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Healthcare professional behaviour: health impact, prevalence of evidence-based behaviours, correlates and interventions

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ABSTRACT

Healthcare professional (HCP) behaviours are actions performed by individuals and teams for varying and often complex patient needs. However, gaps exist between evidence-informed care behaviours and the care provided. Implementation science seeks to develop generalizable principles and approaches to investigate and address care gaps, supporting HCP behaviour change while building a cumulative science. We highlight theory-informed approaches for defining HCP behaviour and investigating the prevalence of evidence-based care and known correlates and interventions to change professional practice. Behavioural sciences can be applied to develop implementation strategies to support HCP behaviour change and provide valid, reliable tools to evaluate these strategies. There are thousands of different behaviours performed by different HCPs across many contexts, requiring different implementation approaches. HCP behaviours can include activities related to promoting health and preventing illness, assessing and diagnosing illnesses, providing treatments, managing health conditions, managing the healthcare system and building therapeutic alliances. The key challenge is optimising behaviour change interventions that address barriers to and enablers of recommended practice. HCP behaviours may be determined by, but not limited to, Knowledge, Social influences, Intention, Emotions and Goals. Understanding HCP behaviour change is a critical to ensuring advances in health psychology are applied to maximize population health.

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Behaviours that are undertaken ‘for the purpose of preventing or detecting disease or for improving health and well-being’ (Conner & Norman, 1995, 2005, 2015) are performed by individuals to improve their own health outcomes. But these outcomes are also importantly influenced by healthcare professionals (HCPs), people who have a duty of care towards healthcare service users. In this article, we present some models and methods from health psychology that have been applied in

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'implementation science', the field of research and practice that aims to support behaviour change within healthcare systems so that people receive optimised care (that is evidence-based, equitable and consistent). In all healthcare systems, there is evidence of substantial care gaps or gaps between what patients *should* receive (according to current evidence and ethical practice) and what they *actually* receive (Runciman et al., 2012; Schuster et al., 2005; Seddon et al., 2001; Shrank et al., 2019; Squires et al., 2022), usually despite the best intentions of HCPs. Although implementation science is an interdisciplinary field that investigates change at multiple levels in healthcare systems, its methods and theoretical models are influenced by the science of behaviour change (Presseau et al., 2021). HCP behaviours, their correlates and interventions to optimize them can be approached using the theories, methods and tools applied to understand and support health behaviour change in patients and the public. A focus on HCP behaviours provides two key opportunities for health psychology: (a) to support practice change so that patients and the public receive best evidenced advice, prescriptions, tests, surgeries, examinations, screening and care, and (b) to advance the science of behaviour change by capitalising on aspects of HCP behaviour that can provide generalizable principles applicable to other health behaviours (e.g. setting-dependencies; repeated performance; embedded self-monitoring; multiple social influences; starting and stopping). In this article, we seek to define HCP behaviour to inform investigations into the prevalence of evidence-based care, its correlates and interventions to support change in professional practice.

1. Definitions of healthcare professional behaviours

HCP Behaviours are the actions performed by HCPs when delivering healthcare to their patients. HCPs include a wide variety of professions, for example, physicians, nurses, midwives, physiotherapists and other allied healthcare professionals, clinical and health psychologists, pharmacists and dentists. They may practice independently or as members of healthcare teams working in a wide range of settings embedded in healthcare systems. HCP behaviours are generally tailored to patients' needs and the clinical setting and are also determined by the specific professional training and identity of the provider (Francis & Presseau, 2019).

HCPs (individually and in teams) perform behaviours relating to at least six different objectives (Table 1 presents a proposed typology of the objectives and broader functions of HCP behaviours). Specifically, HCP behaviours can include activities related to (1) promoting health and preventing illness, (2) assessing and diagnosing illnesses, (3) providing treatments, (4) providing general management of health conditions (5) carrying out action related to healthcare system management and (6) building therapeutic alliances with patients and carers (Graves et al., 2017; Martin et al., 2000). Behaviours focused on promoting health and preventing illness support health behaviours such as physical activity and healthy eating among people without diagnosis and include providing advice for engaging in health behaviours, recommending health behaviours and monitoring clinical markers. The category 'Assess and diagnose illnesses' includes behaviour related to taking patient history, using examination and diagnostic tests. Behaviours in this category identify specific diseases to determine

Table 1. Proposed typology of Healthcare Professional behaviours and their functions.

Objective	Examples	Function / Target
Promote Health and Prevent illness	Provide advice for engaging in health behaviours; recommend health behaviours; monitor clinical markers	Support health behaviours among people without a diagnosis, e.g. provide advice, encourage behaviour change
Assess and Diagnose illnesses	Take patient history, use examination and diagnostic tests	Identify specific diseases to determine likely prognosis or guide treatments (or to rule out disease)
Provide treatments	Prescribe appropriate medications; provide advice about lifestyle changes, short term or long-term medication, surgery or rehabilitation	Cure or mitigate impact of disease; support adherence behaviours among patients (i.e. encourage behaviour change and maintenance)
Provide general management of health conditions	Monitor symptoms; review medications	Support self-management behaviours among people with a diagnosis
Carry out actions related to healthcare system management	Document referrals; document test results; document treatments; document patient concerns	Support continuity of care and healthcare system efficiency
Build a therapeutic alliance with patients and carers (Graves et al., 2017; Martin et al., 2000)	Range of collaborative, communicative, empathetic and respectful behaviours (Cole & McLean, 2003) eliciting concerns; providing reassurance	Support engagement of patients with self-management behaviours; help patients to manage cognitive and emotional representations of their condition (Leventhal et al., 1992)

likely prognosis, guide treatments or to rule out disease. ‘Provide treatment’ behaviours aim to cure or mitigate impact of disease, physical or mental and include prescribing appropriate medications, providing advice about potential treatments, lifestyle changes, surgery or rehabilitation. The ‘Provide general management of health conditions’ category of behaviours includes behaviour related to supporting patients with a diagnosis with self-management behaviours. These HCP behaviours can include monitoring symptoms and reviewing medications. The ‘Carry out actions related to health management system’ category of behaviours supports continuity of care and health system efficiency and can include documenting referrals to other HCPs, documenting test results and treatments and documenting patient concerns. The final category, ‘Build a therapeutic alliance with patients’, supports engagement of patients with self-management and helps patients to manage cognitive and emotional representation of their conditions (Leventhal et al., 1992). These behaviours include a range of collaborative, communicative, empathetic and respectful behaviours (Cole & McLean, 2003). Whilst this table is not exhaustive, it does include the main types of patient-facing HCP behaviours. The behaviours performed by HCPs determine the quality of care received by patients and the extent to which practice is evidence-based and focused on patient needs and concerns.

As healthcare service users move through the healthcare system, they typically receive multiple care behaviours from one HCP (clusters of sequential behaviours, such as history taking, test ordering for diagnosis, shared decision-making about treatments, monitoring effects of treatments), multiple care behaviours from different HCPs working in different parts of the healthcare system (sequential activities based on referrals as is often the case in a cancer-related pathway of care, such as a primary care doctor conducting an examination and referral for specialised testing and

diagnosis and then referral to specialist treatment in hospital, and then discharge to community-based care) or from a multidisciplinary healthcare team (clusters of inter-dependent behaviours based on the skill sets and professional roles of different HCPs, such as provision of multidisciplinary 'prehabilitation' to optimise dietary, psychological and strength training needs prior to cancer surgery). Indeed, healthcare delivery behaviours have been described as 'collective behaviours' (Eccles et al., 2009). All these types and clusters of behaviours are delivered by HCPs in the context of complex, time-constrained and resource-constrained settings, where competing priorities influence the feasibility of delivering optimal care (McCleary et al., 2020; Presseau et al., 2009). Furthermore, HCPs are often required to decide which action to take in the context of a complex and often unclear clinical evidence base.

1.1. Specifying healthcare professional behaviours

Principles to guide clear behaviour specification are found in psychological literature. Fishbein proposed that the most important domains of specification are the action and the target of the action (Fishbein, 1967). To better understand the relationship between attitude and behaviour, Fishbein argued that cognitive and behavioural measures should appropriately match clearly defined action and target components to increase the correlation between the two measures. Building on Fishbein's work, Ajzen proposed the Theory of Planned Behaviour which predicts actions performed in a specific context at a specific time (Ajzen, 1991). These four domains (target, action, context and time) became known as the TACT principle, which has had considerable influence in guiding specification of behaviour (e.g. (Francis et al., 2004)). More recently, Presseau et al. (2019) proposed that, in the healthcare context, it is important to also specify who is responsible for performing the action, thus giving rise to the 'AACTT' framework: Action (the clinical act), Actor (which HCP should do the clinical act), Context (where), Target (the patient), and Time (when). The AACTT framework proposes common elements that can be used for consistent description, specification and monitoring of clinical behaviours (see Figure 1). For example, in the case of providing evidence-based vaccination in a community/public health centre to enhance immunity to an infectious disease (Vallis et al., 2021), AACTT can specify the behaviour according to what the specific clinical act is (ACT – administering the vaccination), which HCP does the act (ACTOR – community health nurse), where to do the act (CONTEXT – in the consultation room), for whom the act is done (TARGET – patient due for their vaccine) and when to do the act (TIME – during visit).

The AACTT framework can also be used to describe the sequence of multiple interdependent behaviours of multiple Actors engaging in their own Action at different levels of the organisation required to enact change (Presseau et al., 2019). For instance, in the case of providing evidence-based vaccination in primary care practices to enhance immunity to an infectious disease, different HCPs may have to do different things to ensure that a patient gets the appropriate vaccination at the correct time. AACTT provides a means for clarifying the behaviours of those responsible in the delivery of the vaccination, from for acquiring and appropriately storing the vaccine (pharmacist), contacting patients to notify them of vaccine availability (practice

Action	Specify the <i>behaviour</i> that needs to change, in terms that can be observed or measured
Administering the vaccine	
Actor	Specify the person/people that <i>do(es)</i> or <i>could do</i> the action targeted
Community Health Nurse	
Context	Specify the physical location, emotional context, or social setting <i>in which</i> the action is performed
In the consultation room at the clinic	
Target	Specify the person/people <i>with/for whom</i> the action is performed
Patient due their vaccination	
Time	Specify <i>when</i> the action is performed (the time/date/frequency)
During patient visit	

Figure 1. Single actor AACTT specification for “providing evidence-based vaccination in community health clinic”. (Worksheet provided via Presseau et al. (2019) supplemental file).

manager and administrator), arranging and confirming appointments (practice administrator), administering the vaccine (practice nurse), monitoring reactions (physician or nurse) and recording the vaccination in the patient notes (practice physician or administrator). Each behaviours by these Actors is required for the patient to receive a vaccine appropriately. For example, a multiple-actor component AACTT specification for administering a vaccine may involve: (a) a clinical administrator (ACTOR) arranging then confirming an appointment (ACTION) at the reception desk or over the phone (CONTEXT) with a patient due their vaccine (TARGET) prior to patient visit (TIME), (b) a health psychologist (ACTOR) discussing vaccine concerns (ACTION) via a video call (CONTEXT) with a patient who is vaccine hesitant (TARGET) prior to the patient visit (TIME) and (c) a community health nurse (ACTOR) administering the vaccination (ACT) in the consultation room (CONTEXT) for a patient due their vaccine (TARGET) during patient visit (TIME) (see Figure 2). Importantly, specifying the Actor enables the implementation scientist to identify the sampling frame for investigations of barriers



Figure 2. Multiple actor AACTT specification for “providing evidence-based vaccination in community health clinic” (Worksheet provided via Presseau et al. (2019) supplemental file).

to performing the Actions. That is, we need to sample the people who are responsible for performing the specific action within the sequence of multiple interdependent behaviours.

Rather than making implicit assumptions about such a sequence of behaviours or describing them as discrete factors, the AACTT framework helps to unpack the complexity and clarify the responsibility of all interdependent behaviours in healthcare settings, providing an opportunity for theory-informed investigation of correlates of each behaviour to inform development and evaluation of interventions to optimise HCPs engaging in these behaviours.

2. Health impact of healthcare professional behaviours

HCP behaviours are critical to the health of patients and the general population. For example, for medication to benefit patients, the medication prescribed first needs to be ‘appropriate’ (i.e. consistent with clinical evidence). Yet, instances of inappropriate prescribing continue to be documented, particularly in the overprescribing of

medications (Canadian Institute for Health Information, 2017; Choosing Wisely Australia, 2022). In high-income countries like Poland, Sweden and the UK, rates of antibiotic prescribing for viral upper respiratory infections are reported to be high, with half of patients receiving unnecessary antibiotics (Brownlee et al., 2017; Gulliford et al., 2014). A recent systematic review of inappropriate clinical practices in Canada reported overuse of antimicrobials ranged from 11.8 to 76.0% (Squires et al., 2022). Further, global consumption of antibiotic drugs has risen by 36% between 2000 and 2010 (Brownlee et al., 2017). Other drugs such as antipsychotics and opioids have over-prescribing rates in Canada ranging from 5.6 to 76.5% and 0.1 to 23.9%, respectively (Squires et al., 2022). The United Kingdom has reported a 400% rise in opioid prescription in the last decade and community pharmacies report an increase of dispensing opioids from 33.1 million to 40.5 million occasions between 2008 and 2018 (Alenezi et al., 2021).

Inappropriate HCP behaviours have the potential to cause physical, psychological and financial harms to patients and deflect resources from public health and other social spending in both low- and high-income countries (Brownlee et al., 2017). The overuse of antibiotics has led to the emergence, spread and persistence of antimicrobial resistant bacteria, a serious global threat concerning not only human health but also animal and environment health (Davies & Davies, 2010). In addition, overuse of opioid prescribing has led to governments such as Canada and US to declare an opioid crisis or epidemic (Belzak & Halverson, 2018; Jones et al., 2018). Opioids have a significant addiction risk and high opioid prescribing rates are associated with increasing hospitalizations and deaths (Gomes et al., 2011; Spooner et al., 2016). In 2016, there were 2861 opioid-related deaths in Canada and, on average, 16 Canadians were hospitalized each day due to opioid-related poisonings (Belzak & Halverson, 2018). In the United States 66% of all drug-related deaths in 2016 were opioid deaths (Jones et al., 2018) and in England over half of all drug-related deaths in 2017 involved opioids (Alenezi et al., 2021).

In other types of HCP behaviours, the behaviours (e.g. giving advice, delivering behaviour change techniques) may not inherently be necessary for health behaviours in patients but are nevertheless helpful due to the potential influence that HCPs have for supporting behaviour change among patients (Amelung et al., 2020). Regardless of the type of HCP behaviour, gaps in quality of care are a significant problem that influences health outcomes (Canadian Institute for Health Information, 2017; Institute of Medicine, 2001; Mangione-Smith et al., 2007). Appropriateness of care requires that HCPs are up to date with evidence-based practice. If preventative treatments are missed, patients may be burdened with long-term conditions with life-long implications for their health outcomes and healthcare needs. For example, there is now overwhelming evidence that health behaviours performed throughout the life course (e.g. exercise, maintaining social engagement, reducing or stopping smoking, management of hearing loss, depression, diabetes, hypertension and obesity) can contribute to prevention or delay of dementia (Livingston et al., 2017).

HCP behaviours can also indirectly impact the availability of services other HCPs have available to provide to their patients. In a resource-constrained healthcare system, if a HCP overuses or inappropriately delivers care (e.g. orders unnecessary diagnostic tests, prescribes unnecessary medications) these resources may be unavailable

for another HCP to provide to their patient who appropriately requires the care. This can result in longer waitlists for access to health care services. Long waitlists to access services is a global healthcare problem across many clinical settings. For example, 20% of total knee replacements in Spain and 30% in the USA are estimated to be inappropriate (Quintana et al., 2008; Riddle et al., 2014) increasing waitlists for these types of surgeries. That means HCPs are unable to provide the necessary surgery for their patients who do require it due to other patients receiving a knee replacement that was inappropriate (Hart et al., 2021). Recently, in the face of the global COVID-19 pandemic, HCPs around the world experienced a global shortage of test collection tubes for blood tests (Otis, 2022; Rimmer, 2021) and Choosing Wisely Canada issued recommendations to reduce unnecessary blood tests to help protect blood collection tubes supply in Canada (Choosing Wisely Canada, 2022). If the resources are used by HCPs for inappropriate testing (i.e. the blood collection tubes), then they are not available to these same HCPs or other HCPs for clinically important, high-value tests. Hence, the impact of HCP behaviours may appear to impact only the patient with whom they directly interact; however, the effects do reach others and can continue over time.

3. Prevalence of evidence-based healthcare professional behaviours

A given HCP's scope of practice typically involves enacting multiple behaviours within a given patient encounter (multiple behaviours within a patient contact) and across multiple patient encounters (multiple behaviours repeated over time with different patients) (Voruganti et al., 2015). Some of these may be one-off HCP behaviours from the perspective of a patient (e.g. surgery) but may represent repeated, recurring activities from the perspective of the HCP (e.g. the surgeon), while others may be repeated activities both within and across multiple patients over time (e.g. prescribing blood pressure medication). HCP behaviours can thus differ in their prevalence characteristics from more general health behaviours in two important ways: (a) frequency of performance tends to be high for a given HCP (almost never a one-off behaviour and often performed very frequently, sometimes many times a day) and (b) HCP behaviours can be performed either within or between patients (e.g. a vaccination could be a one-off behaviour for a given patient but performed by the HCP multiple times across many different patients or the HCP providing physical activity advice to multiple patients, multiple times over time). These distinctions have implications for measuring the prevalence of HCP behaviour and for evaluating change in practice following an implementation intervention.

There is consistent evidence globally of evidence-practice gaps suggesting that 30% of patients do not receive the care they need, and 20–25% of patients receive care that is unnecessary or potentially harmful (Runciman et al., 2012; Schuster et al., 2005; Seddon et al., 2001; Shrank et al., 2019; Squires et al., 2022). In addition, audits of HCP behaviour indicate that there is large variability in the quality of care delivered by HCPs, resulting in potential inequities in the care being delivered to patients. It is important to understand the reasons for the gaps in care and determinants of HCP behaviours to guide the development of interventions to improve care delivery.

There are arguably at least four kinds of ‘care gaps’ (or implementation problems) that require investigation and intervention to improve the quality of care that patients receive:

1. *Slow uptake* of new interventions that are clinically effective or failure to deliver ‘high-value care’ (e.g. not using intermittent auscultation instead of electronic foetal monitoring for low-risk pregnancies during labour (Alfirevic et al., 2017; Chen et al., 2012; Patey et al., 2017)).
2. *Premature or continued uptake* of new interventions and technologies that are subsequently shown to be ineffective, wasteful or even harmful (delivery of ‘low-value care’) (e.g. prescribing antibiotics to manage upper respiratory tract infections (Palin et al., 2019; Ray et al., 2021; Wong et al., 2022)).
3. *Failure to keep up* with gradually emerging evidence associated with high-value care or low-value care, depending on nature of clinical evidence (e.g. slow uptake of revised guidelines into clinical practice (Grimshaw et al., 2005; Gupta et al., 2016; Kastner et al., 2015)).
4. *Failure to keep up* with changes in the ethos of care (e.g. person-centred care; <https://www.safetyandquality.gov.au/our-work/partnering-consumers/person-centred-care> (Santana et al., 2018)).

These exemplify the types of behaviours needing to be addressed to improve the care that patients receive. Addressing these gaps requires investigation of correlates and determinants of HCP behaviour, followed by intervention to support change.

4. Correlates and determinants of healthcare professional behaviours

4.1. The scientific basis of HCP behaviour

There is a substantial and ever evolving scientific base to support HCP behaviour change. Over 100,000 records are added to the Cochrane Central Register of Randomised Trials (CENTRAL) each year (Cochrane Collaboration, 2008). As a result, it is impossible for HCPs to keep up-to-date even within their area of practice. Hence, HCPs increasingly depend on systematic reviews (that summarise the global evidence base on a topic) and clinical practice guidelines (that formulate practice recommendations based upon systematic reviews). For example, Cochrane is an international collaboration that produces and maintains high quality systematic reviews; it currently has over 8,750 systematic reviews and 2,400 systematic protocols in the Cochrane Database of Systematic Reviews (and publishes around 500 new or updated reviews and 350 protocols each year). In the UK, the National Institute of Health and Care Excellence (NICE) guidelines offer advice to guide practice relating to specific healthcare conditions, alongside a critique and synthesis of recent evidence (National Institute for Health & Care Excellence, 2016). A major implication of the evolving evidence base is that practice recommendations will change over time as innovations are introduced and/or more evidence accumulates requiring HCPs to change their practice (including implementing new practices, modifying existing practices or de-implementing existing practices). Given this, it is unsurprising that the uptake of

guidelines and transfer of evidence into clinical practice is usually a slow, haphazard and iterative process.

4.2. Determinants specific to HCP behaviours

There are some key aspects of HCP behaviour which may distinguish it from health behaviours more generally. First, HCPs typically receive extensive education and training in the performance of certain behaviours required as part of their role (Francis & Presseau, 2019). Core clinical training frameworks focus on identifying and defining the specific competencies required of HCPs, designing curricula to facilitate development of these competencies, and developing strategies for assessment focused on demonstration of these competencies (Holmboe et al., 2017). Second, whilst HCPs themselves are impacted by the behaviours they enact as part of their role, the key health-related outcomes of their behaviours are primarily experienced by others (i.e. patients), rather than themselves. Third, HCPs are enacting behaviours as part of their professional role and within the context of an employment relationship (Francis & Presseau, 2019). This requires that they adhere to the legal and regulatory requirements applying to their specific role, which inevitably impacts their actions.

Social and physical aspects of the healthcare environment also influence HCP behaviour. Whilst some HCPs may practice relatively independently, many healthcare environments are team-based, with HCPs from various specialties and disciplines working together to provide care. In some instances, a given behaviour may have the potential to be performed interchangeably (e.g. depending on who is available) by multiple HCPs, whilst in others, different HCPs may enact distinct behaviours which form part of the overall care process. Therefore, the behaviours and perceived expectations of HCPs (social processes) may substantially influence clinical behaviours of other HCPs (Webster et al., 2016). Healthcare environments may also be hierarchical; thus, social roles and power dynamics may be important determinants (Etherington et al., 2021). In addition, given increasing recognition of the importance of patient-centred care approaches, which position patients as active collaborators in their healthcare, the beliefs, values and behaviours of patients and their carers also impact what HCPs do. HCPs carry out their duties in often chaotic and high-pressure environments (such as an Emergency Department or a busy primary care clinic) which require rapid action based on their expertise and experience with multiple competing demands placed on the time that is available (Presseau et al., 2009). HCPs may also often be faced with resource constraints which impact their enactment of specific behaviours (e.g. access to equipment required to perform a behaviour or access to relevant expertise of other types of HCPs).

4.3. Theoretical frameworks as basis for identifying correlates and determinants of healthcare professional behaviours

Like any human behaviour, the clinical behaviours of HCPs are determined by a complex array of factors. The theories developed to explain and predict human behaviours, and which are ultimately used to support human behaviour change, could

be applied in the same manner to HCP behaviour. Over recent years, implementation science has drawn on theories traditionally developed to explain general health behaviours (Kislov et al., 2019; Presseau et al., 2021). For example, research has demonstrated that the relationships between predictors of intention (e.g. self-efficacy, outcome expectancies and goals (particularly perceptions of conflicting and facilitating goals and goal hierarchies)) and intention, as well as intention and behaviour (Godin et al., 2008), and between habit/automaticity and behaviour (Potthoff et al., 2020; Potthoff et al., 2019; Presseau, Johnston, Heponiemi, et al., 2014) typically seen when predicting general health behaviours (Gardner, 2015; McEachan et al., 2011), also hold for HCP behaviours. For example, Presseau et al. (2014) found that across six health professional behaviours related to diabetes care behaviours (e.g. advising, prescribing and examining) constructs from social cognitive theory (self-efficacy), learning theory (habit) and action and coping planning consistently predicted the clinician behaviours. In addition, each theory included in the study accounted for a medium amount of variance (median $R_{adj}^2 = 0.15$), large and medium amount of variance for two intention measures (median $R_{adj}^2 = 0.66$; 0.34) and small amount of variance for simulated behaviour (median $R_{adj}^2 = 0.05$) (Presseau et al., 2014).

In recognition of this vast array of potential determinants, and the challenges posed by selecting one individual theoretical approach from the many available (which include a range of both overlapping and distinct determinants), a team of experts including health psychologists and health services researchers developed the Theoretical Domains Framework (TDF) of behaviour change, to support research into factors perceived to influence HCP behaviour in specific contexts (Atkins et al., 2017; Cane et al., 2012; Michie et al., 2005). The TDF comprises a set of theoretical construct 'domains' or groups of similar constructs, to describe modifiable factors that can influence HCP behaviour. The original version (Michie et al., 2005) synthesised 128 constructs from 33 theories into 12 domains, with the updated and validated version comprising 14 domains (Cane et al., 2012). As a framework rather than a theory, the TDF does not propose testable hypotheses about the relationships between determinants of behaviour but rather can be applied to help understand individual, socio-cultural and environmental influences on behaviour in specific contexts (Prothero et al., 2021). A guide has been developed to support researchers in using this framework (Atkins et al., 2017).

The TDF has been used to investigate factors influencing a broad range of HCP behaviours, including behaviours relating to: diagnosis (e.g. routine ordering of pre-operative tests, managing acute low back pain without ordering an X-ray, diagnosing dementia); treatment or support for managing health conditions (e.g. prescribing errors, management mild traumatic brain injury, providing tobacco cessation counselling, transfusing red blood cells); and provision of preventative services (e.g. discussing human papillomavirus (HPV) vaccination) (Atkins et al., 2017). While no systematic review has reported on which domains are the important determinants of HCP behaviour, a systematic review of health behaviours identified 123 TDF studies of HCP behaviour (McGowan et al., 2020). Preliminary findings from a review currently we have underway has identified a total of 420 studies published in the 15 years after the germinal TDF paper (Michie et al., 2005; Patey et al., 2019; Presseau et al., 2017). Important determinants of course vary as a consequence of differences in the context,

the professional group being investigated, and the nature of the behaviour itself, hence the number of situation-specific TDF studies that have investigated these determinants.

The TDF domains have been further mapped to three key factors that comprise the Capability-Opportunity-Motivation-Behaviour (COM-B) model, which can also be used to investigate factors influencing HCP behaviour (Michie et al., 2011). This model, based on a systematic review of behaviour change frameworks, incorporates three overarching factors that are posited to influence behaviour: an individual's physical and psychological Capability to perform that behaviour; their social and physical Opportunity to perform the behaviour; and their automatic and reflective Motivation to perform the behaviour (Michie et al., 2011). Michie et al. (2011) defined Capability as the physical and psychological capacity to engage in the behaviour, including having the required knowledge and skills. Opportunity includes the factors that make the behaviour possible or cue it and lie outside the person. Motivation includes brain processes that boost and direct behaviour, such as goals and conscious decision-making, but also habitual processes, emotional responding and analytical decision-making (Michie et al., 2011). For example, one study investigating why sexual counselling was not being provided for patients by cardiac rehabilitation staff identified psychological capability (e.g. lack of knowledge and training about sexual counselling for cardiac patients), social opportunity (e.g. staff beliefs that patient culture, religion and ethnicity can make sexual counselling more difficult), reflective motivation (e.g. perceptions about the relationships between gender and age and sexuality) and automatic motivation (e.g. a sense of awkwardness and uneasiness with sexual matters among staff, exacerbated by the older age of many patients) as key barriers to HCP behaviour (Mc Sharry et al., 2016).

Table 2 presents the 14 domains from the 2012 version of the TDF, their corresponding constructs and how the domains map to the COM-B model, along with examples of how factors represented by each domain may influence HCP behaviour in a specific context.

Factors that may enable or act as a barrier to an HCP providing appropriate care may include, but are not limited to, the HCP not being aware of the most recent evidence-based guidelines (Knowledge barrier) (Beenstock et al., 2012) or a public health nurse not having the required interpersonal skills to discuss with a vaccine-hesitant individual their concerns about influenza (Skills barrier) (Castillo et al., 2021). One HCP may forget to discuss exercise or healthy eating activities with a patient (Memory, attention and decision processes barrier), while a primary care nurse has developed a personal strategy or script to discuss with patients who are reluctant to stop smoking (Behavioural regulation enabler) (Passey et al., 2021). Space within an emergency department may make it difficult to appropriately remove personal protective equipment safely (Environmental context and resources barrier) (Curtis et al., 2022). Other barriers to changing behaviour in specific clinical contexts include: surgeons may order tests they perceive as unnecessary because they know certain anaesthetists will want them prior to the patient's surgery (Patey et al., 2012) and family physicians may order a diagnostic test due to their patient's concern or worry about illness symptoms (Pike et al., 2022) (Social influences barriers). Another type of barrier may relate to which HCP is primarily responsible for the care behaviour

Table 2. TDF (Version 2) Domain definitions Cane et al. (2012), corresponding constructs, HCP Example.

	TDF (v2) domain label & definition	Theoretical Constructs mapped to the domain	Example influencing factor in a specific context
COM-B Capability	Knowledge An awareness of the existence of something <i>Existing procedural knowledge, knowledge about guidelines, knowledge about evidence and how that influences what they do</i>	Knowledge (including knowledge of condition/scientific rationale) Procedural knowledge Knowledge of task environment Skills	HCP is aware of most recent evidence-based guideline recommendations for supporting patients who are trying to quit smoking. (Beenstock et al., 2012)
	Skills An ability or proficiency acquired through practice <i>Competence and ability about the procedural techniques required to perform the behaviour and how that influences what they do</i>	Skills development Competence Ability Interpersonal skills Practice Skill assessment Memory Attention Attention control Decision making Cognitive overload/tiredness	Clinical Psychologist identified recent Cognitive Behaviour Therapy Training improved in the delivery of care to clients. Public Health nurse does not have the required interpersonal skills to discuss with a vaccine-hesitant individual their concerns about influenza vaccine. (Castillo et al., 2021) Health psychologist forgets to discuss exercise and healthy eating activities with patient, focusing on smoking cessation activities.
	Memory, attention and decision processes The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives <i>Attention control, decision-making, memory (i.e. is the target behaviour problematic because people simply forget?) and how that influences their behaviour</i>	Self-monitoring Breaking habit Action planning	Primary care nurse has developed a personal strategy or script to discuss with patients who are reluctant to stop smoking. (Passey et al., 2021; Beenstock et al., 2012)
	Behavioural Regulation Anything aimed at managing or changing objectively observed or measured actions <i>Ways of doing things that relate to pursuing and achieving desired goals, standards or targets; Strategies the participants have in place to help them perform the behaviour; Strategies the participants would like to have in place to help them</i>	Environmental stressors Resources/material resources Organisational culture/climate Salient events/critical interactions Person x environment interaction Barriers and facilitators	Space within the Emergency department makes it difficult to appropriately remove personal protective equipment in a safe manner. (Curtis et al., 2022)

(Continued)

Table 2. Continued.

COM-B	TDF (v2) domain label & definition	Theoretical Constructs mapped to the domain	Example influencing factor in a specific context
Motivation	Social influences Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours <i>External influence from people or groups to perform or not perform the behaviour; How the views of colleagues, other professions, patients and families and doing what you are told, influence the behaviour</i>	Social pressure Social norms Group conformity Social comparisons Group norms Social support Power Intergroup conflict Alienation Group identity Modelling	Surgeons may order tests they perceive as unnecessary because they know certain anaesthetists will want them prior to the patient's surgery. (Patey et al., 2012) Family physician orders a diagnostic test due to their patient's concern or worry about illness symptoms. (Pike et al. 2022)
	Social/professional role and identity A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting <i>Boundaries between professional groups (i.e. is the behaviour something the participant is supposed to do or someone else's role?)</i>	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership	Anaesthesiologists/Anaesthetists and surgeons are unsure about who is primarily responsible for ordering the appropriate preoperative tests for a patient, so everyone orders the tests. (Patey et al., 2012)
	Beliefs about capabilities Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use <i>Perceptions about competence and confidence in doing the behaviour and how that influences their behaviour</i>	Organisational commitment Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence	Emergency Doctors are not confident in their ability to discuss goals of care/advance care plans with terminally ill patients visiting Emergency Departments. (Cheskes et al., under review)
	Optimism The confidence that things will happen for the best or that desired goals will be attained <i>Whether the participant's optimism or pessimism about the behaviour influences what they do</i>	Optimism Pessimism Unrealistic optimism Identity	Prison Nurses are not hopeful about the implementation of a new policy to automatically screen patients for infectious diseases. (Konfli et al., under review)
	Beliefs about Consequences Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation <i>Perceptions about outcomes, advantages and disadvantages of performing the behaviour and how that influences whether they perform the behaviour</i>	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents	Birth Unit Nurses/Midwives see manual foetal surveillance (intermittent auscultation) as delivering high value one-on-one care compared to continuous foetal monitoring. (Patey et al., 2017)

(Continued)

Table 2. Continued.

COM-B	TDF (v2) domain label & definition	Theoretical Constructs mapped to the domain	Example influencing factor in a specific context
Reinforcement Increasing the probability of a response by arranging a dependent relationship or contingency, between the response and a given stimulus <i>Previous experiences that have influenced whether or not the behaviour is performed</i>		Rewards (proximal/distal, valued/not valued, probable/improbable)	Anaesthesiologist/Anaesthetists experiences a bad outcome when certain tests were not ordered prior to patient surgery, so they now order these specific tests every time. (Patey et al., 2012)
		Incentives	
		Punishment	
		Consequents	
		Reinforcement	
Intentions A conscious decision to perform a behaviour or resolve to act in a certain way <i>A conscious decision to perform a behaviour or resolve to act in a certain way</i>		Contingencies	
		Sanctions	
		Stability of intentions	Family Physician has a high intention to ensure every patient with diabetes has their annual foot exam. (Mc Sharry et al., 2016)
		Stages of change model	
		Transtheoretical model and stages of change	
Goals Mental representations of outcomes or end states that an individual wants to achieve <i>Priorities, importance, commitment to a certain course of actions or behaviours and how that influences whether they perform the behaviour</i>		Goals (distal/proximal)	
		Goal priority	Family physician prioritises their discussion about alternatives to opioid prescribing with their next patient with pain. (Desveaux et al., 2019)
		Goal/target setting	
		Goals (autonomous/controlled)	
		Action planning	
Emotion A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event <i>How feelings or affect (positive or negative) may influence the behaviour</i>		Implementation intention	
		Fear	Intensive Care Nurse experiencing stress and burnout due to staffing shortages and surge in service users such as the COVID pandemic. (Maunder et al., 2021)
		Anxiety	
		Affect	
		Stress	
		Depression	
		Positive/negative affect	
		Burn-out	

Note: italicised definitions from Grimshaw et al. (2020), are refined domain definitions that reflect the influencing factors on behaviour.

(Social/professional role and identity). For example, anaesthesiologists/anaesthetists and surgeons may be unsure about who is primarily responsible for ordering the appropriate preoperative tests for a patient, so everyone orders the tests even when they should not (Patey et al., 2012). An example of a barrier in the domain Beliefs about capabilities in a specific clinical context may relate to emergency doctors reporting they are not confident in their ability to discuss goals of care/advance care plans with terminally ill patients visiting Emergency Department (Cheskes et al., under review). Other examples for the domains Intention and Goals include general practitioners having a high intention to ensure every patient with diabetes has their annual foot exam (Mc Sharry et al., 2016) and family physician prioritises their discussions alternatives to opioids with their next patient with pain (Desveaux et al., 2019; Desveaux et al., 2019). Additionally, Emotion barriers may include hospital staff reports of increased burnout amongst themselves and colleagues in the COVID-19 pandemic (Maunder et al., 2021). Additional examples are presented in Table 2.

Health Psychologists have also identified opportunities for and shown demonstrated successes in, incorporating the COM-B model into traditional competency-based HCP education and training activities, encouraging educators to adapt their activities to address these three overarching influencing factors (Byrne-Davis et al., 2017). For example, Byrne-Davis et al. (2017) report on three case studies whereby behavioural scientists were embedded in health partnerships in Uganda, Sierra Leone and Mozambique, supporting knowledge and skill development in behaviour change. In these studies, taking a behavioural approach led to health partners' recommendations regarding future interventions to improve HCP competencies. Health partners suggested that these interventions should go beyond training healthcare professionals on a new technology and look at the implementation in terms of how the systems can encourage or discourage healthcare professionals to change their behaviour. In addition, because health partnerships took a behavioural approach in these projects and learnt more about determinants of practice, the authors reported that the health partners could assess the determinants and were able to feed that information back into the development of their education and training and into evaluation of their project work (Byrne-Davis et al., 2017).

4.4. Reflective and automatic determinants of healthcare professional behaviour

Clinical behaviours are often highly routinized. Hence, implementation studies have also applied dual process models to explore HCP behaviour and inform HCP behaviour change interventions, with a particular focus on how automatic processes impact HCP behaviour (Brehaut & Eva, 2012; Helfrich et al., 2018; Nilsen et al., 2012; Presseau, Johnston, Heponiemi, et al., 2014; Sladek et al., 2006). For example, Presseau, Johnston, Heponiemi, et al. (2014) tested a dual process model across six guideline-recommended HCP behaviours in the management of type 2 diabetes across general practitioners and nurses in 99 UK practices. They showed that a sequential reflective process (define by a model composed on intention operating on behaviour via action and coping planning) accounted for significant variance in all six HCP behaviours and that an

impulsive process (operationalised as automaticity) worked alongside the reflective process in four of the six HCP behaviours. Dual process models posit that human behaviour is guided by two cognitive systems: one involving processes that are deliberative (analytical, reflective, rule-based and slow), and one involving processes that are automatic (heuristic, intuitive, implicit and immediate) (Evans, 2008; Kahneman, 2003; Sloman, 1996; Strack & Deutsch, 2004). Automatic processes guide an action or decision with minimal cognitive effort. Dual process theories propose that learned behaviours are often largely driven by automatic processes, which enable efficient action. This is proposed to manifest in HCPs through the development of expertise and through routines. As their expertise develops, HCPs come to rely on cognitive representations of disease schemas or illness scripts based on their past experiences to assist them in making complex decisions (Custers et al., 1996). This helps ensure that finite cognitive resources are reserved for situations in which they are most needed. HCPs also often enact similar behaviours repeatedly, often in the same physical locations with the same colleagues, in high-stakes situations under time pressure, resource constraints and multiple competing demands. In such situations, automatic processes may be more likely to influence behaviour. The overall role of habitual/automatic processes in HCPs is further underscored in a systematic review of studies by Potthoff et al. (2019) reported a mean $r_+ = 0.35$ for the relationship between habit and HCP behaviour across 9 studies, highlighting the importance of considering and addressing non-reflective processes in HCPs such as prescribing to reduce blood pressure for people with diabetes.

Other work has focused on the use of heuristics, defined as mental (often automatic) shortcuts used to make decisions in an efficient manner (Kahneman et al., 1982; McCleary et al., 2017). For example, Kulkarni et al. (2019) demonstrated how the representativeness heuristic can impact care. This is our tendency to classify objects, events and people into a category based on typicality or similarity to a prototype of that category, regardless of the prior probabilities of the object/event/person fitting that category (Tversky & Kahneman, 1974). After asking a group of clinical experts to outline the characteristics of 'typical' trauma cases, the researchers reviewed electronic medical records of patients attending hospital with moderate-to-severe injuries and found that (i) most injured patients did not present with these characteristics and that (ii) these patients were less likely to be appropriately transferred to a trauma centre for the care they needed (Kulkarni et al., 2019). A systematic review of studies assessing the use of heuristics in clinical decision-making showed that 80% of the 64 included studies of HCPs found evidence for the use of heuristics (Blumenthal-Barby & Krieger, 2015). These studies focused on a range of clinical decisions made in different clinical areas, indicating the pervasiveness of heuristic decision-making in clinical practice.

4.5. Enacting multiple healthcare professional behaviours

In a final note about correlates and determinants, it is important to emphasise that healthcare contexts are microcosms of daily life in which there is limited time to enact a potentially broad range of behaviours that may be appropriate. For instance, in a 15-minute consultation with someone with diabetes, a physician may take a

history, measure blood pressure, provide nutrition and exercise advice, review medication adherence and symptoms, prescribe new medication, update electronic medical records, refer the person to the practice nurse for follow-up and refer the person to a specialist for foot examination, all while maintaining rapport and addressing acute concerns that the patient brings to the consultation (Presseau et al., 2009). Any one of these behaviours could be focused on in detail in research aiming to understand determinants of HCP behaviour, but clearly cannot be fully isolated from the competing demands inherent in this healthcare context involving multiple interdependent behaviours. Some of these behaviours may facilitate others (e.g. discussing medication may facilitate a conversation about increased physical activity) while other behaviours may conflict by taking time or shifting the focus of the consultation (Presseau et al., 2009). If we extend the investigation from the focus on a single behaviour enacted by one HCP to focusing on multiple behaviours enacted by single or multiple HCPs, there are several possible interrelationships between behaviours which may powerfully influence the performance of a single action. These can include concurrent facilitation between behaviours (e.g. forming a patient-centred action plan for physical activity may also support rapport building); sequential facilitation between behaviours (e.g. providing physical activity advice sets the stage for providing nutrition advice); conflict between behaviours (e.g. examining feet requires removal of clothing which takes time and interferes with providing advice about stress); interpersonal behavioural facilitation and conflict (e.g. the impact of one HCP's behaviour on another HCP's behaviour). Applying a multiple behaviour approach can also help elucidate how HCPs prioritise the multiple goals pertaining to their clinical practice (McCleary et al., 2020).

The correlates or determinants, of HCP behaviours can be many depending on the types of behaviour or care delivered (multiple, habitual, reflective behaviours), for whom (patients with differing illnesses, concerns and lived experiences) and the context (social and physical environments) in which they may be performed. Targeting all the determinants in an intervention to change HCP behaviour may be impossible. Identifying interventions that may target the most influencing determinants (clinically and theoretically) or multiple determinants at once may have the most effective impact.

5. Interventions to change healthcare professional behaviour

In 1999, Grol and Grimshaw published a call to match evidence-based healthcare with evidence-based implementation (Grol & Grimshaw, 1999). Unfortunately, many attempts to address gaps in healthcare delivery still take an intuitive approach rather than drawing on evidence about the behaviour change strategies that are likely to be effective. However, the past two decades have seen the development of evidence and resources to guide the development of interventions to support behaviour change among HCPs. The Cochrane Effective Practice and Organisation of Care group ((EPOC, 2015); <https://epoc.cochrane.org/>) publishes systematic reviews of interventions that seek to address practice gaps by supporting change in HCP behaviour. Such reviews include rigorously conducted studies including trials that randomize HCPs or clusters of HCPs to receive an implementation intervention or not then evaluated change in practice and care (cf. Wolfenden et al. (2021) for guidance on conducting randomized implementation trials). For example, a systematic review of 140 trials using 'audit and

feedback' to change HCP behaviour across a variety of healthcare professions and behaviours reported that this intervention results in 4–16% improvement in HCP practice (Ivers et al., 2012). Whilst this may not seem like a significant change in behaviour, changes this small can improve the care and outcomes of hundreds of thousands of people a year and can alleviate added costs to the healthcare system (Halpern & Mason, 2015).

There are a number of taxonomies that identify potential behaviour change interventions and components. For example, the *Behaviour Change Technique (BCT)* taxonomy consists of 93 techniques, hierarchically organised into 16 groupings (Michie et al., 2013). Each technique has a definition and an example to aid in designing interventions or coding of pre-existing intervention descriptions. The majority of the examples provided within the taxonomy are directed at changing health behaviours of patients and members of the public but can be and have been applied to describe behaviour change interventions relating to clinical practice (Patey et al., 2021; Presseau et al., 2015). In a systematic review by Hall et al. (2021) the most frequently used BCTs in implementation interventions targeting physician behaviour to reduce unnecessary LBP imaging from 36 studies included Instruction on how to perform the behaviour (e.g. Active/passive guideline dissemination and/or educational seminars/workshops), followed by Credible source, Feedback on behaviour (e.g. electronic feedback reports on physicians' image ordering) and Prompts and cues (electronic decision support or hard-copy posters/booklets for the office). In a study that used a random sample of 26 papers from a systematic review (Tricco et al., 2012), Presseau et al. (2015) identified the most commonly used BCTs for implementation interventions to change HCP behaviour related to the management of diabetes were *Adding objects to the environment*, *Prompts/cues*, *Instruction on how to perform the behaviour*, *Credible source*, *Goal setting (outcome)*, *Feedback on outcome of behaviour* and *Social support (practical)*. Synthesis of 43 diabetes quality improvement trials by Konnyu et al. (2020) examining continuing professional development (CPD) showed fourteen (of a possible 93; 15%) behaviour change techniques were identified in the clinician education content of the quality improvement trials that focussed on addressing the behavioural determinants Beliefs about consequences, Knowledge, Skills and Social influences of diabetes care providers' behaviour. Additionally, Patey et al. (2021) compared the most common BCTs used for a selection of implementation versus de-implementation interventions in three Cochrane systematic reviews (Davey et al., 2017; French et al., 2010; Ivers et al., 2012). They reported that in the 181 studies included in the analysis *Feedback on behaviour* was identified more frequently in implementation than de-implementation ($X^2(2, n=178) = 15.693, p < .01$). Three BCTs were identified more frequently in de-implementation than implementation: *Behaviour substitution* ($X^2(2, n=178) = 14.561, p < .01$); *Monitoring of behaviour by others without feedback* ($X^2(2, n=178) = 16.187, p < .01$); and *Restructuring social environment* ($p < .01$, Fisher's exact test) (Patey et al., 2021). Whilst these reviews do not report on effectiveness because the effectiveness reported in the individual studies could not be attributed to a single BCT but rather to the cluster of BCTs identified in the intervention, it does suggest that informal 'theorising' by researchers may influence of BCTs for implementation interventions. A recent study proposed links from groups of commonly used BCTs in interventions to behaviour change theories, suggesting that this kind of informal

theorising about how BCTs work together may be consistent with behaviour change theories (Bohlen et al., 2020; Patey et al., 2021).

The Expert Recommendations of Implementation Strategies (ERIC) taxonomy is a list of 73 discrete strategies that can serve as 'building blocks' for constructing multifaceted, multilevel interventions for to change HCP behaviour (Powell et al., 2015). The Cochrane Effective Practice and Organisation of Care (2015) taxonomy proposes four broad categories (Delivery arrangements, Financial arrangements, Governance arrangements, Implementation strategies) to help facilitate explicit and systematic synthesis and interpretation of the existing body of evidence on strategies to achieve change at different levels of healthcare systems. These three taxonomies offer different levels of granularity and specificity of their components.

Methods for designing implementation interventions are developing rapidly in this field. The key challenge is choosing and optimising behaviour change interventions that address barriers and facilitators to recommended practice. French et al. (2012) proposed a model which uses frameworks, taxonomies and methods for health psychology to develop theory-informed interventions to change HCP behaviour. The model involves four key steps: (1) specifying who needs to do what, differently (e.g. using the AACTT framework); (2) identifying the factors that might influence whether or not they do it (e.g. using the TDF); (3) identifying strategies or techniques to target those factors (e.g. using the BCT taxonomy); and (4) measuring behaviour change. Attempts to apply the French model and similar theories and models grounded in the behaviour sciences in the design and evaluation of behaviour change interventions increase the likelihood of the intervention being successful (Davies et al., 2010; French et al., 2012; Grimshaw et al., 2020). Intervention Mapping (and its related approach, implementation mapping (Fernandez et al., 2019)) is another approach that can be used in implementation research to develop theory-informed interventions to change HCP behaviour. It can guide the design of multi-level health promotion interventions and implementation strategies (Bartholomew-Eldredge et al., 2016). Intervention Mapping involves six steps: (1) analyzing the problem by identifying what, if anything, needs to be changed and for whom; (2) creating matrices of change objectives by crossing performance objectives with determinants; (3) selecting theory-based intervention methods that match determinants, and translating these into strategies; (4) integrating strategies into a program; (5) planning for adoption, implementation, and sustainability of the program; and (6) generating an evaluation plan (Bartholomew-Eldredge et al., 2016).

6. Conclusions

The behaviours of HCPs as they deliver care to their patients are enacted within complex systems and in the context of multiple demands. This results in many challenges to the performance of evidence-based healthcare practice, especially in the context of rapidly emerging clinical evidence. HCPs and healthcare systems need support to manage change effectively. Theories and methods from the behavioural sciences can be applied to understand HCP behaviour, to develop interventions to support behaviour change and to provide valid and reliable tools to monitor change and evaluate implementation interventions. Investigations and interventions to support

change in HCP behaviour can also provide opportunities to advance health psychology theory and methods through the field of implementation science.

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