Chapter 21: Creating and breaking habit in healthcare professional behaviours to improve healthcare and health

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Abstract

Healthcare professionals (HCPs) prescribe, provide advice, conduct examinations, perform surgical procedures, and engage in a range of clinical behaviours as part of their work in the service of providing care for patients and the public. Their actions are characteristically performed repeatedly – sometimes multiple times, or multiple dozens of times per day – in the same physical locations with the same colleagues and patients, under constant time pressure and competing demands. This repetition under pressure in a stable setting provides ideal naturalistic circumstances for creating contingencies between physical and social cues and clinical actions. HCP behaviour provides an ideal setting in which to advance theory, methods and intervention design to better understand habit formation and habit reversal. Contemporary theoretical and methodological development in the psychology of habit has begun to be applied to understand and promote the formation, breaking, and replacement of habitual behaviour in healthcare professionals. This chapter highlights key theoretical approaches, methods, and intervention techniques that have been applied to

conceptualize, measure, develop, and break habit and automaticity in healthcare professionals. In turn, these insights have the potential to synergistically contribute novel perspectives to the wider habit literature.

Main text

The role of habit in predicting the behaviour of healthcare professionals

Habit can be defined as a phenomenon whereby internal and external cues trigger automatic reactions, based on a learned stimulus-response association (Gardner, 2014). A habit can be developed through repetition of behaviour in a stable context (Lally, van Jaarsveld, Potts, & Wardle, 2010; Verplanken, 2006; Wood & Neal, 2007). As applied to HCP behaviours, consider a disinfectant dispenser at an elevator that may cue HCPs to automatically disinfect their hands. Initially, the decision to disinfect their hands may be a deliberate process, however sufficient cueing and repetition may automatically trigger hand-sanitising behaviour. Hand washing is but one of the many routine clinical actions involved in everyday clinical practice for healthcare professionals. Some actions, like hand washing, serve a health-protective purpose, while others affect patients more directly in the provision of healthcare, including the range of examination, testing, prescribing, advising, surgical, and referral behaviours involved in routine care.

New medications, interventions and technologies continue to be developed that have the potential to improve patient and public health. The mere availability of these new developments does not guarantee that patients will receive them; indeed, a considerable amount of healthcare provided to patients is either not needed, out-dated, or potentially harmful (Prasad & Ioannidis, 2014). Recognizing that provision of evidence-informed care to patients requires HCPs to change their own clinical behaviour, a concerted effort with the field of Implementation Science draws upon behavioural science to support healthcare professional behaviour change. The nature of such behaviours, characterised by a social and physical setting that promotes repetition of behaviour, favours the formation of habitual clinical behaviours that rely less on a process of active reflection and more on automatic responses to cues (see table 21.1). Given competing demands, time and resource constraints faced by HCPs (Presseau, Francis, Campbell, & Sniehotta, 2011; Presseau, Sniehotta, Francis, &

Campbell, 2009), habit formation is adaptive, minimizing cognitive resources required for a given behaviour to ensure that it can be performed with a maximum of patients and/or for when such resources are especially needed. Habitual performance of clinical actions by skilled HCPs is to be heralded as a means for ensuring low wait times and high quality healthcare. However, habitual behaviours can become maladaptive when they maintain 'low-value care', i.e. clinical actions that have since been replaced by better evidenced practices (e.g. a new type of medication), clinical actions for which there is no evidence of patient benefit (e.g. using a plaster cast on children with small fractures on one side of the wrist. Treatment with a removable splint and written information suffices; Handoll, Elliott, Iheozor-Ejiofor, Hunter, & Karantana, 2016), or clinical actions for which evidence suggests it may cause more harm than benefit (e.g. antibiotic prescribing for upper respiratory tract infection; Kenealy & Arroll, 2013; Spinks, Glasziou, & Del Mar, 2013).

Emerging evidence supports the idea that habit influences HCPs' behaviours. A systematic review and meta-analysis of nine studies including 1,975 HCPs found a medium-sized combined effect for the association between habit and HCP behaviour (Potthoff, Rasul, et al., submitted). This effect size is similar in magnitude to the association between intention and behaviour (Godin, Belanger-Gravel, Eccles, & Grimshaw, 2008). The systematic review included studies focusing on a range of HCP behaviours including advising, examining, prescribing, providing dental treatment and referring. The review showed that although there is clear evidence for the role of habit in relation to HCP behaviour, there is still relatively little research that included measures of habit in the predictive literature and little to none in the experimental trial literature (Potthoff, Rasul, et al., submitted).

A better understanding of how and under what conditions habit influences HCP behaviour could help to design more effective interventions to support HCP behaviour change and thus better healthcare. Such an understanding can draw on habit-informed theories of behaviour that describe how impulsive and deliberate processes interact to influence behaviour. Such theories have been developed and tested in patient, student, and general population samples, however there is a growing evidence-base supporting their utility for understanding and changing HCP behaviour (Fuller et al., 2012; Potthoff, Presseau, Sniehotta, Elovainio, & Avery, 2017; Presseau et al., 2013; Presseau et al., 2014). In the following section we describe a selection of contemporary theories that have been applied to better understand habit in relation to

HCP behaviour and highlight opportunities for further theory development to drive forward our understanding of the concept habit.

Table 21.1 Characteristics of healthcare professional behaviour that may promote habit formation and undermining habit reversal	
Characteristics of environment/context in which healthcare professionals work	Mechanisms of habit formation
Training (Reyna, 2008)	During clinical training HCPs often repeat the same behaviours in a stable context, which facilitates cue-response associations and habit formation.
Performance environment replete with physical cues that create contingencies (Shojania et al., 2010)	In the clinical context HCPs are constantly exposed to physical (e.g., clinical instruments) cues that trigger behaviour repeatedly. Repetition of behaviour in the presence of these cues may lead to habit formation.
Clear performance rules (policies) and professional roles (Schoenwald, 2010)	Policies and roles facilitate the safe performance of clinical behaviours, which facilitate habit formation. However, when policies and roles change there is a need for habit change.
Healthcare is provided within multidisciplinary teams of junior and more experienced HCPs (Hofmann, Friese, & Wiers, 2008)	HCPs often act in response to being prompted by colleagues in their team. For example, more senior HCPs may prompt junior HCPs to perform certain tasks (e.g. change patients' bed sheets). Such social cueing can maintain behaviour and lead to habit formation.
Clinical actions can be influenced by patient and caregiver expectations and behaviours (De Sutter, De Meyere, De Maeseneer, & Peersman, 2001)	Patient and caregivers often have expectations for the care they think they should receive. Sometimes patients may express their expectations to the HCPs,

	which may prompt habitual behaviour. For example, if patients repetitively ask for antibiotics and the HCP decides to grant this request it can quickly.
Time pressure (Johnston et al., 2015)	With little time on their hands HCPs are often required to act fast and efficiently in the face of multiple demands.
Remuneration (reinforcement) schedules (Flodgren et al., 2011)	Some healthcare systems link specific remuneration for very specific behaviours, encouraging repetition and habit formation.

Theoretical approaches to understanding habit in healthcare professionals

A range of contemporary theories of behaviour describe how human behaviour is the result of both conscious and unconscious processes (Evans, 2008). Three specific theories that have been used to date to understand and predict HCP behaviour include the Reflective Impulsive Model (RIM; Strack & Deutsch, 2014), Fuzzy Trace Theory (FTT; Reyna & Brainerd, 2011) and Novice to Expert Theory (NET; Benner, 1982). Although such approaches use different terminology, there are key similarities between them (Stanovich & West, 2001): One system (1) is characterised as fast, effortless, unconscious, and automatic; the other system (2) is characterised as slow, effortful, conscious and deliberate (Stanovich & West, 2001). Given this division of mental processing these theories have commonly been called dual process theories (Evans, 2008). In this chapter we will use Strack and Deutsch's terms '*reflective'* and '*impulsive'* to describe the two systems (Strack & Deutsch, 2004; Strack, Werth', & Deutsch, 2006).

Reflective Impulsive Model (RIM)

The RIM offers a comprehensive account of these two systems and describes their most important properties and functions (Strack & Deutsch, 2004; Strack et al., 2006). In contrast to other dual processing theories (e.g., Heuristic-Analytical Theory; Evans,

1989) the RIM postulates that the reflective and impulsive system function in parallel, such that the impulsive system is always active whereas the reflective system may be disengaged (Strack et al., 2006). As applied to HCP behaviour, a well-practiced nurse may for instance draw blood from a patients' arm without engagement of the reflective system. However, there may be patients whose veins are less visible which makes it harder to draw the blood. In such cases the reflective system may have to be engaged to assist the impulsive system in the operation of behaviour.

The two systems differ in their processing *capacity* (Deutsch & Strack, 2008; Strack & Deutsch, 2014; Strack et al., 2006). The reflective system has limited capacity and does not deal well with distractions or extreme levels of arousal. The impulsive system on the other hand operates even under suboptimal conditions (Strack et al., 2006). HCPs are often under a lot of pressure and work long hours. As they navigate multiple demands they rely on well-rehearsed routines that allow them to provide optimal care for their patients, even when their cognitive capacities are low.

The reflective and impulsive systems also differ in how they process information. When HCPs acquire new knowledge during training and clinical practice they draw heavily on the reflective system to form new semantic connections in memory (Strack & Deutsch, 2014; Strack et al., 2006). A HCP in training may learn that hand hygiene is important to prevent the spread of viral infections. The impulsive system relies on associative links, which are formed through repeated experience in similar settings (e.g. soap dispenser near elevator becomes a cue for hand washing after sufficient repetition).

An extension of the RIM describes a range of situational and dispositional *boundary conditions* (see table 21.2) that influence whether the impulsive or reflective system is dominant in controlling behaviour (Hofmann et al., 2008). Low cognitive control resources (e.g., due to tiredness or stress) may lower the functioning of the reflective system whilst favouring impulsive actions. For example, HCPs may be encouraged to provide physical activity advice to patients with lower back pain in accordance with evidence-based practice, however a more habitual response may be to prescribe an opioid. In such a scenario a conflict in behavioural schemas (i.e., repetitive actions that are represented as generalisations in memory) may arise. If control resources are high (e.g., no time pressure, motivated patient) HCPs may advise on increasing physical activity (reflective system response). However, if there

is a lack of time and it is the end of the day the reflective system might fail to inhibit the impulsive system prompting the HCP to prescribe an opioid (impulsive system response). Indeed, real-world data suggests that control resources may impact clinical behaviour: Using billing and electronic health record data, Linder and colleagues (2014) showed that the likelihood of inappropriate antibiotic prescribing for acute respiratory infection increases during the course of both morning and afternoon clinic sessions, consistent with the hypothesis that impulsive responses are more likely when cognitive resources become depleted. Boundary conditions highlight the need for promoting the formation of evidence-based habit that allow HCPs to act appropriately even in high-pressure conditions (Hofmann et al., 2008).

Table 21.2 Potential boundary conditions that may promote the impulsive system in healthcare professionals

Boundary condition	Boundary condition as applied to healthcare professional context
Stress	A variety of factors can contribute to high stress levels in HCPs. This may include long working hours, lack of staff, patients with difficult problems, and medical emergencies.
Fatigue	Working hours of HCPs often stretch until late in the night and overtime can be the norm rather than the exception.
Cognitive load	HCPs have to perform highly complex tasks involving reading and interpreting test results, diagnosing, prescribing, and advising. These tasks have the potential to draw heavily on cognitive resources.
Emotional exhaustion	Many of the behaviours that HCPs perform have severe consequences for patient health. There are also things that happen to the patient that are sometimes

	outside of HCPs' control (e.g., death or other family tragedies). These are all examples of situation that can cause emotional exhaustion, which in turn has the potential to influence behaviour.
Physical exhaustion	Some tasks that HCPs such as nurses perform can put severe strain on the body (e.g., moving patients in and from the bed). Physical exhaustion may also cause mental tiredness and habitual behaviour.
Experience	HCPs who have higher levels of experience will be more likely to have performed certain clinical actions more often than their more junior colleagues. Given that behavioural repetition increases with experience this can be viewed as a boundary condition with more experienced HCPs being more likely to rely on habit.
Hunger	Research shows that hunger is associated with more impulsive processing. With high amounts of pressure HCPs may sometimes not find the time to have a meal or a snack which may cause them to act more habitually.
Time pressure	HCPs often work under time pressure requiring them to act fast in response to the problems they are encountering. Such time constraints may favour impulsive actions.
Presence of old cues	There may be cues in the HCP's context which prompt habitual behaviours that are no longer in line with best practice

	(e.g. if a HCP is no longer recommended to order a specific diagnostic test, but the test ordering form is not updated and so the test still appears at the top of the form). In such situations impulsive actions may be favoured over more reflective processing.

RIM principles have been investigated in predictive studies of HCP behaviour, demonstrating that it is possible to operationalise and test dual-process approaches in HCPs (Potthoff et al., 2017; Presseau et al., 2014). One study tested the utility of a dual process model to predict six different clinical practice guideline-recommended behaviours performed in type 2 diabetes management in primary care (Presseau et al., 2014). The study used a self-reported measure of automaticity (Gardner, Abraham, Lally, & Bruijn, 2012) as an indicator of the impulsive system and measures of motivational and volitional processes (Gollwitzer, 1999; Kwasnicka, Presseau, White, & Sniehotta, 2013; Sniehotta, 2009) as an indicator of the reflective system. Self-reported prescribing, examining and advising behaviours were measured at 12 months follow-up. The dual process model successfully predicted four of the six clinical behaviours. The reflective pathway was predictive of all six behaviours, indicating the importance of deliberate decision-making. Importantly, the study found that the impulsive system (represented by habit) accounted for significant amount of variability in four of the six behaviours, suggesting that automatic processes are an important predictor of HCP behaviour. Other research has used cognitive processing time as an objective measure to distinguish reflective from impulsive processing (with longer processing time indicating involvement of the reflective system). In a study by Norman and colleagues (2014), trainee physicians (second year residents) made diagnoses for computerised patient scenarios, with half instructed to work rapidly, and the other half to be slow and reflective. There were no differences in overall diagnostic accuracy between groups, but within both groups there was a negative correlation between accuracy and time, with cases diagnosed incorrectly taking significantly longer than cases diagnosed correctly. Further evidence using patient scenarios to investigate primary care physicians' simulated antibiotic prescribing for

upper respiratory tract infection found that appropriate (no prescribing) decisions were more likely when difficulty with decision-making was lower and decision time was shorter, indicating that appropriate prescribing decisions can be made quickly using a less effortful cognitive process (McCleary et al., 2017). These results consistently show that rapid clinical actions may involve the use of intuitive processes and can be as accurate as clinical actions involving reflective processes, supporting their appropriateness in clinical settings, which may be contrary to popular belief that careful reflection is always favoured.

Fuzzy Trace Theory (FTT)

FTT explains how the reflective and impulsive system interact with human memory (Reyna & Brainerd, 2002). According to FTT, memories are represented as *verbatim* and *gist traces.* For most decision-making people draw on gist traces, which are 'fuzzy' representations of past events (e.g., mental shortcuts). For example, in their daily practice some HCPs prefer judging risks in terms of high or low, rather than trying to recollect precise risk probabilities (Reyna & Brainerd, 2007). Fuzzy traces have also been referred to as heuristics, which are rules of thumb that are used to come to a decision in an efficient manner (Elstein, 1999; Gigerenzer & Gaissmaier, 2011; Hamm, 2004). Kahneman, Slovic, and Tversky (1982) provided the first comprehensive description of the influence of heuristics on decision-making and behaviour. Heuristics are commonly used because they are cognitively undemanding and can be used rapidly, hence providing a useful method for coping with complex problems under the constraints of bounded rationality (Eysenck & Keane, 2010). Bounded rationality models propose that decision-making is bounded by constraints in the environment (such as the cost of obtaining information), as well as cognitive constraints (such as limited attention and memory) (Eysenck & Keane, 2010; Patel, Kaufman, & Arocha, 2002; Simon, 1957). Decision makers adapt to these limitations by focussing on only some of the available information, producing reasonable solutions by using various heuristic strategies (Eysenck & Keane, 2010; Patel et al., 2002). Verbatim traces are detailed representations of past events, including recollections such as ratio concepts. In contrast to some other dual process theories, FTT assumes that behaviours that are the result of gist-based decision-making can be more accurate than behaviours resulting from verbatim-based decision-making (Reyna, 2008). Importantly, reliance on gist traces is only superior if the actor is

experienced in the topic of question (e.g., experienced consultant deciding on a medication). In line with this proposition HCPs with a lot of clinical experience are better advised to act according to their intuition rather than relying on verbatim-based reasoning. One study tested the so called *unconscious thought effect,* which refers to the phenomenon that some people make better decisions after being distracted for a period of time (de Vries, Witteman, Holland, & Dijksterhuis, 2010). The authors studied this effect in relation to one of the most difficult clinical decision-making processes: diagnosis. The study aimed to assess the effects of unconscious thought on the precision of diagnosis of psychiatric cases. Half of the participating HCPs were asked to consciously reflect on a clinical case before making their diagnosis. The other half of HCPs had to perform an unrelated distracter task. The study found that compared to conscious processing condition, HCPs in the 'unconscious' condition (distracter task) achieved a higher number of correct classifications (de Vries et al., 2010). The study highlights the potential importance of unconscious decision-making in trained HCPs; it also has important implications for habit formation and reversal in trained healthcare professionals.

Novice to Expert Theory (NET)

Another theory that is consistent with the idea that HCPs' behaviour is driven by both reflective and impulsive processes is the Novice to Expert Theory (NET; Benner, 1982). NET was developed in the nursing context and builds on Dreyfus Model of Skill Acquisition (Dreyfus, 1992; Dreyfus & Dreyfus, 1980). According to this model people pass through five levels of proficiency as they acquire new skills (i.e., novice, advanced beginner, competent, proficient, and expert) (Dreyfus & Dreyfus, 1980). Benner conducted a series of qualitative studies (including interviews and observations) to apply Dreyfus' Model to the context of nursing and found that it was in agreement with their experiences (Benner & Benner, 1979). NET posits that nurses in the early stages of skill acquisition (i.e., novice and advanced beginner stage) rely mostly on reflective processing as they apply rules learned during their clinical training. For example, to determine fluid balance in a patient, nurses may check morning weights and daily intake of outputs during the past days. During this forming period nurses are still reliant on mentoring as they have not yet learned how to see the wider context and prioritise their actions. As nurses gain more experience and move through the stages of competent to expert they become less reliant on rules and their

behaviour is more guided by intuition (in line with the impulsive system). According to Benner, when experts are asked why they performed certain masterful actions they will often reply, “Because it felt right. It looked good” (Benner, 1982). NET posits that with increased experience behaviour moves more into the background of experience rather than being controlled by conscious processes. However, the theory does not say that expert behaviour is never driven by reflective processes. According to NET experts still make use of analytical thinking when they are confronted with novel or difficult situations. The importance of analytical thinking in experts is in line with research comparing the accuracy of conscious thought with deliberation without attention in diagnostic decision-making (Mamede et al., 2010). The study found that expert doctors made more accurate diagnostic decisions when they made a careful analysis when compared to making a decision based on intuition. Interestingly, novices (medical students) diagnosed more accurately when asked to make an immediate decision, rather than considering the case more carefully (Mamede et al., 2010). The NET highlights the importance of experience in the development of clinical habit. It also draws attention to the need of tailoring HCP behaviour change interventions to the phase of skill acquisition. For example, in the early stages of skill acquisition (habit formation) HCPs may benefit from role-playing and practicing behaviours in an applied or simulated setting. Advanced beginners also benefit from mentors who help them prioritise certain tasks. Proficient HCPs like case examples to advance their knowledge and skills. Lastly, experts may need to watch video observations of their own behaviours to become aware and be able to change their habits (Benner, 1982).

What does each of the theories uniquely contribute?

When choosing a theory to help understand HCP behaviour or to design and evaluate an intervention to change HCP behaviour it is important to understand what each theory uniquely contributes (Birken et al., 2017). A key contribution of the RIM is that it describes the circumstances under which each of the two systems (i.e., reflective and impulsive) is dominant in controlling behaviour. The model specifies concrete *boundary conditions* that influence whether people’s behaviour is likely to be the result of reflection or impulse. Boundary conditions such as tiredness, stress and task demands are likely to affect HCPs even more so than people from the general population. This may have consequences for the way in which care is delivered. For

example, HCPs are more likely to prescribe antibiotics inappropriately in the late morning and afternoon when cognitive resources become depleted (Linder et al., 2014). The unique contribution of FTT is that it describes how HCP use heuristics or mental short cuts that guide behaviour. Importantly, the theory describes how with increased experience HCPs starts relying more heavily on such short cuts, which allow them to solve even complex tasks with high efficiency. However in some situations heuristics can also lead to bias, which can cause inappropriate actions. For example, a systematic review showed that the anchoring bias (the tendency to form an initial impression too early in the diagnostic workup, and to fail to adjust this in light of subsequent information) and availability bias (the tendency to judge diagnoses as being more likely if examples of it readily come to mind, and less likely if examples do not readily come to mind) were associated with inaccurate diagnoses for case scenarios (Croskerry, 2003). However, a limitation of this area of research is that most of the conclusions are based on responses to hypothetical scenarios, and therefore may not translate to the real world of clinical practice (Saposnik, Redelmeier, Ruff, & Tobler, 2016). In addition, these studies are often explicitly designed to induce the bias being investigated, which again calls into question the extent to which these biases occur in real practice (Norman et al., 2017). A better understanding of how heuristics drive appropriate behaviours and under what circumstances they lead to error may have important consequences for how information is presented to HCPs. The NTT describes how HCPs acquire new skills and how these skills become habitual over time. According to this theory behaviour is more strongly lead by the impulsive system as HCPs gain experience in their profession. Therefore it assumes that during the initial years of their career HCP behaviour is mostly driven by reflection, however that the experience of behaviour moves more into the background of consciousness as experience increases. It provides clear guidance for training that may support HCPs at different stages of expertise in improving their skills.

Measuring habit in healthcare professionals

To understand how habit influences HCP behaviour on a daily basis, one option is to measure habit strength. Such a measure needs to be internally valid, that is it needs to be in line with current definitions of habit. For example a measure needs to

capture to what extent the actor was conscious of a given behaviour, how much effort went into the behaviour, and whether the actor was in control of the behaviour (Bargh, 1994). Furthermore a good measure of habit needs to be reliable, that is it needs to capture the phenomenon consistently on different occasions. There are different methods of measuring habit and their utility depends on the extent to which they capture some of the core facets of habit including automaticity, cue-dependency and the underlying stimulus-response association (Gardner et al., 2012). Furthermore, given that much of the research on HCPs takes place in an applied setting it is important that measures of clinical habit are feasible to deliver.

Self-reported measures of habit and automaticity

A systematic review showed that self-report measures are currently the predominant method of assessing HCPs' habit (Potthoff, Rasul, et al., submitted), with most studies using a 2-3 item 'Evidence of Habit' measure (Eccles et al., 2011) derived from Learning Theory (Blackman, 1974) and focuses on the automaticity facet of habit (e.g., 'When I see a patient I automatically consider taking a radiograph'). For example, a cross-sectional study in the UK used this measure to understand to what degree referral for lumbar spine x-ray in patients presenting with low back pain was something that primary care physicians did automatically (Grimshaw et al., 2011). The study found a significant relationship between measures of habit and self-reported referral for lumbar spine x-rays (Grimshaw et al., 2011). Two other self-reported measures are the Self-Reported Habit Index (SRHI; Verplanken & Orbell, 2003) and the shorter Self-Reported Behavioural Automaticity Index (Gardner et al., 2012). The SRHI includes twelve items that measure four facets of automaticity—lack of control ('…that would require effort not to do'), lack of awareness ('…I do without thinking), behavioural frequency ('…I do frequently') and self-identify ('…that's typically "me") (Verplanken, 2006). The SRBAI is a shorter version of the SRHI, which focuses on the automaticity aspect of habit (Gardner et al., 2012). A prospective study used the four-item SRBAI to understand to what degree self-reported levels of behavioural automaticity predict HCPs' performance of six guideline-recommended behaviours in their management of type 2 diabetes (including prescribing, advising, and examining) (Presseau et al., 2014). The study found that self-reported levels of automaticity could account for significant amounts of

variability in HCPs' behaviour over and above reflective constructs (Presseau et al., 2014).

Though self-reported measures are a feasible method of measuring habit in HCPs they clearly have limitations. Habit is theorised to operate outside a persons' awareness, therefore if HCPs are asked to self-report the perceived automaticity of a clinical behaviour they are likely to make an inference about a behaviour based on the consequences of habit (e.g., hand washing habit inferred from empty soap dispenser) (Sniehotta & Presseau, 2012). Some self-report measures also have shortcomings in construct validity, as measures such as the SRHI may be conflated with constructs that are not part of habit (e.g., self-identity) (Gardner, 2014). The SRBAI is a more parsimonious measure that focuses on the automaticity aspect of habit and excludes items that detract from its construct validity (Gardner et al., 2012). Given the cue-dependency of habit it is important that any self-reported measure (i.e., Evidence of Habit, SRHI, or SRBAI) includes the contextual cue that triggers the behaviour (e.g., 'Behaviour X in Context Y is something I do automatically') (Sniehotta & Presseau, 2012). For example, HCPs could be asked whether 'Washing their hands' (behaviour) 'after taking off their gloves' (context/ cue) is something they do automatically. Being more specific about the target behaviour by including contextual cues may help participants picture the behaviour more clearly, which may help increase the construct validity of questionnaires measuring habit (Francis & Presseau, in press).

Think-aloud

The Think-Aloud technique can be used to investigate the cognitive processes underlying behaviour by asking participants to verbalise their thoughts while completing a task (Ericsson & Simon, 1993; Van Someren, Barnard, & Sandberg, 1994). The verbalisations reveal the cognitive processes involved in task completion, such as how participants analyse available information (Austin & Delaney, 1998; Fonteyn, Kuipers, & Grobe, 1993; Johnson et al., 2012; L. Bowen & S. Ilgen, 2014). The Think-Aloud technique has been used in numerous studies of GPs' simulated behaviour (i.e. studies using patient scenarios) (Backlund, Skånér, Montgomery, Bring, & Strender, 2003, 2004; Denig, Witteman, & Schouten, 2002; Johnson et al., 2012; Klungel et al., 2000; Offredy, 2002; Offredy & Meerabeau, 2005; Skånér, Backlund, Montgomery, Bring, & Strender, 2005). Backlund and colleagues (2004; 2003) used Think-Aloud to investigate prescribing for high cholesterol and found

evidence for the use of rules or heuristics (typically associated with the impulsive system). Although Think-Aloud is a self-report method with all the associated caveats described above (and the additional caveat that not all cognitive processes can be verbalised, particularly for those associated with the impulsive system), thinking aloud concurrently while performing a behaviour may help alleviate memory problems associated with other self-report measures. Think Aloud may also give us clues as to the environmental cues prompting habit, which could then be the subject of objective investigations (for example, embedded within behavioural simulation studies/lab-based studies involving manipulation of cues).

A call for moving towards more objective measures of habit

Lab-based association tests apply response time tasks to measure habit and are often seen as gold standard as they tap into the underlying cue-response association that underpins habit. Association tests are based on the idea that habitual responses are more readily accessible in memory than non-habitual responses, so that people respond faster to cues that are associated to habitual behaviours (Danner, Aarts, & de Vries, 2008; Webb, Sheeran, & Luszczynska, 2009). Although these tests might help overcome some limitations of self-reported measures they are difficult to administer in the field in applied HCP samples and depend on prior knowledge of cues that prompt habit. One way of advancing habit measurement could be to cross-validate self-reported measures of habit with lab-based association tests (Greenwald, McGhee, & Schwartz, 1998). Recent progress in portable computing devices may further support the administration of association tests with healthcare professionals. Such methods could further look at physiological correlates of habit such as pupil dilation, which can be measured with a tablets' front camera (Paas, Tuovinen, Tabbers, & Van Gerven, 2003).

It may also be possible to use routinely collected health administrative data gathered within healthcare systems to study habit and the impact of reflective and impulsive cognitive processes on healthcare professional behaviour, in particular to investigate boundary conditions that may determine whether reflective or impulsive processes are engaged. As described above, Linder and colleagues (2014) used billing and electronic health record data to indicate that inappropriate antibiotic prescribing for acute respiratory infection was more likely to occur near the end of clinic sessions, when cognitive resources are likely depleted. Further work is needed to investigate

this across a range of clinical behaviours, which may form the basis of suggestions for interventions aiming to change environments in order to change behaviour (for example, Linder and colleagues suggest time-dependent decision support, shorter clinic sessions, mandatory breaks, or snacks).

Another issue with self-reported measures is that people experience difficulties remembering habitual behaviours and the cues that trigger them (Gardner & Tang, 2013). To overcome difficulties of recalling habit cues future studies could employ self-reported habit measures in combination with video observations of HCPs' clinical behaviours. Seeing their behaviour in action may enable HCPs to make a more informed reflection about the level of automaticity of a given behaviour. Video observations can be further combined with conversation analysis which is a method to assess cues and automatic behaviours by examining interactions and the verbal and non-verbal cues that drive HCPs behaviour (Drew, Chatwin, & Collins, 2001)

Overall, self-reported measures are the most commonly applied method of measuring habit in HCPs but they have clear limitations. Using self-reported measures in combination with or preceding other methods may help overcome some of these limitations.

Strategies for creating and breaking habit in healthcare professionals

Habit can be adaptive as it allows HCPs to act in an efficient way in the cognitively demanding clinical context. However, habit can also become maladaptive when HCPs continue performing behaviours that are no longer in line with best clinical practice (Prasad & Ioannidis, 2014). In this section we will describe behaviour change strategies that can be used to support HCPs with changing their behaviour by addressing habitual processes (see 21.3 for additional strategies). This may involve creating new routines of delivering evidence-based care, substituting old ways of providing care with new practices, or breaking routines of providing out-dated and potentially harmful care.

Creating habit in healthcare professionals

Healthcare professional behaviour change interventions predominantly target reflective processes by providing HCPs with information (Giguère et al., 2012;

O'Brien et al., 2007), revising professional roles (Glisson et al., 2010), or using mass media to inform a large number of HCPs of a new innovation (Magnabosco, 2006). Different types of interventions, or different intervention components, are likely needed to influence impulsive processes. Habit formation requires two main ingredients: behavioural repetition and the presence of consistent contextual cues (Lally & Gardner, 2013). Electronic reminders have the potential to serve as cues and their effectiveness to change HCPs' behaviour has been shown in systematic reviews (Shojania et al., 2009). Reminders may be installed on HCPs practice computers to prompt the enactment of a particular practice during a clinical encounter. HCPs in a qualitative study reported that electronic pop-up reminders in their patients' electronic records supported them with making more frequent use of an information prescription for type 2 diabetes (Potthoff, Presseau, et al., submitted). Importantly, they reported that it was essential that pop-up reminders only appeared for patients for whom an information prescription was appropriate. Therefore it is important that electronic reminder systems incorporate intelligent algorithms that prevent too frequent reminding of HCPs (Potthoff, Presseau, et al., submitted). It is also important to note the issue of 'alert fatigue', whereby if a HCP perceives that they are receiving too many alerts, they may ignore or override them (Ash, Sittig, Campbell, Guappone, & Dykstra, 2007). It is therefore important to balance the use of electronic pop-up reminders with other strategies aiming to influence habit.

In addition to electronic reminders there may be a range of other contextual and social cues that may be harnessed to support the formation of clinical habit. For example, clinical checklists have long been used to improve the safety during surgical procedures (Borchard, Schwappach, Barbir, & Bezzola, 2012). There is a range of other cues such as clinical instruments, medication packages, or disinfectant dispensers that may serve as cues to clinical habit. Thus far, there is only limited research on the effects of different types of cues on HCPs habit. Future studies could use experimental designs whereby contextual cues are altered and the formation of habit is measured.

Strategies can be used to support habit formation in HCPs that directly activate impulsive processes (i.e., reminders and cues) and can be manipulated by others, while some strategies can be leveraged by oneself and use the reflective process to 'program' the impulsive process. One example is the use of planning interventions such as action and coping planning (Gollwitzer, 1999; Hagger et al., 2016; Kwasnicka

et al., 2013; Sniehotta, 2009). Action plans are very specific plans of when, where and how to perform a specific behaviour (Sniehotta, 2009; Sniehotta, Scholz, & Schwarzer, 2005). For example, an action plan for hand washing could be 'When I remove my protective gloves after surgery, then I will wash my hands at the sink outside the operating theatre'. Coping plans are specific plans to overcome pre-identified barriers to an intended behaviour (Kwasnicka et al., 2013). For example, a coping plan could be 'If the soap dispenser outside the operating theatre is empty, then I will ask someone to refill it'. There is evidence suggesting that such planning interventions are effective in supporting HCP behaviour change (Casper, 2008; Squires et al., 2013; Verbiest et al., 2014). For example, one study found that HCPs who formed a specific plan (i.e., implementation intention) in addition to receiving clinical training were more likely to apply the training in their daily practice, when compared to HCPs who received the training alone (70% and 58% respectively) (Casper, 2008). Likewise, HCPs who reported having formed a highly specific action plan for providing smoking cessation care were more likely to provide this care at 6-month follow-up (Verbiest et al., 2014).

A study assessing the mechanisms through which planning may effect HCP behaviour (Potthoff et al., 2017) investigated the relationship between action and coping planning and six guideline recommended behaviours in HCPs working in diabetes care. Analysis of correlational data showed that the relationship between planning and HCPs' clinical behaviours was mediated by habit. These results suggest that HCPs who have formulated a specific plan may have formed a cognitive link between an opportunity to act and an appropriate response (i.e., providing guideline recommended care). Such a link will allow HCPs to act in a fast and intuitive way, rather than having to rely on effortful decision-making each time (Potthoff et al., 2017).

Breaking habit in healthcare professionals

Studying HCP behaviour change also offers an opportunity to test strategies that could be effective in breaking existing habit. For example, the 'Choosing Wisely' initiative provides healthcare improvers with up-to-date lists of unnecessary tests, treatments, and procedures, which can be accessed online (http://www.choosingwisely.org/). The lists were generated in collaboration with 6 specialty societies such as the American Academy of Family Physicians, who were

asked to choose 5 tests or treatments that were prone to overuse within their areas. The resulting lists are accompanied by the reasoning and evidence for their selection. For example, one of the items on the list recommends not to do imaging for low back pain within the first 6 weeks, unless red flags are present. Initiatives such as Choosing Wisely amongst others (e.g. Avoiding Avoidable Care [http://avoid ablecare.org] or Selling Sickness [http://selling sickness.com]) aim to change HCPs routines through media campaigns that are intended to educate HCPs.

However, the provision of information is likely insufficient for helping HCPs with breaking habit because the clinical context is full of contextual cues that may prompt *dormant habit*. Dormant habit describes existing habits that are only prompted rarely due to infrequent encounters of relevant cues (Gardner et al., 2012). For example, HCPs may only infrequently encounter an empty soap dispenser, which may prompt them to skip washing their hands. Therefore, one way of disrupting the influence of old habit is to remove any contextual cues that may trigger automatic responses (Verplanken & Melkevik, 2008). This could involve removing out-dated information leaflets or making access to over-prescribed medications and lab tests more difficult. A systematic review found that interventions such as those involving changes to laboratory forms (e.g. removing checkboxes for overused lab tests from laboratory order form) resulted in significant reductions in test-ordering (Thomas, Vaska, Naugler, & Turin, 2015). A questionnaire study looked whether grouping of menu items in electronic health records (EHR) would affect primary care physicians' prescribing behaviour of highly aggressive antibiotics (Tannenbaum et al., 2015). The study found significant reduction in the prescription of aggressive antibiotics when over-the-counter (OTC) medications were listed separately followed by all prescription medications, as opposed to the opposite (all prescription medications listed separately followed by all OTC medication options in one group). These results suggest that changes to the configuration of EHR can be used as a way of encouraging guideline-appropriate behaviours.

Removing or changing contextual cues may not always be feasible, especially if the patient becomes a cue for a specific behaviour (e.g., patient with an upper respiratory tract infection (URTI) asking for an antibiotic). In such cases HCPs could formulate specific 'If-then' plans, or *implementation intentions* that help them respond to an old habit cue in a more desirable way (Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011). For example, if patients with an URTI prompt

HCPs to overprescribe antibiotics they may want to form a plan that helps them substitute this behaviour with a more desired response (Helfrich et al.). Such a plan could be as follows 'If a patient with URTI asks for an antibiotic, then I will explain that it is important to first monitor the progression of the infection before prescribing an antibiotic'. Intervention modelling experiments, where an intervention is evaluated within a randomised controlled design in a manner that simulates the real world (Eccles et al., 2007), have indicated that planning may also contribute to breaking existing habitual behaviours. These have shown that interventions involving action planning can influence primary care physicians' self-efficacy in managing upper respiratory tract infection without prescribing antibiotics, and reduce their likelihood of prescribing antibiotics in response to patient scenarios (Hrisos et al., 2008; Treweek et al., 2016).

Intervention strategies aimed at reducing cognitive effort and capitalising on the use of heuristics may contribute to the formation and/or breaking of healthcare professional habit. Gigerenzer and Gaissmaier (2011) conceptualise heuristics as adaptive strategies which provide efficient modes of processing, and which are essential for effective decision-making in our information-rich environments due to our limited processing capacity. They claim that using heuristic strategies, whereby some information is deliberately ignored, can lead to decisions being made faster than, and as accurately as, more complex methods. Gigerenzer and Gaissmaiers' (2011) central focus is on 'fast and frugal' heuristics, which involve rapid processing of relatively little information to come to a decision, and they argue that effort should be focussed on exploring the effective use of these strategies. Researchers have begun to develop strategies based on fast-and-frugal heuristics to assist clinicians in decision-making, and to compare them with more complex decision support tools. Fischer et al. (2002) compared two tools for assisting hospital clinicians in identifying Mycoplasma pneumoniae as the cause of community acquired pneumonia in children, and subsequently targeting the prescription of macrolide antibiotics. The first was a scoring system derived from a logistic regression analysis, which had identified age and duration of fever as key predictors of infection. The scoring system required a clinician to look up scores representing the risk of infection (derived from the regression coefficients) for each child's age and duration of fever. The clinician summed the scores before consulting a risk interpretation sheet. The second tool was a fast-and-frugal decision tree, consisting of two yes/no questions for the clinician

relating to the duration of fever and the child's age. Children who were fevered for more than two days and were older than three years of age were identified as being at risk of infection. Both tools performed similarly well in identifying children at risk, with the scoring system identifying 75% of cases and the fast-and-frugal decision tree identifying 72% (Fischer et al., 2002). However, the fast-and-frugal tree was more straightforward and could be easily memorised. Strategies such as these may assist healthcare professionals in breaking old habits based on out-dated evidence, and replacing them with new habits based on the best available current evidence, and in turn make an important contribution to improving the quality of care delivered in healthcare systems.

Table 21.3 Potential strategies to address impulsive processing in healthcare professionals

Strategy	Definition/ description of strategy
Learning Theory strategies (Skinner, 1963)	These techniques focus on producing measurable change in behaviour by delivering reinforcement (e.g., through remuneration) or punishment (e.g., disciplinary actions or sanctions). When these strategies are applied to HCPs it is important to consider the complexity of the behaviour and the scheduling of reinforcement or punishment.
Techniques leveraging social cues (O'Connor, 2009)	This technique could involve engaging patients to prompt HCPs to provide certain clinical services. For example, media campaigns could be used to encourage patients to ask their HCP to provide them with advise on a given health behaviour. Such patient-mediated approaches are already being used successfully to support the implementation of new medical

	innovations.
Techniques that change the physical environment (Prochaska, 2013; Verplanken & Aarts, 1999; Wood & Neal, 2007)	This could involve both adding and removing physical cues in the clinical environment. For example, stickers or posters could be added in practices. Equally, stimuli that relate to undesired practices (e.g., packaging of overprescribed medications or checkboxes for overused lab tests on forms) could be removed.
Techniques dealing with emotion and stress (Shapiro, Astin, Bishop, & Cordova, 2005)	HCPs who experience large degrees of emotional stress could be supported through regular supervisory meetings during which they could learn active ways of coping with emotions (e.g., using positive emotion regulation strategies). Strategic short breaks could be used as a strategy to reduce stress more generally and thereby reducing unhelpful habitual behaviours.
Behavioural substitution (Wood & Neal, 2007)	This technique involves increasing the frequency of a behaviour whilst reducing the frequency of another. For example, HCPs could provide physical activity advice to people with lower back pain instead of prescribing an opioid where appropriate. This technique requires the availability of substitute behaviours.
Implementation intentions (Gollwitzer & Sheeran, 2006; Potthoff et al., 2017; Verplanken & Aarts, 1999)	Prompting HCPs to make specific If-then plans linking situational cues with responses that are in line with delivering best practice care. For

	example, HCPs could make a plan to provide physical activity advise if a patients' BMI is outside the recommended range.
Coping planning (Hofmann et al., 2008; Marlatt & Donovan, 2005)	Getting HCPs to identify barriers to providing evidence-based care and ways to overcome these. For example, if a patient is eligible to receive physical activity advice but the HCP is running out of time he might provide a leaflet, which provides further information.
Public commitment (Ajzen, Czasch, & Flood, 2009)	Stimulating HCPs to commit to engaging themselves to deliver evidence-based care to their patients, and announcing that decision to their co-workers. For example, a healthcare professional could announce to his co-workers that he will from now on deliver self-management advise to all his patients with chronic conditions who have not received this type of advice before.
Audit and feedback (Ivers et al., 2012)	Gather and summarise data on the performance of specific clinical behaviours and feeding back to HCPs. This quality improvement technique aims to make HCPs conscious of their enactment of clinical actions with hopes of changing behaviour. This technique can be applied to either increase or decrease the performance of habitual actions.

Next steps

The use of psychological methods and theories can lead to impactful changes and the context in which healthcare professionals provide care to patients offers a naturalistic laboratory to study routines and habit. There is an opportunity to harness theories of behaviour to better understand how habit influences HCP behaviour. Such insights could help develop more effective interventions to support HCP behaviour change and improve the care provided to patients. In this section we will build on the previous sections to highlight areas for future research on habit and HCP behaviour.

Future research should explicitly test predictions of theories that hypothesise about the impulsive process underlying HCP behaviour. For example, in table 21.2 we provided a list of potential boundary conditions that may promote the functioning of the impulsive process. Thus far, there has been relatively little research exploring the effects of boundary conditions on HCP behaviour (Linder et al., 2014). Future research could explore how and to what degree boundary conditions such as stress, fatigue or cognitive load affect clinical behaviours. This could involve looking at whether certain habitual behaviours (e.g. use of unnecessary diagnostic tests) are performed at a higher rate when HCPs are under stress (e.g. busy clinic). Similarly, research could explore the role of professional experience as a moderator of the habit-behaviour relationship as hypothesised by the Fuzzy Trace Theory. This could be done by looking at whether more experienced HCPs rely more heavily on the impulsive process when delivering healthcare.

We described commonly used methods to measure habit in HCPs and pointed out some of the limitations of such methods (e.g. how self-reported measures reflect an inference about a behaviour based on the consequences of habit). Future research should explore novel ways of measurement that address the core facets of the construct habit (e.g. cue-dependency and underlying stimulus-response association). For example, one way of inferring the level of automaticity of a given clinical behaviour could be by testing its' dependency on physical cues. If adding or removing a simple cue to a HCPs' environment has a direct affect on behaviour it could be reasoned that behaviour was driven by the impulsive process. An example of this idea provides the cues-of-being-watched paradigm in which placing an image of a pair of eyes above an "honesty box" for hot drinks, can lead to higher amount of contributions (Bateson, Nettle, & Roberts, 2006). Similarly, one could design a study

whereby an image of a pair of watching eyes is introduced above a hand disinfectant dispenser. The hypothesis would be that the image would increase the use of hand disinfectant by hospital staff.

Another area for future research could focus on exploring behaviour change strategies that may be effective in addressing the impulsive process underlying HCP behaviour. In 21.3 we described a range of potential habit change strategies many of which were derived from theories that incorporate impulsive processes (e.g. Learning theory and dual process models). Although some of these strategies have already been tested and proven effective in HCPs (Casper, 2008; Squires et al., 2013; Verbiest et al., 2013; Verbiest et al., 2014) there is a need to further explore effective habit change strategies. One way of doing this could be through theory-based process evaluation alongside experimental or quasi-experimental studies (Presseau et al., 2015). Such an approach could help evaluate the active ingredients of existing implementation strategies such as reminding clinicians, altering incentive/allowance structures, or obtaining formal commitments (Powell et al., 2015). To do this, trials should include measures of habit (e.g. self-report) to see whether there are any measurable post-intervention changes in automatic processing.

Lastly, more research is needed to uncover whether there are certain clinical behaviours that are more or less conducive to habit formation. Evidence from a meta-analytic synthesis shows that behavioural frequency and stability of the context may be two key characteristics, which may help determine which behaviours are more conducive to habit formation (i.e. behaviours that are performed more frequently in a stable context are more likely to become routine) (Ouellette & Wood, 1998). An implication of these findings is that if we want to support HCPs with forming new habits of providing evidence-based care it is important to guarantee that the new behaviour is repeated sufficiently in a stable context. Further research is needed to understand how many repetitions are necessary for a given behaviour to become habitual in the presence of specific contextual cues. Equally, the formation of new habit often necessitates breaking old habit. Figure 21.1 depicts how a new clinical habit may form whilst an old habit is broken.

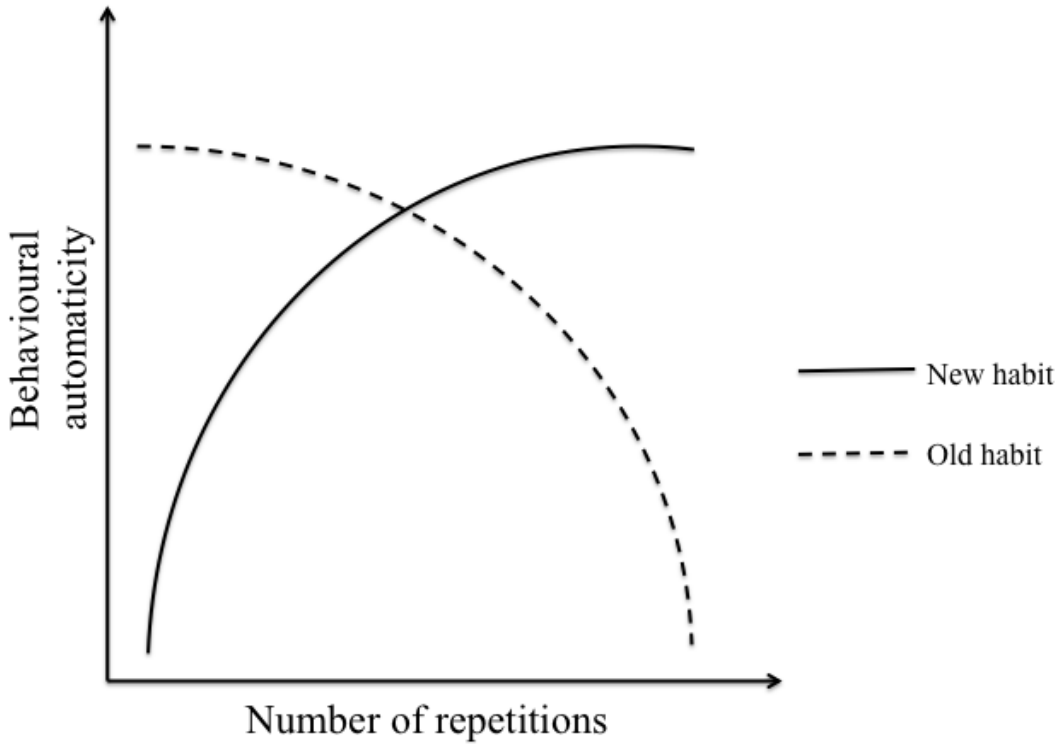

Figure 21.1 Formation of a new clinical habit and simultaneous breaking of old clinical habit.

Conclusion

This chapter provided a state of the art overview of theoretical approaches to understanding habit in healthcare professionals; methods for measuring habit in healthcare professionals; and strategies for creating and breaking habit in healthcare professionals. Given the nature of the context in which HCPs provide healthcare it is necessary to target habit to change clinical practice. Theories and strategies from the behavioural sciences may provide the necessary tools to effectively change HCPs behaviour and improve care provided to patients. Much opportunity remains to advance habit theory and methods by leveraging the unique properties of HCP behaviour and the settings in which they are enacted, which naturally facilitate habit formation.

Extended box

Understanding habit in relation to planning

The volitional constructs action planning (planning when, where and how to perform a behaviour) and coping planning (planning how to overcome predefined barriers) are theorised to have a positive relationship with behaviour and there is evidence to support this hypothesis in both general population (Sniehotta, 2009; Sniehotta et al., 2005) and HCP populations (Casper, 2008). Planning promotes behavioural repetition through the creation of cue-response associations in memory (Gollwitzer, 1999). Applied to HCPs, they could form an action plan to disinfect their hands whenever they pass a disinfectant dispenser so that dispenser becomes the cue to behaviour. Given that behavioural repetition and cue-response links are two of the key ingredients in habit formation we hypothesised that habit would mediate the relationship between planning and behaviour (Potthoff et al., 2017). We tested this hypothesis in a study that aimed to explore psychological constructs that could predict the provision of six underperformed prescribing, examining and advising behaviours in diabetes care (Eccles et al., 2011). General practitioners and practice nurses (n=427 from 99 UK primary care practices) completed measures of action planning, coping planning and habit at baseline and then self-reported their enactment of guideline-recommended advising, prescribing and examining behaviours at 12 months follow-up. To measure habit we used the four-item subscale of the Self-Reported Behavioural Automaticity Index (SRHI; Verplanken & Orbell, 2003): the Self-Reported Behavioural Automaticity Index (SRBAI; Gardner et al., 2012). We ran twelve separate bootstrapped mediation analyses using Preacher and Hayes (2008) INDIRECT macro to test our mediation model (see figure 2 and figure 3). Bootstrapped mediation analysis involves repeatedly resampling from the data and is arguably the most robust method for testing mediation effects (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; MacKinnon, Lockwood, & Williams, 2004). As predicted we found that action planning and coping planning were positively related to the six behaviours and that this relationships operated indirectly through their relationships with habit. To date our theoretical model has only been tested in a correlational design and therefore future research should test this hypothesis in a process evaluation alongside an active trial. For example, in an active

trial HCPs could be asked to form their own plans to improve the uptake of new or underperformed clinical behaviours.

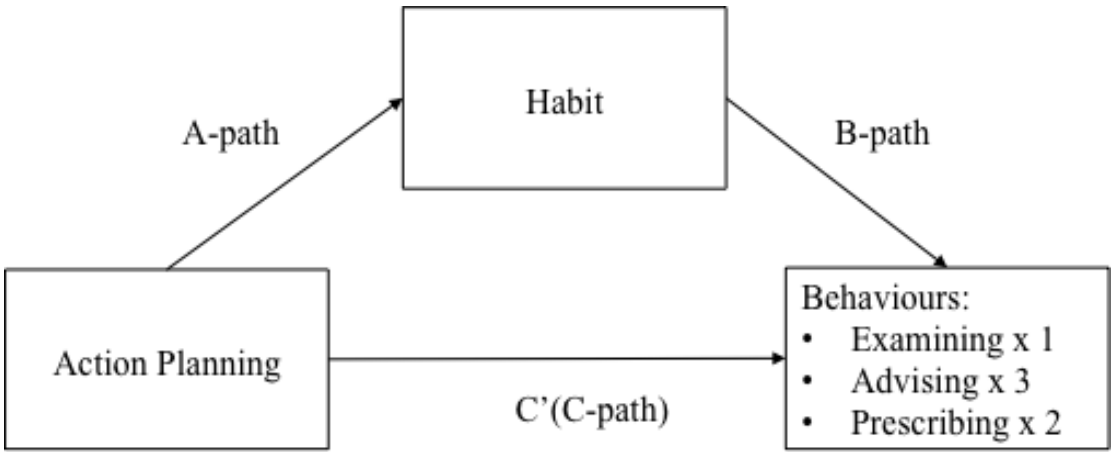

Figure 21.2 Indirect effect of action planning on healthcare professional behaviours through habit. Path *a* is the direct effect of the predictor variable (action planning) on the mediator (habit). Path *b* is the direct effect of the mediator on the outcome variable (clinical behaviour). Path *c* is the direct effect of the predictor on the outcome variable. Path c' is the indirect effect of the predictor variable on the outcome variable. Adapted from "Planning to be routine: habit as a mediator of the planning-behaviour relationship in healthcare professionals" by S. Potthoff et al., *Implementation Science, 12,* p. 5. Adapted with permission.

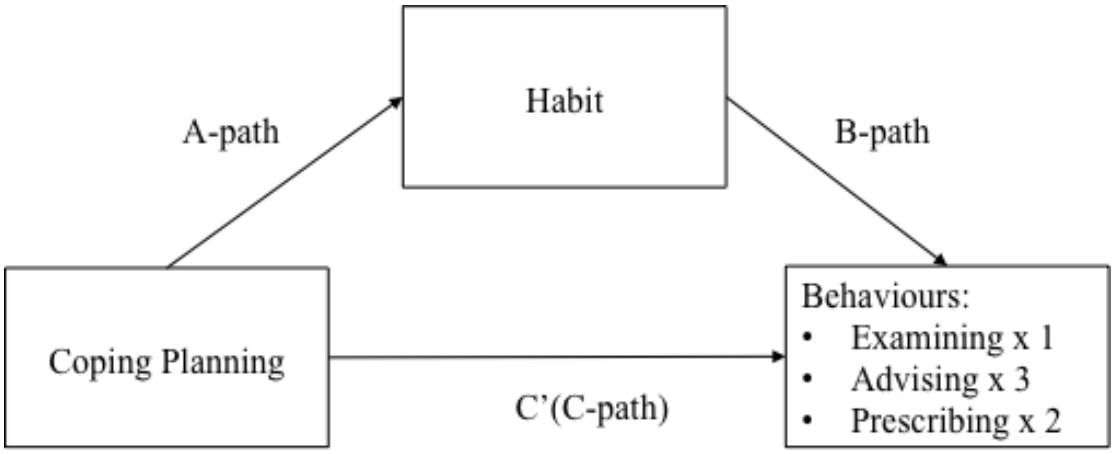

Figure 21.3 Indirect effect of coping planning on healthcare professional behaviours through habit. Path *a* is the direct effect of the predictor variable (coping planning) on the mediator (habit). Path *b* is the direct effect of the mediator on the outcome variable (clinical behaviour). Path *c* is the direct effect of the predictor on the outcome variable. Path c' is the indirect effect of the predictor variable on the outcome variable. Adapted from "Planning to be routine: habit as a mediator of the planning-behaviour relationship in healthcare professionals" by S. Potthoff et al., *Implementation Science, 12,* p. 5. Adapted with permission.

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