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## Improving patient adherence: a three-factor model to guide practice

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Patient nonadherence is widespread and costly. This paper provides a brief narrative review of research on (non)adherence and validates a clinically useful three-factor heuristic model to guide practitioners as they work with patients to improve adherence. This model is based on the most stable findings from meta-analyses and large-scale empirical studies, reflects the realities of medical practice and offers recommendations for assessing and enhancing patient adherence, particularly in chronic disease management. The model comprises three important clinical actions: (1) insuring that patients have the right *information* and know how to adhere – including listening to patients' concerns, encouraging their participation and partnership in decision-making, building trust and empathy, and enhancing recall; (2) helping patients believe in their treatment and become *motivated* to commit to it – that is, addressing the cognitive, social, cultural normative and contextual factors that affect patients' beliefs, attitudes and motivation; and (3) assisting patients to overcome practical barriers to treatment adherence and develop a workable strategy for long-term disease management – including assessing and enhancing patients' social support, identifying and treating their depression and helping patients overcome cost-related treatment barriers.

**Keywords:** adherence; nonadherence; compliance; noncompliance

In medical treatment, the term *nonadherence* describes the failure of a patient to follow recommended health behaviours and treatment advice given by the clinician. Among other actions, nonadherence can include: (1) failing to fill medication prescriptions (*primary nonadherence*); (2) ceasing to take medications (*nonpersistence*); (3) taking medications improperly; (4) ignoring medical advice such as to eat or avoid certain foods, to exercise or to engage in regular disease-screening; and/or (5) incorrectly carrying out prescribed health behaviours (such as by practicing prescribed exercises but failing to target appropriate muscle groups, only partially avoiding certain food ingredients or misusing medical devices). *Noncompliance* is a term sometimes used interchangeably with nonadherence although many argue that the terms adherence and nonadherence better focus necessary attention on a collaborative clinician–patient relationship (Martin, Haskard-Zolnierrek, & DiMatteo, 2010). The World Health Organization's (WHO's) definition emphasises clinician–patient partnership in noting that adherence behaviours are those which '...correspond with agreed recommendations from a health-care provider' (WHO, 2009).

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Nonadherence may be purposeful or accidental. Intentionality is often difficult to establish but terms like ‘unintentional nonadherence’ are typically used to describe cases in which patients believe (incorrectly) that they are adhering, whereas ‘intentional nonadherence’ is reserved for cases in which individuals choose to dismiss treatment recommendations entirely or to modify their prescribed regimens. These individuals are called ‘rejecters’ and ‘active modifiers’, respectively, by Pound et al. (2005); their actions are called ‘purposeful’ vs. ‘unintentional’ by Johnson, Williams, and Marshall (1999).

Adherence is *behaviour*, although it is often confused with its outcome. Blood pressure control, for example, is likely correlated with adherence behaviour (e.g., medication persistence, sodium restriction) but is not equivalent to it. A patient can be perfectly adherent and still have poor blood pressure control. The degree of connection between adherence and a health outcome varies by disease condition, the appropriateness and efficacy of the treatment prescribed, and a host of other variables (DiMatteo, Giordani, Lepper, & Croghan, 2002). Adherence to a prescribed treatment might also be highly correlated with certain ‘surrogate outcomes’ (e.g., lowering of cholesterol) but not with ultimate health outcomes (e.g., prevention of myocardial infarction or stroke). Despite limitations, the connection between adherence and health outcomes is strong and significant; on average, the odds of a good health outcome for adherent patients are 2.88 times higher than the odds of a good outcome for nonadherent patients (DiMatteo et al., 2002). Nonadherence generally assures that optimal health outcomes will not be achieved and there is some evidence that the very process of being adherent (even to a placebo) may itself incur some health benefits (Epstein, 1984).

### Focus of the present narrative review and model

The medical literature on patient adherence is extensive (DiMatteo, 2004b). The goals of the present paper are: (1) to appraise the most stable empirical findings about adherence from meta-analyses and large-scale empirical studies in the adherence literature; and (2) to provide validation for a clinically useful model, supported by the important findings of the best of the adherence literature as it applies directly to patient care.

Regarding the first goal, it is important to recognise that meta-analytic reviews combine individual studies together in order to identify aggregate trends; they provide statistical estimates of overall effects from both correlational research and experimental interventions, yielding findings that are much more stable than those from individual studies (Rosenthal & DiMatteo, 2001). When examining individual (vs. meta-analytic) studies, large-scale population-based studies are considerably more stable than smaller studies, the results of which can vary substantially. For example, studies report adherence rates ranging from 30 to 70% for asthmatic patients using inhaled corticosteroids (Bender, Milgrom, & Rand, 1997); from 20 to 90% for schizophrenics taking antipsychotics (Bosworth, Oddone, & Weinberger, 2005); from 26 to 98% for patients taking antiretroviral therapies (Mills et al., 2006); and from 5 to 90% for patients taking antihypertensives (Iskedjian et al., 2002). Therefore, in this paper, we focus on synthesising findings from large-scale population-based studies and meta-analyses. We identified these studies in two ways.

First, we conducted a 'bottom-up search' for large empirical studies in an extensive literature database on patient adherence that has been previously used in the authors' ongoing work. This database includes all English language empirical journal articles that have been published on patient adherence, catalogued and coded in Endnote. The authors also conducted a 'top-down' search of the PubMed and PsycInfo databases from 1948 through the present for meta-analyses using the keywords *patient adherence* and *patient compliance*. Inclusion criteria were: (1) publication in a peer-reviewed English language journal from 1948 through December 2009; (2) empirical assessment of patient adherence; and (3) one of the following types of studies: meta-analysis, systematic review or individual empirical study (cross-sectional or longitudinal) with at least 400 participants.

Towards the second goal, we have organised the clinically relevant findings from these studies to validate a simple, evidence-based heuristic model of adherence. The model we have synthesised from this literature reflects the reality of medical practice and offers useful recommendations for clinicians who wish to help their patients to be more adherent to suggested treatments.

### Extent and costs of nonadherence

Nonadherence rates vary substantially across diseases and treatment regimens. The WHO estimates that in developed countries 50% of patients with chronic disease do not adhere to their medication regimens; the situation is worse in developing countries (Sabaté, 2003). A meta-analysis involving retrieval, compilation and averaging of adherence rates in all published English language empirical studies from 1948 to 1998 found that 24.8% of all patients (one in four) were nonadherent (DiMatteo, 2004b). This analysis was based on 569 different samples, in various time periods, using a variety of measurement methods and across many diseases and treatment regimens. Adherence has been found to vary by disease condition but often is lowest among patients with the very conditions for which adherence would be most effective (DiMatteo, 2004b). Multiple clinical factors contribute to (non)adherence including type of treatment regimen prescribed, the seriousness of the disease and the severity (both subjective and objective) of the patient's condition (DiMatteo, 2004b; DiMatteo, Haskard, & Williams, 2007). When regimens are more complex and intrusive patients are more prone to forget what they are supposed to do and are less likely to be able to carry out the directives that they do recall. Patients carry out prescribed regimens less effectively when they view their health problem as less severe. Thus patients' beliefs, prior experiences, symptoms and a variety of external factors (e.g., regimen complexity, resource availability) all work together to influence the adherence of individual patients.

Nonadherence exacts a significant toll on patients, providers and the healthcare system. From a psychosocial standpoint, the failure to achieve healthcare goals as a result of nonadherence can frustrate providers and patients. Societally, the economic burden of nonadherence is very high with estimates in the USA being between US\$290 billion (New England Healthcare Institute, 2009) and US\$300 billion (DiMatteo, 2004b) annually. Each year the number of US medical visits effectively wasted because of patient nonadherence is estimated at 240 million using 2005 ambulatory medical visit data (Cherry, Woodwell, & Rechtsteiner, 2007); using the

more recently reported 1.1 billion ambulatory medical visits made in 2006 (Schappert & Rechtsteiner, 2008), this number may be closer to 275 million.

Despite its prevalence and importance to health outcomes, nonadherence often goes unrecognised by patients and their clinicians. Patients often misunderstand the value of following medical recommendations accurately and physicians often overestimate patient adherence or cannot determine which patients are having adherence difficulties (DiMatteo, 2004b).

Interventions aimed at improving treatment adherence are not hard to find; what is more difficult is finding ones that work. According to systematic reviews, fewer than half of published adherence-enhancing interventions actually demonstrate improved adherence or enhanced patient outcomes (Haynes, McKibbin, & Kanani, 1996; McDonald, Garg, & Haynes, 2002; van Dulmen et al., 2007). These studies underscore the fact that a simple adjustment of one or two elements of a complex treatment regimen embedded within a complex human life may not be enough to achieve and maintain adherence. While some individual changes can help (e.g., simpler medication dosing is better for adherence than complex medication scheduling; Bangalore, Kamalakkannan, Parkar, & Messerli, 2007; Iskedjian et al., 2002; van Dulmen et al., 2007), no single factor can affect adherence sufficiently to improve population-level clinical outcomes. Multifaceted approaches, which typically work best even in individual cases, involve a combination of strategies such as providing information and reminders; simplifying the behaviour required; practicing ongoing assessment, counselling and self-monitoring; and providing reinforcements (McDonald et al., 2002). Even the most effective interventions tend to yield modest changes in the short term; thus adherence to treatment for chronic disease is best viewed as a long-term challenge that must be addressed regularly and consistently in clinical practice.

Multifaceted interventions targeted at patients, providers and the healthcare system are more effective than narrowly targeted ones as was demonstrated in a review of 41 diabetes management intervention studies (Renders et al., 2001). The complexity of adherence in diabetes treatment typifies many of the challenges faced more broadly in chronic disease management and thus serves as an appropriate example. In addition, although patient education about diabetes management has been shown to improve short-term outcomes, continuous reinforcement and long-term management are needed for long-term success (Norris, Lau, Smith, Schmid, & Engelgau, 2002). For patients managing hypertension, it was found that physician counselling, family support to monitor home pill-taking, and group sessions with a social worker helped patients maintain weight, maintain blood pressure and consistently keep appointments (Morisky et al., 1983). In this same study of 400 participants with a five-year follow-up, hypertension-related mortality decreased by 53.2% and all-cause mortality by 57.3%.

Several meta-analyses have highlighted the importance of individually tailoring behavioural interventions to obtain optimal effectiveness (53 studies in Chodosh et al., 2005; 61 studies in Peterson, Takiya, & Finley, 2003; 136 articles in Roter et al., 1998; 16 studies in Takiya, Peterson, & Finley, 2004), as did a meta-review or 'review of reviews' (van Dulmen et al., 2007). Similarly, in a review of 36 studies, asthma self-management training was found to reduce hospitalisations, physician visits and the number of workdays missed (Gibson et al., 2002). A meta-analysis of 70 studies of paediatric patients demonstrated that even information-only interventions to

improve chronic disease adherence showed small improvements (mean  $d=0.16$ ) and that behavioural and multifaceted interventions were even more effective (mean  $ds=0.54$  and  $0.51$ , respectively; Kahana, Drotar, & Frazier, 2008). In all, these studies emphasise the complexity inherent in establishing effective adherence-enhancing protocols and highlight the need to tailor interventions to individual patients.

### **The Information–Motivation–Strategy (IMS) Model**

Targeting individual patients' needs in order to promote their adherence may be as difficult as it is essential. In the limited-time context of the typical medical visit, elements crucial to adherence outcomes may easily be forgotten. A simple heuristic model, grounded in the large body of empirical literature, may be beneficial by reminding clinicians of what they need to do in every patient encounter to promote patient adherence. Here we offer a simple clinical approach based on the (sometimes overwhelming) body of literature on improving patient adherence.

The elements of the *Information–Motivation–Strategy Model* (IMS Model; see Table 1) were first introduced in the early 1980s (DiMatteo & DiNicola, 1982), although at that time there were few meta-analyses and large-scale studies of adherence on which to build support. The IMS Model extends and is grounded in the literature that surrounds several classic health behaviour models (e.g., the Health Belief Model [HBM] by Rosenstock, 1974; the Theory of Planned Behaviour [TPB] by Ajzen, 1991). The IMS Model conceptualisation has taken a simple but wide-ranging approach and involves provider and patient factors including cognitive/intrapsychic, social/interactional and environmental. The IMS Model contrasts with current models developed to explain specific behavioural elements in a particular population (e.g., the Information–Motivation–Behavioural Skills Model for HIV/AIDS by Fisher & Fisher, 1992, which despite the name similarity is focused on patients' behavioural skills, whereas the IMS Model deals with all elements of provider–patient interaction, goals and actions). The IMS Model offers three broad categories of achievement to guide providers and patients towards adherence; these categories offer a range of goals, actions and accomplishments that can be tailored individually to a given patient. In Martin et al. (2010) the IMS Model forms the framework for a practical emphasis on applications to health behaviour change in patient care. In the present paper, we focus on providing validity evidence for the model, building on empirical results from meta-analytic reviews and large-scale trials. Our goals are to assemble the evidence base for the IMS Model and to offer clinicians of all types a valid and practical rubric for remembering and utilising three broad elements of care essential for improving patient adherence.

### **Information**

The information component of this model highlights the importance of patient knowledge and its achievement through effective provider–patient communication. Patients are capable of doing only what they clearly understand; unintentional nonadherence is often rooted in failures at this stage of the process. An assessment of more than 300 studies suggests that many patients are incapable of understanding the health information they receive (Nielsen-Bohlman, Panzer, & Kindig, 2004) and

Table 1. Achieving adherence and health behaviour change: The Information–Motivation–Strategy Model (Martin et al., 2010).

Component of the model	Reason for nonadherence	What the clinician can do to promote adherence
1. Information	Patients do not understand what they are supposed to do.	Communicate information effectively to patients. Build trust and encourage patients to participate in decision-making and to be partners in their own healthcare. Have patients share why and how they are to carry out their treatment recommendations. Listen to patients' concerns and give them full attention.
2. Motivation	Patients are not motivated to carry out their treatment recommendations.	Help patients to believe in the efficacy of the treatment; elicit, listen to and discuss any negative attitudes towards treatment; determine the role of the patient's social system in supporting or contradicting elements of the regimen. Help the patient to build commitment to adherence and to <i>believe</i> that they are capable of doing it.
3. Strategy	Patients do not have a workable strategy for following treatment recommendations.	Assist in overcoming practical barriers that stand in the way of patients effectively carrying out a course of action. Identify individuals who can provide concrete assistance; identify resources to provide financial aid or discounts; provide written instructions/reminders; sign a behavioural contract; link to support groups; provide electronic reminders or follow-up phone calls etc.

a systematic review of the literature from 1990 to 2006 indicates that health literacy has not improved over the past decade (Ngoh, 2009). Members of the healthcare team must therefore not only inform patients effectively and thoroughly, but also check the adequacy of patients' understanding.

Understanding is best achieved when health professionals communicate effectively with their patients. In a meta-analysis of more than 100 studies (Haskard-Zolnieriek & DiMatteo, 2009), physicians' communication skill was found to be significantly and positively correlated with patient adherence. There was a 19% greater risk of nonadherence among patients whose physicians communicated poorly as compared with those whose physicians communicated well. In this meta-analysis, 'effective communication' did not have a singular definition across all the studies but rather was operationalised in various ways including elements such as providing clear information, checking for understanding and expressing empathy (Hall, Roter, & Katz, 1988; Street, 2003).



Surveys show that both physicians *and* patients view communication as an essential component of the physician's role; yet of all diagnosis- and treatment-related skills patients rate their physicians lowest on communication and physicians report that their weakest area of training is communication (DiMatteo, 1998; McBride et al., 1994). There is evidence that during the medical visit physicians consistently omit critical elements of information regarding medication use, thus contributing to nonadherence (Tarn et al., 2006). In order to effectively receive and understand the information they are given, patients need the opportunity to ask questions and have them answered, to clarify information they receive and to tell the story of their illness experience (Smith & Hoppe, 1991). In a study of more than 1300 diabetic patients, understanding of self-care (based on effective provider communication) was strongly and independently related to patient self-management (Heisler, Bouknight, Hayward, Smith, & Kerr, 2002). Fortunately, it is clear that good communication can be learned. In a meta-analysis of 21 experimental studies, training interventions to improve physicians' communication skills increased the odds of their patients' adherence by 1.5 times (Haskard-Zolnierrek & DiMatteo, 2009).

Even when information is clearly given during a medical visit research demonstrates that the majority of patients fail to recall it well (Kravitz et al., 1993). In the Medical Outcomes Study (MOS) assessment of almost 2000 patients with a variety of chronic illnesses, the majority failed to recall important elements of medical advice (Sherbourne, Hays, Ordway, DiMatteo, & Kravitz, 1992). Further, patients were inconsistent in adhering to the advice that they did recall. This point underscores that providing information to patients is *essential*, but is *not sufficient*, to ensure adherence. Meta-analysis indicates that better recall of information is predicted by the provision of more information to patients (Hall et al., 1988), although patients can also sometimes become overwhelmed by too much information; additionally, better outcomes accrue when physicians assess their patients' recall although this step in communication is often neglected (Kravitz et al., 1993; Schillinger et al., 2003). Simply put, when patients understand clearly and remember what they are asked to do they are much more likely to do it.

Cognitive deficits make it difficult to understand and/or retain information and thus contribute to the nonadherence problem. Among elders, cognitive deficits, particularly combined with social isolation, emotional vulnerability and economic disadvantage are notably predictive of nonadherence (Balkrishnan, 1998). Cognitive decline has been markedly associated with nonadherence in 11 countries (Cooper et al., 2005) and cognitive performance has been shown to predict adherence to antihypertensive regimens in a large cohort study of older adults (Salas et al., 2001). In two large meta-analyses of studies on older adults, it was found that offering clear instructions, having pharmacists review medication information and providing special packaging improved medication adherence considerably (Conn et al., 2009; Holland et al., 2008).

Another factor that is relevant to patient understanding is participation in medical decision-making. Active participation has been shown to be essential for diabetic patients' realistic assessment and understanding of their regimens (Golin, DiMatteo, & Gelberg, 1996), and chronically ill patients with a variety of diagnoses have been shown to be more adherent when their physicians answer their questions (DiMatteo et al., 1993). In addition, allowing the patient to tell the story of his or her illness can develop trust and rapport, leading to better adherence (Sherbourne et al.,

1992). Verbal communication (including information-giving and positive discussion) has been linked to numerous health outcomes including patient adherence (Hall et al., 1988; Stewart, 1995); and accurate nonverbal encoding (expression) and decoding (recognition) of emotion are also crucial to the process of care (DiMatteo & Hays, 1980; Roter, Frankel, Hall, & Sluyter, 2006). Effective nonverbal communication involves making eye contact, facing patients with open posture, demonstrating active listening, smiling and using positive facial expressions, and having a warm, encouraging voice tone (Smith & Hoppe, 1991).

When patients are adequately informed, they are better able to share in the decisions that affect their health and, as is highlighted in the next section, patients are more committed to regimens they have had a part in choosing. All patients, even those who are initially reluctant, are likely to reap the benefits of shared decision-making and physician–patient partnership and should be encouraged to ask questions and offer their opinions (Golin, DiMatteo, Duan, Leake, & Gelberg, 2002). Patients are more likely to leave the medical encounter with accurate, memorable and usable information when their clinicians provide clear advice, target information to their health literacy level, allow opportunities to clarify misunderstandings and provide mechanisms to help patients recall the information they have received. Together these aspects of communication and information exchange form the first stage of the IMS Model.

### **Motivation**

Decades of research underscore the important but easily forgotten fact that patients will only follow treatments they believe in. One goal of the health professional, then, should be to work together with each patient to develop a treatment plan to which the patient can commit wholeheartedly. While the commitment might be only for the short term (e.g., until the next appointment, when the issue will be revisited) and some persuasion by the clinician may be necessary, evidence is abundant that adherence depends heavily upon a strong therapeutic relationship and shared decision-making or ‘informed collaborative choice’ (DiMatteo, 1994; DiMatteo, Reiter, & Gambone, 1994).

Shared decision-making involves a two-way exchange of information between healthcare professional and patient, addressing all information (including psychosocial) that is relevant to the decision (Charles, Gafni, & Whelan, 1997). This exchange, in turn, leads to improved patient outcomes as demonstrated by a meta-analysis of 48 studies which found that greater physician–patient collaboration was significantly associated with better adherence and health outcomes (Arbuthnott & Sharpe, 2009). Although some patients do prefer a passive approach to their own healthcare (Benbassat, Pilpel, & Tidhar, 1998) and most patients do not want to make decisions entirely on their own (Arora & McHorney, 2000), most patients want to be informed about treatment alternatives and to be involved in treatment decisions (Guadagnoli & Ward, 1998). Patients want to *participate* in the process of caring for their own health. Even impoverished diabetic patients who were initially uninterested in participating but whose physicians encouraged them to become involved were more satisfied when they actively engaged in medical decision-making (Golin et al., 2002).

In order to adhere, patients must believe in the efficacy of their recommended treatments and thus one major aim of clinician–patient collaboration is to establish

recommendations that the patient believes in. Such belief, however, depends upon several cognitive, social and contextual factors. The previously mentioned HBM (Rosenstock, 1974) is one of the earliest theoretical models to attempt to predict why people engage (or don't) in health behaviours, highlighting the importance of beliefs about disease severity, personal susceptibility, efficacy of treatment, barriers to treatment and cues to action. Self-efficacy was later added to this model (Rosenstock, Strecher, & Becker, 1988), improving its predictive ability. This modification was based on the recognition that individuals are not motivated to do what they believe is impossible to achieve. Other research models have expanded on this basic framework to include elements not present in the HBM and although it is beyond the scope of this paper to thoroughly detail the outcomes data associated with these models, several meta-analyses have been conducted testing the power of these models to predict patient adherence and other health behaviours. A sampling of these meta-analyses is presented in Table 2.

As is indicated in some of these meta-analyses, patients' beliefs about the value of the treatment (i.e., the likely risks, benefits and efficacy of therapy) and patients' confidence that practical barriers to adherence can be overcome are also meaningful in influencing motivation to adhere (DiMatteo et al., 2007; Harrison, Mullen, & Green, 1992; Munro et al., 2007). When patients believe in the importance of the treatment health professionals can use simple behavioural contracts to enhance patient commitment (Bosch-Capblanch, Abba, Prictor, & Garner, 2007).

Patients who believe that the consequences of nonadherence are severe are more likely to be adherent than are those who believe that consequences are less serious; according to the necessity-concerns framework (Horne & Weinman, 1999), the former individuals would score high on 'necessity'. Thinking in terms of consequences seems to be a consistent motivator with one meta-analysis of 12 prospective studies showing that worry about breast cancer is positively associated with screening behaviours (Hay, McCaul, & Magnan, 2006) and another meta-analysis of 53 studies showing that loss-framed messages (those emphasising the disadvantages of nonadherence) are slightly more effective than gain-framed messages (O'Keefe & Jensen, 2009). But it is important to remember that patients' perceptions are often unrelated to the actual severity of their illnesses; thus some of the most seriously ill patients can sometimes be at great risk for nonadherence (DiMatteo et al., 2007). It is vitally important, then, for health professionals to openly discuss patients' beliefs and perceptions with them, help them feel comfortable expressing their concerns and respectfully address their confusions, misgivings and apprehensions about treatment.

Cultural norms, family members and friends also strongly influence patients' decisions about health actions – particularly through their goals and intentions – and adherence to treatment is no exception. Meta-analyses show that intentions are among the best predictors of actual behaviour and are meaningfully affected by subjective norms (Armitage & Conner, 2001; Sheppard, Hartwick, & Warshaw, 1988; Webb & Sheeran, 2006). Providers must therefore be aware of, and sensitive to, patients' cultural beliefs and practices and always view treatment through a cultural lens to make sure that recommendations do not conflict with cultural norms (DiMatteo, 1994). Health professionals should identify the important people in a patient's life, examine their roles in the patient's beliefs and attitudes, and assess their degree of support for the patient's adherence (Ammassari et al., 2002; DiMatteo, 2004a; Lanouette, Folsom, Sciolla, & Jeste, 2009). Garnering support from these

Table 2. Some commonly used models for understanding adherence with a sampling of meta-analyses examining their associations and outcomes.

Theoretical models	Meta-analyses <sup>a</sup> of outcomes
Health Belief Model (Rosenstock, 1974; Rosenstock et al. 1988)	DiMatteo et al. (2007); greater perceived severity is associated with better adherence.
	Harrison et al. (1992); relative importance of elements (perceived susceptibility, severity, benefits, costs) varies by study, but all are related to better adherence.
Theory of Reasoned Action (Fishbein & Ajzen, 1975)	Sheppard et al. (1988); attitudes and subjective norms are related to intentions, which are important predictors of behaviour.
Social Cognitive Theory (Bandura, 1977)	No meta-analyses identified.
Self-Regulation Model or Common-Sense Model (Leventhal, Meyer, & Nerenz, 1980)	No meta-analyses identified.
Self-Determination Theory (Deci & Ryan, 1985)	Hagger and Chatzisarantis (2009); the constructs of perceived autonomy support and self-determined motivation are related to aspects of the TPB, including perceived behavioural control, intentions and health-related behaviour.
Precaution Adoption Process Model (Weinstein, 1988)	No meta-analyses identified.
Theory of Planned Behaviour (TPB) (Ajzen, 1991)	Armitage and Conner (2001); attitudes, subjective norms and perceived behavioural control are related to behaviours, but intentions and self-predictions better predict behaviour. Hagger and Chatzisarantis (2009); also see above, Self-Determination Theory.
Transtheoretical Model (Prochaska, DiClemente, & Norcross, 1992)	Marshall and Biddle (2001); readiness for behavioural change is important to whether behavioural action is taken, although development may not follow a stage-type process.
Information–Motivation– Behavioural Skills Model (Fisher & Fisher, 1992)	No meta-analyses identified.
Medication Adherence Model (Johnson, 2002)	No meta-analyses identified.
Health Action Process Approach (Schwarzer, 2008)	No meta-analyses identified.

<sup>a</sup>Many of the studies included in these meta-analyses do not focus specifically on adherence; please see the original meta-analyses for more complete information.

individuals is crucial not only because social networks can encourage (or hinder) adherence, but also because they comprise the ever-changing context of patients' lives. Ongoing discussions with friends and family members, or a piece of novel information encountered on the Internet, can alter attitudes and beliefs and thereby influence behaviour even after an initial adherence commitment has been made. Therefore, the second stage of the IMS Model is best viewed as a cyclical, ongoing stage to be revisited frequently by the clinician.

### Strategy

Patients must be *able* to adhere. They must have the tools and strategies necessary and must have the capacity to overcome any barriers to adherence that stand in their way. Thus, the third important task for any health professional is to help the patient identify and overcome obstacles to adherence. These obstacles may be medication induced or merely involve the inconvenience or hard work associated with implementing lifestyle modifications. They may relate to the diminished self-regulation abilities that remain at the end of a taxing day that has already required a good deal of self-control, as suggested by a recent review of the 'Strength Model' of self-regulation (Hagger, Wood, Stiff, & Chatzisarantis, 2009). They can involve such issues as the cost of medications or embarrassment in taking them, difficulties remembering medication scheduling, unpleasant side effects and the challenge of incorporating diet and exercise regimens into a busy life.

Concrete barriers represent a common set of obstacles to adherence. The financial cost of antibiotics may prompt a patient who feels 'well' to save half of her prescription for the next time she 'needs an antibiotic'. Or a patient may repeatedly miss his scheduled office visits because the bus is not reliable and he has no one available to drive him to his appointments. The support of family and friends has already been described as a potent motivator but it is relevant to strategy as well. With regard to the motivation stage of the IMS Model, social support is primarily of the emotional sort – that is, one's motivation may be influenced by the belief that others *approve* of a particular course of action or by having someone to talk to when feeling 'down'. In the context of strategy, however, social support is important in a more *assistance-oriented* way. It encompasses specific ways in which people close to the patient can help overcome barriers such as transportation, affordability, child-care during medical appointments and so on. Health professionals should always assess the levels of practical support available to the patient because the absence of support is a significant barrier to adherence (DiMatteo, 2004a). Potential questions might include: 'If you think you might forget to take the medication, is there someone whom you can ask to remind you?' or 'Do you have a friend or family member who can drive you to your appointment next week?' In the MOS, social support contributed strongly to adherence, especially among diabetic patients and those with cardiovascular disease (Newell, Bowman, & Cockburn, 2000; Sherbourne et al., 1992). Among elderly patients struggling with physical, social and economic vulnerabilities, support is particularly important in helping patients to be active participants in their care (DiMatteo, Hays, & Sherbourne, 1992; Williams, Haskard, & DiMatteo, 2007). Ideally, through the process of collaborative care, health professionals should know their patients well enough to evaluate not only the concrete, physical aids that people close to the patient can provide, but also the valence of their close relationships; family cohesiveness can positively influence adherence, whereas family conflict can severely threaten it (DiMatteo, 2004a).

Healthcare providers may also help patients to identify other formal systems of aid and encouragement that are available. For example, workplace-based interventions to improve physical activity were shown in one recent meta-analysis to effectively improve patients' physical activity levels (Abraham & Graham-Rowe, 2009). 'Youth Fit For Life', a 12-week fitness programme for children aged 5–12 years that is available in many after-school programmes, was shown in another recent

meta-analysis to be effective in reducing body mass index (Annesi, Marti, & Stice, 2010). Community-based resources such as these can be invaluable when integrated with other elements of an individual health behaviour plan.

Mental health issues represent another common barrier to successful adherence. Health professionals should therefore assess the mental health problems that their patients face including anxiety, depression and cognitive deficits, all of which can reduce adherence (DiMatteo, Lepper, & Croghan, 2000; Gonzalez et al., 2008). Depression is particularly problematic because the odds of nonadherence are three times greater for depressed than for non-depressed medical patients (DiMatteo et al., 2000). In the MOS those who were distressed about their health, used avoidant coping strategies, or reported worse role functioning were significantly less likely to adhere (Sherbourne et al., 1992). In a large cross-sectional study of the relationship between distress and preventive health behaviours in older adults, emotionally distressed elders were less likely to receive flu vaccines, yearly dental cleanings and (for women) clinical breast exams (Thorpe, Kalinowski, Patterson, & Sleath, 2006). These findings suggest that an important piece of the strategy step of the IMS Model is to identify patients who are suffering from mental health problems and then connect them with appropriate resources.

A complex treatment regimen is one of the most consistent barriers to successful adherence. Treatment regimens should always be kept as simple as possible because a complex regimen can diminish motivation to adhere, and even patients with high motivation and a clear commitment to action have greater difficulty adhering to more complex treatments. Frequent and complicated dosing schedules can combine with side effects and affordability issues to seriously threaten medication adherence (Buring, Winner, Hatton, & Doering, 1999; DiMatteo, 1995). It is not always easy (or even possible) to make adjustments to a regimen but when it can be done regimen simplification is effective. As one meta-analysis of studies with hypertensive patients demonstrated, improvements in adherence can be achieved with once-daily dosing (Iskedjian et al., 2002). Side effects represent another impediment to carrying out recommended health behaviours although one meta-analysis shows that when patients adhere more effectively their side effects tend to be fewer (Furukawa, McGuire, & Barbui, 2002). Thus health professionals should always strive to make treatment regimens as straightforward as possible, discuss expected strategies for implementing treatment with patients, and prepare patients for anticipated side effects that may present potential barriers to treatment adherence.

Although measuring current adherence is not typically viewed as a strategy for improving future adherence, the accurate assessment of adherence in clinical practice is essential to optimising effective treatment outcomes. The primary reason may be that previous adherence tends to be the strongest predictor of future adherence (Sherbourne et al., 1992; Turner, Weiner, Yang, & TenHave, 2004) and identifying nonadherence can lead to discussion of the barriers that are preventing the target health behaviour. Thus it is crucial to assess, and to regularly track, the continuing adherence status of individual patients; it is one of the best ways to estimate their future behaviour.

Measuring adherence accurately is not easy, however. The many methods used to assess adherence include pill counts, urine or blood assays, medication claims records, electronic monitoring devices and reports by patient or significant others. Analysis suggests that the easiest of these may be simply to ask patients about their

Table 3. Selected adherence measures and availability information.

Measure	Description	Reference
Medication Adherence Scale	Four-item self-report scale	Morisky, Green, and Levine (1986)
General Adherence Scale	Five-item self-report scale	DiMatteo et al. (1992). <a href="http://www.rand.org/health/surveys_tools/mos/mos_adherence.html">http://www.rand.org/health/surveys_tools/mos/mos_adherence.html</a>
Medication Adherence Report Scale	Five-item self-report scale	Horne and Weinman (2002)
The Eight-Item Medication Adherence Scale	Eight-item self-report scale	Morisky, Ang, Krousel-Wood, and Ward (2008). <a href="http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2562622/table/T2/">http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2562622/table/T2/</a>
The Adherence Estimator	Three-item self-report scale	McHorney (2009)

own behaviour. Hays and DiMatteo (1987) examined a variety of options for assessing patient adherence and concluded that, with the right approach, self-report can be very valuable and accurate. Table 3 presents several commonly used self-report assessment instruments along with URLs for accessing them online where available. In addition to the formal (questionnaire-based) measurement of adherence, clinicians may also find it instructive to ask patients, in a supportive way, to list the treatment regimens that were prescribed at the last visit and to describe how these have been followed (e.g., all of the time, most of the time, some of the time a little of the time, none of the time) (Hays & DiMatteo, 1987). Perhaps the most important element in the process of obtaining the patient's honest and accurate self-report of their adherence is an open, honest, caring and empathic relationship with the health professional – one in which patient and clinician approach care as partners.

## Conclusion

The IMS Model illustrates that knowledge, commitment and ability are all crucial for maximising adherence. In addition, the model emphasises the importance of patient–practitioner relationships for effectively informing, motivating and strategising with patients. Nonadherence is a complex problem and addressing it requires the efforts of both patients and clinicians, as well as all members of the healthcare team and the individuals who are part of patients' everyday lives. The simplicity and flexibility of the IMS Model makes it a useful heuristic for targeting patient needs, focusing on elements that are essential to achieving individual patient adherence and ultimately optimising health outcomes.

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