passes of the MISC 2.5 to avoid a bias in parsing. Due to the nature of the research project and limited resources it was necessary for the author to carry out both the parsing and coding for all MI sessions. In an attempt to reduce the risk of measurement error in the parsing process the transcripts were parsed separate to the coding framework being applied. Any parsing queries were resolved by the research supervisor.

The final potential source of measurement error was the MISC 2.5 coding training. Dobber et al. (2015) recommends at least 35 hours to reduce risk of coding bias and thus reduce measurement error. Due to limited time, it was only possible to spend 15 hours training the second coder for the purposes of inter-rater reliability. In retrospect,

this training was limited by the fact that more time was dedicated to the behavioural coding rather than the global coding aspect of the tool. This occurred as the behavioural coding section of the manual is more extensive and complex than the relatively straightforward global coding requirement.

Although it was not possible given the scope of the project, reliability of the MISC 2.5 would have been improved by having as many coders as possible code the data and this would have helped to limit any potential bias in the data (Hill and Lambert, 2004). As the main coder achieved an almost perfect level of fidelity to the gold standard transcripts during the training phase and the supervisor checked coding for one session out of every five to prevent coding drift, it is hoped that the measurement bias in the data is minimal.

As the SMACS is a new tool which has been developed specifically for this study to measure autonomous and controlled motivational talk within an MI session it is important to consider its limitations as a measurement tool. The SMACS was low on convergent validity as there was no association found between baseline scores on an established measure of autonomous and controlled motivation (TSRQ; Williams et al., 2004) and the amount of autonomous and controlled motivational speech expressed during the MI therapy session. This absence of an association may however be explained by measurement error present within the TSRQ. Self-report measures are vulnerable to certain biases such as socially desirable responding whereby on questionnaires people tend to present a favourable image of themselves which can lead to measurement error and limit results (Crowne & Marlowe, 1960).

Questionnaires are also subject to demand characteristics whereby the participant is

influenced by what they anticipate the researcher might be expecting to find and thus may bias answers in response (Orne, 1962). The absence of a relationship between autonomous and controlled motivation as measured by the SMACS and the TSRQ may also be explained by limitations of the framework of SDT within the context of ART adherence. Much of our existing knowledge is built on information gathered using measures which have been grounded in the theoretical conception of autonomous and controlled motivation. The perspective of the participant or patient has been largely absent. One study which aimed to capture the patient's experience found that participants' implicit categorisations of autonomous and controlled motivations for adhering to ART as measured using multidimensional scaling, did not correspond to theoretical definitions or researcher and clinician understanding of these constructs (Houston et al., 2012).

The reliability of the SMACS is also a limitation of the study. Overall a near perfect level of inter-rater reliability was achieved (.89). However, when considering the reliability at the level of individual codes reliability for autonomous motivation was fair (.32) and was moderate for controlled motivation (.45). Despite using Gwet's AC₁ formula it is difficult to establish high levels of reliability when the prevalence of a code is low. At times, it was difficult to conceptually distinguish between controlled and autonomous motivational reasons for medication adherence as it was not always possible to determine if a behaviour was valued by the person. Due to the low inter-rater reliability estimates achieved, all SDT coding was reviewed by the research supervisor who is an expert in motivational research but there continued to be ambiguity around the coding of adherence motivation as autonomous or controlled.

Ceiling effect

The most likely explanation for the null findings in the study are the high levels of baseline motivation observed along with the relatively high levels of pre-MI session ART adherence.

A high level of baseline motivation to adhere to ART was observed in the original RCT (Goggin et al., 2013). In the current study attempts were made to minimise the influence of high levels of baseline motivation by selecting a subsample which reported the lowest levels of motivation. However, this subsample was still reporting high levels of motivation with an average motivation level of 90%. The lowest level of motivation to adhere was 50% and this was only reported by one participant. Four participants reported 100% motivation to adhere while the rest of the sample ($n = 57$) fell in-between. The sample in this study was low on ambivalence to adhere to ART. It has been demonstrated that MI is most effective for people who are experiencing ambivalence or low levels of motivation to change the target behaviour (Hettema & Hendricks, 2010). In fact, MI was designed to help resolve ambivalence (Miller & Rollnick, 2012). It is unlikely that a significant proportion of non-adherence observed within the study was related to a lack of motivation. An intervention targeting motivation, therefore, was unlikely to have produced an effect, as was observed in the original RCT where no effect was found for MI (Goggin et al., 2013). It is possible that the adherence barriers for those not achieving 100% adherence were not related to the motivation aspect of the IMB model of ART adherence (Fisher et al., 2008).

There was a relatively high level of ART adherence (median of 86% of doses taken on time) observed prior to the MI session with 65% of the sample achieving at least

79% of prescribed doses taken on time and 39% of participants taking all doses on time. When adherence is broadened out to include percentage of doses taken adherence rates increase to a median of 97% of doses taken with 74% of the sample achieving at least 79% adherence and 50% of the sample achieving perfect adherence. This is in contrast to other studies such as Thrasher et al. (2006) who report mean baseline adherence of 56% of doses taken, Ingersoll et al. (2011) who observed mean baseline adherence of 58% of doses taken and DiIorio et al. (2008) report a mean baseline level of 58% of ART doses taken on time. In a systematic review of ART adherence interventions Amico et al. (2006) found that interventions which only targeted people with low adherence levels demonstrated stronger effects than those targeting groups with varied baseline adherence levels. High pre-MI session adherence levels left little room for improvement in adherence in the study and this would have reduced the likelihood of finding a relationship between any of the proposed variables and ART adherence (Goodwin & Leech, 2006).

Strengths

Sample size

The time intensive nature of the transcription and coding process meant that within the time frame of the project it was not possible to reach the targeted sample size of $n = 75$ as recommended by the power calculation. However, the sample size of the current study ($n = 62$) is larger than the sample size of the other published MI process research studies within the context of HIV-related behaviour change (Grodensky et al., 2017; Thrasher et al., 2006) and process studies with other targeted behaviours such as increased fruit and vegetable intake (Pirlott et al., 2012) and reduced alcohol

consumption (Glynn & Moyers, 2010; Miller et al., 1993). It is unlikely that a sample size of 75 would have resulted in significant findings given the small effect sizes observed for the mediational analyses.

Measurement

The use of the MISC 2.5 is a strength of this research study as many process research studies use earlier versions of the MISC which have limitations compared to the MISC 2.5. The MISC 2.5 combines features from two existing MI process tools; the MISC 2.1 and the SCOPE in an attempt to create a more valid tool which aims to capture the subtleties of both client and therapist language. The MISC 2.5 attempts to improve on the validity and reliability of earlier process tools by moving from a 7-point to a 5-point Likert-type scale for the global measures and dropping the strength ratings from client behaviour counts (Houck et al., 2010). The MISC 2.5 is an established measure which has been developed by experts within the field of MI process research and consequently possesses both content and face validity. The researcher also liaised with the authors of the manual to obtain gold standard coded transcripts for the purposes of training.

The SMACS possesses content validity as it was generated by combining both an inductive and deductive approach to the development of the measurement tool. SDT literature was reviewed and existing measures of autonomous and controlled motivation were consulted when developing the coding manual. Excluded MI sessions were used to develop examples for each coding category. The manual underwent numerous reiterations through regular consultation with an expert in HIV-related behaviour change. The manual was further refined through a consultation

process with people living with HIV currently taking ART. In contrast to scale development using classical test theory where items are dropped if they do not load sufficiently on a factor or load equally across one or more factors, the SMACS requires the coding of all incidents of autonomous and controlled motivation.

Therefore, it is possible that the SMACS is a more valid tool than questionnaires such as the TSRQ (Williams et al., 2004) which have been developed using classical test theory methods. The content validity of the SMACS could, potentially, have been further improved by consulting with experts in the field of SDT such as Edward L. Deci and Richard Ryan.

The use of the MEMS cap to collect ART adherence data is one of the strengths in this study. Electronic pill monitoring tools such as the MEMS cap are currently recognised as the gold standard for monitoring medication adherence (Vrijens et al., 2014) and have been shown to be strongly associated with viral load when compared to other methods of monitoring ART adherence (Farley et al., 2003; Müller et al., 2008). Particularly in relation to the SDT aspect of this study, using a MEMS cap improves on the Kennedy et al. (2004) study which relied on self-report data alone as a measure ART adherence.

Robust methods

The use of robust methods is one of the strengths of this study. As behavioural coding data involves frequency counts it is known to often violate the assumption of normally distributed data and the data is typically skewed (Holsclaw et al., 2015) as it was in this study. Bootstrapping methods have been demonstrated to be superior than transforming data when correcting for non-normally distributed data and controlling

for Type I errors (Berkovits et al., 2000; Delucchi & Bostrom, 2004; Russell & Dean, 2000).

Controlling for pre-session adherence.

One of the key strengths of this study is the approach taken to the measurement of change in the target behaviour. This study improves on the two existing process research studies in the context of HIV (Grodensky et al., 2017; Thrasher et al., 2006) in its approach to measuring change in the target behaviour. Thrasher et al. (2006) calculated ART adherence change as the difference in scores between post-MI session adherence and pre-MI session adherence. The use of difference scores as a measure of outcome change is considered to be fundamentally unreliable (Edwards, 1994). It would appear that Grodensky et al. (2017) did not factor baseline rates of unprotected anal/vaginal intercourse in to the analysis either through use of difference scores or building it in to the statistical model. In the current study pre-session MI adherence levels are built in to the mediational model as a covariate and controlled for during partial correlation analyses. This approach is recommended over the use of difference scores (Edwards, 1994).

Generalisability

Selecting a subsample of less motivated participants ran the risk of reducing the external validity of the study. There is evidence however, that in reality the sample in this study is representative of the population of people living with HIV in North America with MSM and African-Americans being disproportionately affected by HIV (Centers for Disease Control and Prevention, 2015). This sample is somewhat representative of adults living with HIV in the UK as an estimated 69% are men and

MSM are most affected (Kirwan et al., 2016). The sample is unrepresentative with regards to ethnicity as in the UK the majority of MSM with a HIV diagnosis are of white ethnicity and the other group that is disproportionately affected by HIV are people of Black African ethnicity (Kirwan et al., 2016).

The generalisability of the study is limited by the changes that have occurred in the guidelines for ART adherence. At the time of the original RCT the guidelines suggested that ART was not recommended for those who were asymptomatic and had a CD4 count >350 cells/mm³ (Hammer et al., 2006; Yeni et al., 2004). Since 2015 it is now recommended ART should be prescribed for all people living with HIV regardless of CD4 count or viral load (World Health Organization, 2016).

Consequently, the sample in this study might not be fully representative of the current population of people living with HIV who are prescribed ART.

Another factor limiting the generalisability of the findings was the high levels of ART adherence observed prior to the delivery of the MI session. Half of the sample were taking 100% of their prescribed doses while 39% were taking all their doses on time. The mean prescribed doses taken was 84% which is higher than other studies where prior to the delivery of MI means of 56% (Thrasher et al., 2006) and 58% (Ingersoll et al., 2011) of prescribed doses taken were reported. In this study, prior to receiving MI, 71% of the sample were achieving mean adherence rates of at least 90% of doses taken and this is higher than the global rate of 62% of ART user achieving adherence rates of at least 90% (Ortego et al., 2011). It could be argued that many of the participants in this study were receiving an intervention for which they had no need. This is unlikely to reflect real-world situations where limited resources can mean that

potentially adherence improving interventions such as MI would only be offered to those with adherence rates of less than 90% of prescribed doses taken.

Finally, the external validity of this study is potentially further limited by the delivery of the MI. The therapy sessions were audio-recorded and the fidelity of the therapists to the MI model was being monitored throughout the study. The therapists were also required to follow a semi-structured MI protocol or script. This monitoring process and the use of a therapy protocol is not reflective of usual clinical practice and may have meant that the therapists were less responsive or flexible. It was observed during the coding of sessions that at times therapists did not respond sensitively to participants' distress and instead prioritised items on their MI agenda. It is possible that this may have impacted on the therapeutic alliance as participants may not have felt listened to by the therapist.

Research implications

Before any conclusions can be drawn about the technical and relational components of the MI model (Miller & Rose, 2009) within the context of ART adherence it is necessary to test the relationship between therapist use of MICO methods, MI spirit, client change talk and ART adherence in a group of people living with HIV who are experiencing low motivation to adhere and low baseline adherence rates. It is acknowledged that therapist use of MICO methods is a very broad category and future research might focus on exploring the association between different types of MICO responses and client change talk. For example, one study has found that affirming statements made by the therapist is the only MICO response which both increased

change talk and decreased sustain talk in the context of reducing hazardous drinking in a student population (Apodaca et al., 2016).

Once evidence for both the technical and relational components has been found then future MI process research studies within the context of ART adherence should focus on sequential analysis to address the temporality limitation of correlational designs. Sequential analysis allows for an examination of the transitional probabilities of therapist use of MICO methods being followed by change talk and sustain talk. Future research might also make use of experimental methodologies to further bolster the evidence base and thus ensure all criteria required to establish a variable as a mechanism of change are met (Kazdin & Nock, 2003). Additional aspects of the relational pathway such as therapist empathy and alternative MI model components such as MI training within the context of ART adherence could also be investigated in future studies.

This study provides tentative support for the use of an SDT informed motivational language coding system to measure autonomous and controlled motivation speech within the context of ART adherence. Future work on the development and refinement of the SMACS needs to be conducted. Additional research needs to be carried out to establish the reliability of the measure which may result in further modifications of the existing manual. Future research might also focus on extending the SMACS to include other target behaviours resulting in a more generic instrument which would be suitable for use across a variety of populations and settings. The refinement and extension of the SMACS could allow for a more nuanced understanding of naturally occurring motivational speech than is currently provided

by existing MI process tools which may further add to the understanding of how MI works. Although it should be acknowledged that SDT might need further refinement and exploration within the context of ART adherence which might allow the constructs of autonomous and controlled motivation to be measured more reliably and validly.

Finally, this study provides tentative evidence to suggest a relationship between autonomous motivation and targeted behaviour outcome in this case ART adherence. Given the null findings also observed, replication of the study is needed before any substantive claims can be made. Future process research might explore the relationship between autonomous motivation and other behaviour change outcomes such as substance use, smoking, or exercise.

Clinical implications

One of the clinical implications of this study is a reminder to consider the characteristics of the population being targeted with an MI based ART adherence intervention. Medication adherence is a complex psychological process and motivation is only one facet of ART adherence as outlined by the IMB model (Fisher et al., 2008). MI is unlikely to be helpful for people who already possess high levels of motivation to adhere to ART. For these people motivation is unlikely to be a barrier to their ART adherence and an alternative intervention targeting a different aspect of this multifaceted process might be more useful. For example, the information aspect of the IMB model may be targeted with medication adherence training while adherence-related behaviour skills may be developed through the use of reminder devices and behaviour skills training. It is important that barriers to

adherence are identified and formulated during the assessment period to ensure the intervention offered targets the appropriate aspect of the IMB model of ART adherence. An ART adherence intervention based on a formulation and targeting the individual factors underlying the problems in ART adherence is likely to be more effective than offering a standardised treatment protocol focussed predominately on enhancing motivation to change.

The development and refinement of the SMACS, alongside its extension to other target behaviours, could result in a more nuanced understanding of client change talk, specifically regarding autonomous and controlled motivational speech. Understanding these potential mechanisms may facilitate further understanding of how MI works and may lead to enhancements in MI. For example, should the link between autonomous motivation and ART adherence be substantiated this could warrant the extension of MI to include eliciting and selectively reinforcing autonomous reasons for making a behaviour change. This could be easily incorporated into the framework of MI therapist strategies as there are already MI questions and techniques which encourage making a connection between personal values or goals and the targeted behaviour for change. Such an approach would be consistent with current directions within the field of MI where the focus is now on selectively responding to and thus influencing client change language within the MI session (Moyers et al., 2017).

Conclusion

The most likely explanation for the null findings relating to the MI model is the high baseline motivation and high levels of pre-MI session ART adherence which meant that there was little opportunity to show evidence of change, and therefore little

opportunity to show mediation. Findings from this study suggest that the SMACS may provide the basis for a more useful tool for measuring fine-grained naturally occurring motivational speech than current MI process tools allow. Further research is needed before any definitive claims can be made, however eliciting autonomous motivation speech may represent a direction for future research into the clinical application of MI.

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Appendices

Appendix 1 Informed Consent Form

IRB 03 – 60e

INFORMED CONSENT FORM (TMC, KCF, Community sites)

Study Title: Antiretroviral Adherence: Observed Therapy and Enhanced Counseling.

Sponsors: National Institutes of Health and University of Missouri Kansas City (UMKC).

Investigators:

Primary Investigator: Kathy Goggin, Ph.D.

Co-Investigators: Mary Gerkovich, Ph.D., Delwyn Catley, Ph.D., Julie Wright, Pharm.D., and Karen Williams, PhD.

You, _____, agree to participate in a research study to be conducted by Dr Goggin and her co-investigators. While the program of study is under their supervision, other professionals who work with them may act in their behalf.

Background:

The long-term effectiveness of HIV drug therapy depends on strict adherence with the HIV medications that have been prescribed to you by your doctor. That means taking all of the drugs and doses that have been prescribed and following special instructions such as taking doses with or without food or taking them at a certain time each day, which can be difficult to do. Some experts have suggested that observing patients taking their drug therapy for a period of time will help them to adhere to their prescribed drug regimen. This has worked for patients taking antibiotics for tuberculosis. Others have suggested that providing specialized or enhanced counseling about medication adherence will help people adhere to their HIV drug regime.

Purpose:

The purpose of this study is to study the effects of enhanced counseling alone and enhanced counseling combined with observed therapy compared to the standard care with regard to your adherence with your HIV drug regime.




Subjects:

About 260 study subjects will be recruited from clinics providing HIV care in the Kansas City area.

Treatment groups:

You will be involved with the study for 48 weeks. You will continue to see your HIV doctor as usual and take the antiHIV drug regimen that your doctor has prescribed for you. You will be assigned by chance to one of three study groups – you have an equal chance of being in any group. The groups are

1. Standard care – you will continue to receive the usual care that the clinic staff normally provides all patients taking HIV therapy.
2. Enhanced counseling (EC) – you will meet with a trained counselor to receive counseling about medication adherence during special sessions described below.

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3. Enhanced counseling with observed therapy (OT) {EC/OT} – in addition to receiving special counseling sessions about medication adherence the doses of your HIV drug therapy will be delivered to you by an observed therapy (OT) worker. More details of OT procedures are described below.

Medication administration:

For all subjects, you will continue to take the antiHIV drug regimen that your health care provider has prescribed for you, however, one of your medications will be kept in a bottle that has a special cap called a “MEMS cap”. This is an electronic cap that keeps track of the date and time each time you open the bottle. We will give you the bottle with the MEMS caps and you will be provided with instructions about which drug to keep in the bottle and when and how to fill the bottle. Study staff will briefly meet with you to collect data from the MEMS cap throughout the study; once weekly x 4 weeks, every 2 weeks up to week 12, and then every 4 weeks thereafter.

For subjects assigned to the EC/OT group, in addition to using the MEMS cap for one medication, you will receive your medications from OT staff for the first 24 weeks. In order to do this, you will have your prescriptions filled as usual by your pharmacy and then give these to the study staff. The study staff will repackage your HIV medications into containers for convenient delivery of individual daily doses. You and the OT worker will select a time and location that is convenient and comfortable for you to meet in order for the OT worker to deliver your daily doses. In general the OT worker will observe you taking one drug dose and will give you any other doses that need to be taken that day or until the next time you meet the OT worker. You will also be given a one week supply of your HIV drugs to have available for unexpected situations. More specific details about how the OT will work are as follows:

- From baseline to week 16: Each day Monday through Friday, the OT worker will meet you at the designated place and time. They will watch you take your dose and will give you the remaining doses for the day. Each day you will report your adherence with the unobserved doses from the previous day. On Friday you will be given all doses for the weekend.
- In week 17 there will be 4 OT visits, week 18 there will be 3 visits, week 19 there will be 2 visits, and 1 OT visit in weeks 20 to 23.
- In week 24: you will return to obtaining and taking your antiHIV medications as done prior to study enrollment, with the exception of one medication being kept in the MEMS cap bottle.

Procedures:

All Subjects:

- If you volunteer to participate in the study you will need to complete a study enrollment visit and 5 evaluation visits. The evaluation visits occur at baseline and then weeks 12, 24, 36, and 48 of the study. These evaluation sessions will last about 45 minutes to one hour. At these visits you will complete questionnaires that collect detailed information about your adherence, knowledge and attitudes about HIV and HIV therapy, quality of life, support systems, health status, medical history, drug and alcohol use, and satisfaction with your HIV care. You will answer these questions on computer.

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- We will record your CD4 cell count (tells us how well your immune system is working) and HIV viral load (how much virus is in your blood) test results at baseline and weeks 12, 24, 36, and 48. We will try to coordinate this data collection with your routine medical care visits so that we do not have to draw extra blood to obtain these results. It is possible however that we may have to draw blood (about 1 tablespoon) in order to obtain these results. All patients will have one blood sample taken at baseline visit (about 2 teaspoonfuls) that will be stored in a lab in the school of medicine. This sample will be stored only during the duration of the study and will only be sent for analysis (genotype of the HIV to measure possible resistance) in the event that you experience an increase in your viral load while you are in the study. If you do experience this, an additional sample will be collected for the same analysis.
- Data will be collected from your medical record such as your age, sex, HIV infection and medical history, number of clinic visits, hospitalizations, or emergency department visits during the study.

Subjects assigned to enhanced counseling:

You will meet face to face with a counselor for five counseling sessions; at baseline and then weeks 1, 2, 6 and 11. During weeks 4, 9, 15, 19 and 23 the counseling sessions will occur by phone. All counseling sessions will last about 30 to 45 minutes. The contact with the counselor will involve discussions about adherence and personal issues which may impact your ability to adhere to your medications.

The counseling sessions will be audio taped for the purpose of monitoring and ensuring the quality of the counseling provided throughout this study. These tapes will be saved indefinitely and may be used for future research projects. The purpose of future research would be to evaluate the effectiveness of the counselors and the style of counseling. The tapes will not be labeled with any of your identifiable information.

Subjects assigned to enhanced counseling with OT:

You will meet with a counselor and OT staff separately, as described above under medication administration.

Risks:

Patient confidentiality and privacy could be jeopardized by participating in this study, especially for subjects assigned to receive counseling or observed therapy. The study staff will do everything they can to maintain confidentiality and avoid accidental or unintentional disclosure of your information. There is a small risk that study staff could make a mistake in repackaging your HIV drug doses or the OT worker could make a mistake in dispensing your doses to you. It is unlikely such errors would cause immediate serious harm to you, but could have long-term effects if it resulted in viral resistance.

Benefits:

There may be no benefit to you for participating in this project. If you receive counseling or observed therapy they may benefit your HIV drug therapy adherence. Your participation will help researchers better understand whether counseling or observed therapy benefit adherence with HIV drug therapy.

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Subject Initials _____.

Alternatives:

The alternative is to not participate.

Financial compensation:

You may be paid \$165 for participating in this study to compensate you for your time and transportation if you complete all evaluation visits. These payments will be prorated as follows and paid at the end of each visit; \$20 each for completing evaluations at baseline, week 12 and week 36, \$40 at week 24, and \$65 at week 48. This study does not cover any costs of your medical care or medications, these will be billed as usual.

Access to your medical and study records:

We will create a study record to document your participation in this study. This study record is separate from your medical records and will contain the data we collect as described in the study procedures. The Institutional Review Board or other regulatory agencies may be given access to your study records and any pertinent medical record which contains your identity. Your medical records that identify you, the consent form signed by you, and your study records may be reviewed to verify the study procedures that were performed and the data reported about you. Medical records from treatment you received prior to giving your consent to participate in this clinical study may also be reviewed, if available, to verify your medical history and your eligibility for this study. Results of this research may be published for scientific purposes or presented to scientific groups, however, you will not be identified.

In the future the investigators may want to pursue additional research related to HIV and adherence. May we contact you in the future to participate in such studies? Please initial below next to yes if we may contact you or no if you do not want us to contact you for future projects. If you select no, it will not affect your participation in this project. If you select yes, we will keep only your contact information (no other study related or medical information) in a confidential and secure file that only the investigators of this study have access to.

Yes
 No

Confidentiality of study records:

We will do everything we can to keep others from learning about your participation in this study. To help us protect your privacy, we have obtained a Certificate of Confidentiality from the National Institutes of Health. With this Certificate, the researchers cannot be forced to disclose information contained in your study records that may identify you, even by a court subpoena, in any federal, state, or local civil, criminal, administrative, legislative, or other proceedings. The researchers will use the Certificate to resist any demands for research information that would identify you, except as explained below.

The Certificate cannot be used to resist demand for information from personnel of the United States Government that is used for auditing or evaluation of Federally funded projects or for information that must be disclosed in order to meet the requirements of the federal Food and Drug Administration (FDA).

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A Certificate of Confidentiality does not prevent you or a member of your family from voluntarily releasing information about yourself or involvement in this research. If an insurer, or employer or other person obtains your written consent to receive research information, then the researchers may not use the Certificate to withhold that information. The Certificate does not prevent the researchers from disclosing voluntarily, without your consent, information that would identify you as a participant in the research project under the following circumstances, child abuse or intent to hurt self or others.

Study withdrawal:

You may choose to withdraw from the study at any time by notifying the investigator or study staff. The study staff may withdraw you from the study if you are unable to follow through with study procedures. If you should withdraw or be withdrawn from the study, the study data collected prior to withdrawal may still be processed along with other data collected as part of the study. For purposes of follow-up studies and if any unforeseen circumstances arise, subject identification will be filed at the University of Missouri-Kansas City under adequate security and accessibility restricted to medical research personnel only

Institutional policy:

Truman Medical Center (TMC) will provide medical attention to you if you suffer any injury or harm as a direct result of participating in this research project. TMC, your study doctor, and the sponsor of this study will decide, in their discretion, who should pay for the medical care. TMC will provide treatment for you in the event of any medical emergency while present at TMC, whatever the cause. Moreover, you will have the benefit of the coverage of any existing health insurance you own. Participation in this research study does not take the place of routine physical examinations or clinic visits to your personal physician. If you believe you have been injured as a result of participating in this study you are encouraged to contact the study investigator, Dr Gerkovich at 816-235-6480.

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the investigator, Dr Gerkovich at 816-235-6480 or contact Sheila Anderman, IRB Administrator of UMKC's Adult Health Sciences Institutional Review Board at 816-235-6150.

Emergency provision: In the event of an emergency, where you feel it is necessary that you contact the investigator immediately, rather than waiting until regular office hours, you should page the investigator at 816-435-7539. This page will be answered by one of the investigators Drs. Gerkovich, Wright, or Goggin.

Voluntary participation:

Your participation in this research is voluntary; you are free to discontinue participation in this study at any time and for any reason; refusal to participate will involve no penalty or loss of care to which you are normally entitled. You will be removed from the study, if at any time, it is necessary because of medical reasons. Additionally, you will be informed of any

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significant findings developed during the course of this research. You volunteer and consent to participate in this research study. A copy of this consent form will be given to you.

You have read this Consent for Research or it has been read to you. Further, the purpose of the study, risks involved, and procedures which will be performed have been explained to you. You have had the chance to ask questions, and you may ask questions at any time during the course of the study by calling Mary Gerkovich at 816-235-6480.

Signature (Volunteer Subject)

Date

Signature (Authorized Consenting Party)

Date

Signature of person obtaining consent

Date

02/28/06

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**Authorization to Use and Disclose
Protected Health Information For Research Purposes**

Subject Name _____

Date of Birth _____ SS# _____

Protocol Title: Antiretroviral (ART) Adherence: Enhanced Counseling and Observed Therapy, Substudy A

UMKC IRB #: 03-60e,

I, _____, voluntarily give permission to Kathy Goggin, Ph.D. and her research staff to use and disclose my protected health information (PHI) for the purpose of research, including medical and scientific use for the research study listed above.

Results of this research may be published for scientific purposes or presented to scientific groups, however, my name will not be identified.

Kansas City Free Health Clinic and Business Associates involved in this study, the Study Sponsor and their authorized agents, the University of Missouri-Kansas City Institutional Review Board, and/or the UMKC Department of Psychology may be given access to research study records and any pertinent medical records which contains my identity. My information may be submitted to governmental agencies in other countries where the study information may be reviewed. In addition, the following organizations and/or individuals are included in conducting this study and may have access to my information for the purpose of conducting this research study

National Institutes of Mental Health

My PHI, including: medical records that identify me, information collected or created during this research study, this authorization form and the informed consent form signed by me, may be reviewed to verify the study procedures that were performed and the data reported about me. Medical records from treatment I received prior to giving my consent to participate in this clinical study may also be reviewed, to verify my medical history and my eligibility for this study. The researchers and entities listed above agree to protect my health information by using and disclosing it only as permitted in this authorization and as directed by state and federal law.

According to federal privacy regulations, I may withdraw this authorization at any time by giving written notice of my revocation to David Garrett, Privacy Officer at Kansas City Free

Health Clinic. If I choose not to sign this authorization form, my treatment will not be affected. If I withdraw this my authorization, any information previously disclosed cannot be withdrawn, and I may no longer be allowed to participate in this research study. Once my information is disclosed in accordance with this authorization, the recipients may re-disclose it, and the information may no longer be protected by the federal privacy regulations.

By signing this form, I am authorizing such access to my PHI as outlined in my informed consent form. I may refuse to sign this authorization form. If I choose not to sign this authorization form, I cannot participate in the research study.

If I choose to participate in this study, I will be given a copy of this authorization form. Any questions or concerns regarding this form may be directed to the Primary Care Team at the Clinic (816-753-5144.) I will also receive a copy of the Privacy Notice regarding my privacy rights if I have not already received a copy.

This Authorization does not have an expiration date.

READ CAREFULLY: I understand that my medical records are confidential. I understand that by signing this authorization I am allowing the release of any medical information requested to the agencies or persons specified above. Drug and alcohol abuse information records are specifically protected by federal regulations and by signing this authorization I am allowing the release of any drug and/or alcohol information to the agencies or persons specified above. Additionally, I understand that information released may include medical records related to Acquired Immunodeficiency Syndrome (AIDS) or infection with HIV (Human Immunodeficiency Virus).

I have the right to view and receive copies of certain portions of my medical and financial records kept by Kansas City Free Health Clinic or its business associates. I may not view or receive copies of any psychotherapy notes, any information that will be used in a civil, criminal or administrative action or proceeding, information restricted under the Clinical Laboratory Improvements Amendments of 1988 (42 U.S.C. § 263a), and certain other records. In addition, if I am participating in a research study and am receiving treatment as a part of the study, I may be denied access to copies of my medical records until the study is complete, to maintain the integrity of the research.

Signature of Subject	Date
Signature of Legally Responsible Party	Relationship to Subject
Signature of Person Obtaining Authorization (Investigator or Study Coordinator)	Date

PROHIBITION ON DISCLOSURE: This information has been disclosed to you from records whose confidentiality is protected by Federal Law. Federal Regulations (42 CFR Part 2) prohibits you from making any further disclosure of this information except with the specific written consent of the person to whom it pertains. A general authorization for the release of medical or other information if held by another party is not sufficient for this purpose.

Original signed authorization	Maintain with investigator's research records
Copies given to	Subject & Subject's Medical Record

Appendix 2 Royal Holloway University Ethics Approval

result of your application to the Research Ethics Committee

Ethics Application System <ethics@rhul.ac.uk>

Fri 13/05/2016 08:39

To: Hogan, Ailbhe (2014) <Ailbhe.Hogan.2014@live.rhul.ac.uk>; Evangeli, Michael <Michael.Evangeli@rhul.ac.uk>; ethics@rhul.ac.uk <ethics@rhul.ac.uk>;

PI: Michael Evangeli

Project title: Mechanisms of change in motivational interviewing for antiretroviral therapy adherence in a HIV-positive population

REC ProjectID: 69

Your application has been approved by the Research Ethics Committee.

Please report any subsequent changes that affect the ethics of the project to the University Research Ethics Committee
ethics@rhul.ac.uk

Self-determination theory & Medication Adherence Coding

System

The overall aim of this coding manual is to identify all references to the client's reasons for adhering to the antiretroviral therapy medication. These reasons will be categorised according to two different types of motivation (autonomous or controlled). The rest of the speech utterances are to be coded as non-motivation client speech.

Notes to coder

It is important to listen to the audio recording while coding the written transcript of the session. All transcripts will be separated or parsed (using parentheses) into individual segments of speech. The coder will assign one of three codes [autonomous motivation (AM), controlled motivation (CM), and non-motivational client speech (N)] to the client speech utterances only. The same utterance may never be given two different codes. Therapist speech is not assigned a code but often will serve to provide context for client speech (see coding examples given below). Reasons to adhere are time specific and only those related to current or very recent motivation to adhere are coded as being autonomous motivation or controlled motivation. All references to historical motivation is to be coded as non-motivational client speech.

Codes

1. Autonomous Motivation (AM)

Autonomous motivation is where behaviour is perceived as being chosen by oneself and the person believes that the behaviour is under their control. It includes when the person states that the behaviour is important to achieve personally valued

outcomes. The person recognises and accepts the underlying value of the behaviour. Autonomous motivation also includes where the person identifies with the importance of a behaviour and this behaviour is in line with their core values and beliefs about the self. Carrying out the behaviour is seen to be consistent with other priorities in the person's life and forms part of their identity.

Examples of autonomous motivation in relation to antiretroviral medication adherence include:

- *Part of my identity*

T: [So you rely on yourself and not others. Ok.] [Now can you think about how adherence and taking your medications consistently is maybe related to being considerate or being independent or strong?]

C: [Oh, I take my meds cause it's just who I am.] (AM)

T: [Um-hmm.] [So that's just a core part of your personality?]

C: [Right.] (AM)

- *Important to me*

C. [It is important to me to adhere to my medication.] (AM)

C. [I take my medication because I need to, it's for me.] (AM)

C. [I take my medication for myself, if I make a point of doing something I do it.](AM)

- *I want to be there for my children*

T: [A 10? Ok. So that's a pretty high number, that's like the highest on the, on the scale]

C. [Yea, because I don't wanna...wind up goin'...you know this is my last regimen...and uh...I have my son to think about] (AM)

T: [Mhmm].

C. [That's my main priority]. (AM)

- *I value taking my medication*

C. [I take medication as I value the benefits I get from it.] (AM)

2. Controlled Motivation (CM)

Controlled motivation is where the behaviour is compelled by the self or by others. The person engages in the behaviour to gain a reward, avoid punishment or avoid negative emotions. Controlled motivation can include rewards and punishments that are delivered by other people. For example, taking medication to receive recognition from a health professional (reward) or to avoid criticism from a loved one (punishment). It can also include financial and legal constraints or pressure from other people including society in general, for example, in cases where ART adherence is mandated by a medical practitioner or as part of a research trial.

Controlled motivation can also include where a person is motivated by some internalised self-esteem related judgement and in this case the behaviour is self-imposed. The person is seen as self-controlling by putting pressure on themselves to comply with the behaviour. They will feel guilt, anxiety or shame when they fail at the behaviour and will feel pride and increased self-worth when they are successful. Although the motivation is internally driven the causality is deemed to be external as it is not viewed as being part of the person's self.

Examples of controlled motivation in relation to antiretroviral medication adherence include:

- *My family make me take my medication*

T: [on Saturday.] [So, tell me a little bit about what helped you take your medications on the days you took both doses, like Thursday, Friday, and Sunday?]

C. [My dad and my son are staying on my butt about taking it.] (CM)

T: [Okay, so you had that, like reminder]

C. [Yea. (laughing)] (CM)

C. [I feel under pressure from my family to take my medication (CM)]

○ *To prevent hospital admission*

T: [Well, umm, you mentioned that it's very important for you to take your, your HIV medication.] [Can you tell me a little bit about why, why it's important for you to take those?]

C. [Hmm...good question.] (N) [Well...I'll turn out like a vulture, and end up in the hospital.] (CM)

T: [Mmhmm.]

C. [You know.] (N)

T: [Ok.]

C. [It's the only way I'm gonna get better.] (CM)

○ *Extending my life*

T. [Ok. And what are the upsides of taking your ART meds?]

C. [Controlling this fabulous virus. Um, ya know, again – Mortality is a reality for every single one of us. Ya know, we're dying...] (CM)

T. [Can't get away from it.]

C. [Exactly, from the moment of conception we're dying. So, if I can delay that by, even just a little but, and those help me do it, by all means.] (CM)

T. [So positive for you is being able...taking your medication gives you sense of control...and you're able to do that?]

○ *I take my medication because my family will be sad if I get sick*

T: [Right. That's great.] [Well you've already told me some of the real positive things, reasons why you want to take them. Obviously, which is to live and all the things you have to live for.]

C. [Right.] (AM)

T: [Yeah. Family and yourself.]

C. [Right.] (AM)

T: [I guess you have to be...]

C. [Myself first.] (AM)

T: [Right.]

C. [Then my child. And then my lover.] (AM)

T: [Right.]

C. [And so on.] (N)

T: [Well you can't...yeah, if you're not healthy you can't really be around.]

C. [Right. You can't make, you know, can't be around anybody else if they gonna be helping you.] (N)

T: [Right, exactly.]

C. [They're gonna be sad because you're sick.] (CM)

T: [That's right.]

C. [That's basically it.] (N)

- *What others would think of me*
 - C. [I want my doctor to think I'm a good patient so I adhere to my ART] (CM)
 - C. [I want others to see that I'm trying to take the medication.] (CM)

- *To make others happy*
 - C. [It makes my loved ones happy when I take my medication] (CM)

- *Otherwise I would think and feel bad about myself*
 - C. [I would feel like a failure if I didn't adhere to my ART.] (CM)
 - C. [I feel guilty if I don't comply with my medication regime] (CM)
 - C. [I feel ashamed when I miss a dose of my medication] (CM)

- *Taking my medication makes me feel better*
 - T: [Okay. So it's important for you because that means that you feel better when you take your medicines.]
 - C. [Uh-huh, Yeah.] (CM)

- *No choice*
 - C. [I take my medication because I have no other choice.] (CM)

Differentiating Autonomous Motivation from Controlled Motivation

*At times autonomous motivation can be confused with controlled motivation. It is important to consider if there are any external rewards, punishments or avoidance that is keeping the behaviour going. If there are then the adherence reasons should be coded as controlled motivation. **Note** if you are struggling to decide between autonomous motivation and controlled motivation it is most likely controlled motivation, therefore code it as such.*

C: [I take my medication because I don't want to end up in hospital again] (CM)

C: [I look in the mirror and see that I've put on weight and that keeps me motivated to take my medication] (CM)

C: [I would feel bad about myself if I didn't adhere to my medication] (CM)

Adherence & Health

Where the person has indicated at some point during the transcript that their health is personally valued to them then any reasons for taking medication relating to health are coded as Autonomous Motivation for this person. If the person has not indicated that they value their health at any point in the transcript and an improvement in their health is presented as a description of the consequence of taking their medication, then it is coded as Controlled Motivation.

T: [I have this list of values here, um if you could pick out maybe two or three things that really stick out for you or values that you really hold dear, um then we can talk about that.]

C 1: [Being healthy is one.] (N)

...

T: [Okay. Okay, now you mentioned being healthy, being a good parent, and being responsible were all values that were very important to you. Can you see how taking your HIV medications relates to the values that you mentioned?]

C 1: [Well, taking HIV meds will probably make me healthier.] (AM)

T: [I have a list here. And if you wouldn't mind if you could pick maybe two or three things on that list that you value and we can talk about that.]

C 2: [Being strong, and being happy.] (N)

...

T: [Can you tell me a little bit about why, why it's important for you to take those?]

C 2: [It's the only way I'm gonna get better, taking the HIV meds is gonna improve my health so I'm not in the hospital or really sick or anything. Ok.] (CM)

3. **Non-motivational client speech (N)**

All client speech which cannot be coded as autonomous motivation or controlled motivation is coded as non-motivational client speech. This code will account for the vast majority of client speech. This category includes amotivational speech, which refers to the absence of any intention and thus motivation to engage in a behaviour. All speech relating to historical motivation is coded as non-motivational client speech.

T: [Okay. So, why do you think for, for you though you decided that it's very important for me to take my medications?]

C. [Uh, cause, cause when I wasn't taking it, I wasn't feeling good at all and I was losing weight.] (N)