IMS INSTITUTE FOR HEALTHCARE INFORMATICS

July 2016

# Improving Type 2 Diabetes Therapy Adherence and Persistence in the United Kingdom

## How to Address Avoidable Economic and Societal Burden

# Introduction

As the prevalence of type 2 diabetes (T2D) increases globally, the condition and its associated complications are generating considerable—and growing—economic burden on healthcare systems and societies. The U.K. reflects this trend, facing a rising prevalence of T2D and a growing burden of disease.[1] Despite improved diagnosis, advances in treatment options for individuals with T2D and preventative measures, sub-optimal therapy adherence and persistence limit the benefits derived from these and contribute to avoidable economic and social burden.

This report is part of a publication series examining six countries and their differing stages of recognition of T2D as a public health priority. It examines the U.K.-specific burden of T2D and its complications, national initiatives in place to address this issue, and opportunities in relation to therapy adherence and persistence improvement strategies. A range of validated, U.K.-specific recommendations to address sub-optimal T2D therapy adherence and persistence are put forth for action by government stakeholders, insurers and healthcare administrators — including those in the NHS and NICE, among other organisations — and focus on three broad phases of a patient journey toward optimal adherence and persistence, (i) identify and profile, (ii) activate and, (iii) sustain. These are all designed to improve T2D therapy adherence and persistence in the U.K., and consequently decrease significant and avoidable economic and societal costs, and improve quality of life for people living with the condition.

This study is based on research and analysis undertaken by the IMS Consulting Group with support from Lilly Diabetes. The contributions to this report of Peter Thomas, Graham Lewis, Adam Collier, Mark Lamotte, Volker Foos, Phil McEwan, Raf De Moor and others at IMS Health are gratefully acknowledged.

**Murray Aitken**
Executive Director
IMS Institute for Healthcare Informatics

IMS Institute for Healthcare Informatics
100 IMS Drive, Parsippany, NJ 07054, USA
info@theimsinstitute.org
www.theimsinstitute.org

**Find out more**

If you wish to receive future reports from the IMS Institute or join our mailing list, please **click here**

# Contents

# Burden of T2D

## Overview of T2D and its complications

Type 2 Diabetes (T2D) is a chronic disease characterised by both insulin resistance and the progressive dysfunction of insulin-producing pancreatic beta-cells. Consequently, person(s) with T2D (henceforth referred to as PwD in this paper) suffer from elevated blood glucose and lipid levels as well as elevated blood pressure, which can result in long-term vascular complications.[2]

Undetected or poorly managed T2D with persistently elevated levels of blood glucose increases the risk of long-term debilitating and life-threatening complications due to macrovascular (e.g. stroke, myocardial infarction) and microvascular damage (e.g. nephropathy, foot ulcers leading to amputations, retinopathy leading to blindness), as well as short-term complications such as lethargy, poor wound healing and propensity for opportunistic infections. All of these complications can vastly decrease quality of life, productivity and life expectancy of PwD.

## A major public health concern with significant economic and societal burden

In the U.K., there are at least 3.1 million people diagnosed with the condition, another 500,000 undiagnosed and 11.9 million at high risk of T2D (assuming T2D accounts for 90% of diabetes cases).[3, 4] In other words, almost 1 in 4 people either have or are at high risk of having T2D in the U.K. Furthermore, these figures are set to continue rising with 630 new T2D diagnoses a day and predictions of 4.5 million PwD in the U.K. by 2025 (assuming T2D accounts for 90% of diabetes cases).[3] PwD are managed with a combination of lifestyle changes and pharmacotherapy, which includes a range of oral anti-diabetic and injectable drugs. However, despite a variety of effective medications,[5] this condition is not well controlled in many PwD.[6]

This high prevalence, combined with poor control, translates into diabetes (type 1 and 2) becoming the leading cause of multiple preventable complications including end-stage renal disease requiring dialysis or transplant across all ages and vision loss in people of working age.[3] It is also responsible for 44% of all hospital bed days due to heart failure, myocardial infarction, angina and stroke[4] while causing 135 amputations a week.[3]

Economically, it was previously estimated that diagnosed T2D costs the NHS almost 10% of its budget or £8.8 billion every year,[1] 80% of which is due to diabetes-related complications.[6] It is worth noting that these cost estimates do not account for indirect costs such as loss of productivity of the PwD, caregivers and families. In addition, these costs do not reflect the impact of lower quality of life on all of these people. As such, T2D places a significant strain on the healthcare system and society which, in light of increasing prevalence trends in the country, will rapidly escalate.

## Current strategies to improve T2D outcomes

There is a general consensus at a policy-making level that diabetes is a public health priority in the U.K. For example, recent publications from the Public Accounts Committee,[7] All Party Parliamentary Group for Diabetes[8, 9] and Diabetes U.K.[10, 6] among others, have highlighted the growing burden of T2D and this has translated into a number of interventions and policies to address this problem.[11, 12]

The NHS Health Check programme,[13] developed by Public Health England, the Local Government Association and NHS England, routinely checks people aged 40-74 without an existing cardiovascular condition for the top risk factors of preventable disease and is predicted to help both prevention and early detection of diabetes among other diseases. Additionally, the NHS 5 Year Forward View,[11] a collective view of how the health service needs to change (developed by NHS partner organisations including Care Quality Commission, Public Health England and NHS Improvement), recently announced the NHS Diabetes Prevention Programme, which is due to be rolled out in April 2016.[14] This is a joint commitment from NHS England, Public Health England and Diabetes U.K. and is aimed at delivering an evidence-based behavioural programme targeting people at high risk of T2D with the aim of supporting them and reducing the chance of developing T2D.

However, many of these interventions and policies focus on prevention and early detection which, although critical for reducing increasing prevalence in the long term, are not comprehensive and do not encompass all aspects of T2D management. These could be augmented by other, more targeted strategies that focus on current PwD to help them manage their condition and reduce the rate of diabetes-related complications.

# Sub-optimal adherence and persistence is a cause of T2D-related complications

## Adherence and persistence defined

The current strategies to improve T2D outcomes are not directly focused on addressing sub-optimal T2D therapy adherence and persistence among PwD.

### Defining therapy adherence and persistence

There is a lack of consensus in the literature on the exact definitions of therapy adherence and persistence. In this paper, these terms are defined as:

**Therapy adherence**

The extent to which a patient acts in accordance with the prescribed interval, and dose of a dosing regimen[15]

**Therapy persistence**

The duration of time from initiation to [healthcare professional (HCP) recommended] discontinuation of therapy[15]

Additionally, this paper focuses on the proportion of people who have low therapy adherence, rather than the level of therapy adherence itself.

## Extent of sub-optimal T2D drug therapy adherence and persistence

Literature research and interviews have indicated that sub-optimal adherence and persistence is a significant issue for PwD, globally. A number of systematic reviews and meta-analyses on diabetes therapy adherence around the world have been conducted,[16, 17, 18] the most recent of which identified 27 studies and found that the proportion of PwD who are non-adherent to therapy ranges from 6.9% to 61.5%, with a mean value of 37.7%.[18] In the U.K. specifically, GPs estimated that the proportion of PwD non-adherent to therapy was approximately 30%,[19] while another U.K. study based on medical records reported this to be 67%.[20] A further study in the U.K. also found that the proportion of PwD non-adherent to therapy stood at 66-69%, although the criteria for a PwD to be deemed adherent in this study was stricter than most others, which makes it less comparable.[21]

Despite these significant values, the actual rates of sub-optimal adherence and persistence to T2D therapy in the U.K. may be even higher than the estimates stated above because many of these studies fail to grasp all aspects of adherence and persistence. For example, they are unlikely to include rates of primary non-adherence, defined as PwD who have been diagnosed but never initiated therapy. This is significant as rates of primary non-adherence have been shown to be as high as 15% in countries outside of the U.K.[106] Additionally, many of these studies will not measure those who started but have since ceased taking their medications or, those who pick up their medication but do not take them at the recommended time or dose, i.e. poor concordance with dosing instructions.

## Economic burden of sub-optimal adherence and persistence on governments and healthcare systems

Recognising that sub-optimal T2D therapy adherence and persistence causes persistently elevated blood glucose levels,[22, 23] leading to increased risk of complications[24] and subsequently costs,[1, 25] the extent of this contribution to complication-related costs was estimated. To do this, the CORE Diabetes Model, a validated health economics model used by NICE for updating recent diabetes guidelines,[26, 27, 28, 29] was customised to the U.K. in order to provide guidance on potential healthcare system savings if the issue of sub-optimal T2D therapy adherence and persistence was addressed in the U.K.

### Calculating the cost of sub-optimal T2D therapy adherence and persistence with the CORE Diabetes Model

The CORE Diabetes Model is a validated, peer-reviewed model, which simulates clinical outcomes and costs for cohorts of people with either type 1 or type 2 diabetes.[26, 27] The model has been customised to the U.K. to calculate the cost of avoidable T2D-related complications as a result of those PwD who struggle with therapy adherence and persistence.

This has been achieved by applying two key U.K. specific data points:

1. The percentage of PwD with sub-optimal levels of therapy adherence and persistence in the U.K.
   - Reported to be as high as ~67% as recorded in a U.K. study based on medical records[20]
2. The relationship between sub-optimal therapy adherence and HbA1c as estimated by GPs in the U.K.
   - 17% increase in HbA1c due to sub-optimal adherence[19] (similar to results in a widely-cited scientific study in the US)[23]

## What are HbA1c levels?

HbA1c levels are used to diagnose and monitor diabetes and refer to glycated haemoglobin (HbA1c), reflective of average plasma glucose concentration. HbA1c develops when haemoglobin, an oxygen-carrying red blood cell protein, combines with glucose in the blood, thus becoming glycated.[30]

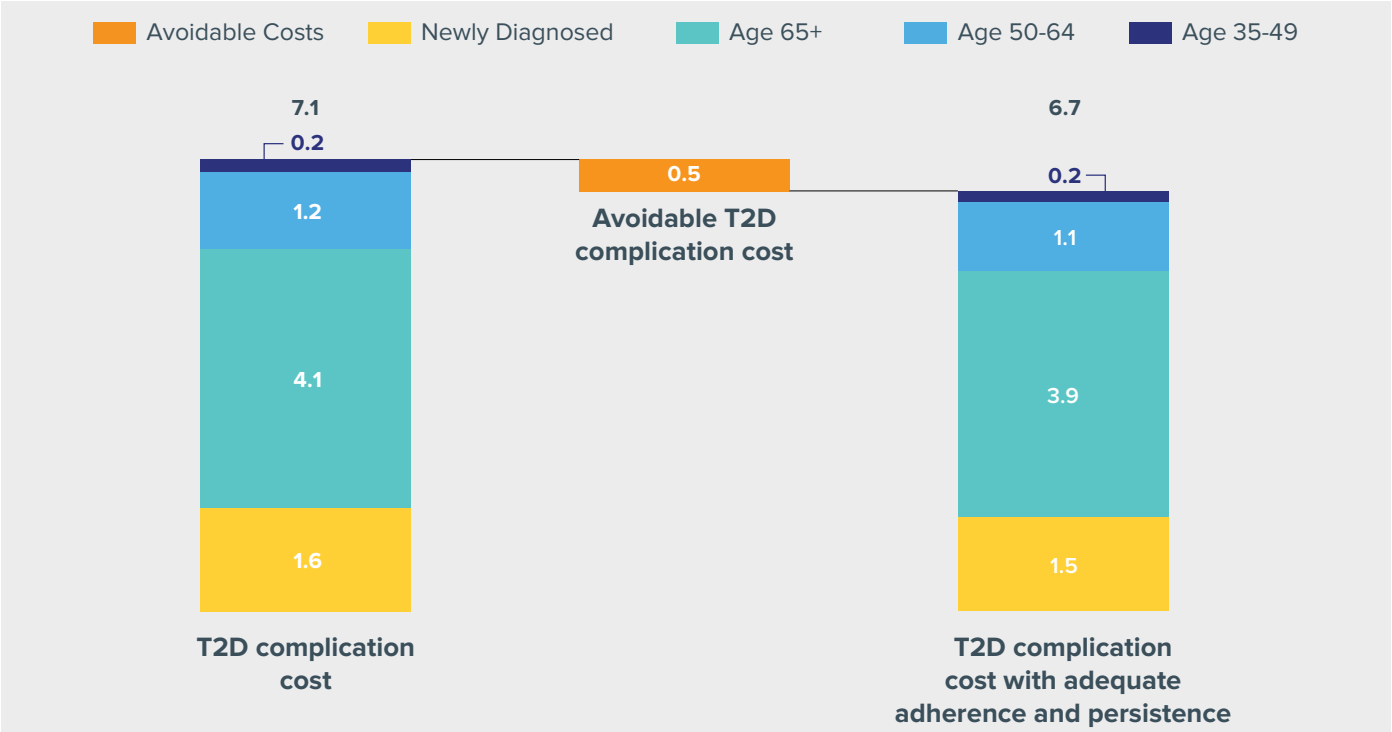
Measurement of HbA1c reflects average plasma glucose levels over a period of 8-12 weeks. It can be performed at any time of the day and does not require any special preparation such as fasting.[31] These properties have made it the preferred test for both diagnosing diabetes and assessing glycaemic control in PwD. The higher the HbA1c level, the higher the increase in risk of diabetes-related complications. Normal, pre-diabetic and diabetic HbA1c ranges are provided below:[30]

| HbA1c Level | Indication |
|---|---|
| <6% (<42 mmol/mol) | Normal range |
| 6 – 6.4% (42 – 47 mmol/mol) | Pre-diabetes |
| ≥ 6.5% (>48 mmol/mol) | Diabetes |

Using the CORE Diabetes Model, it has been estimated that T2D-related complications will cost £7.2 billion per year to the U.K. healthcare system (mean of next 10 years, see Exhibit 1). By customising the CORE Diabetes Model to take into account T2D therapy adherence and persistence levels in the U.K., it has been estimated that as much as 7.1% of this healthcare system cost, or approximately £0.5 billion per year, every year over the next 10 years, will be driven by avoidable costs of T2D complications suffered by those PwD who are currently struggling to achieve optimal T2D therapy adherence and persistence (see Exhibit 1).

To provide a sense of proportion, £0.5 billion average annual cost of avoidable complications due to sub-optimal adherence and persistence is equal to over 0.4% of the total NHS England budget for 2015/2016,[33] likely to be ~5% of total annual spend on diabetes[3] and, is approximately two thirds of the total annual spend on diabetes medications in the U.K. today.[34] In summary, the economic cost burden of T2D complications of U.K. PwD who are struggling to achieve optimal T2D therapy adherence and persistence is significant and, most importantly, avoidable.

## Exhibit 1: Mean Annual Economic Costs Associated with Sub-Optimal T2D Drug Therapy Adherence and Persistence in the U.K. 2015-2025, £ Bn




Source: IMS CORE Diabetes Model

Notes: Adequate adherence was based on the definition of the `adherent' population used in the data sourced for the economic model.[20] This is typically defined as PwD who pick up over 80% of their prescriptions or a score of 6 and above on a Morisky Medication Adherence Scale (MMAS-8). Mean Annual Economic costs are the mean annual costs between 2015 and 2025.

Furthermore, this unnecessary spend and economic wastage is only one dimension of the overall cost of sub-optimal T2D therapy adherence and persistence as it only pertains to the costs associated with avoidable complications of T2D and does not include indirect costs related to lost work days for working-age PwD and their family members. Additionally, spending and investment related to HCP training, T2D screening, diagnosis and PwD education, regular GP or hospital appointments, medication dispensing and medicine costs are all sub-optimised if PwD are unable to comply and persist with their therapy or make the necessary changes to their lifestyle.

Moreover, these costs are expected to be underestimates due to the difficulty in accurately measuring the full extent of sub-optimal therapy adherence and persistence. Separately, due to the long-term nature of the disease and the ever-increasing prevalence, the costs linked to sub-optimal adherence and persistence in T2D therapy are only set to escalate in the short-to-medium term.

# Burden of sub-optimal adherence and persistence on persons with T2D and society

The CORE Diabetes Model has also estimated the extent of increased risk for debilitating and life-threatening complications such as coronary artery disease and myocardial infarction, cerebrovascular disease and stroke, renal failure, diabetic retinopathy and blindness, diabetic peripheral neuropathy and diabetic ulcers and lower limb amputations in PwD that are sub-optimally adherent and persistent to their T2D therapy in the U.K. (see Exhibit 2). It must be noted that the particularly large increase in risk of end-stage renal disease is, at least in part, due to elevated HbA1c levels having a greater impact on microvascular complications in comparison to macrovascular complications with diabetes being the single most common cause of end-stage renal disease in the developed world. Therefore, poor diabetes control will create a much stronger impact on increasing the risk of these diabetes specific microvascular complications when compared to those with multiple other risk factors (i.e. stroke and heart attack).[35]

## Exhibit 2: Increased Risk of Complications and Healthcare Costs Over the Lifetime of a Non-Adherent PwD

| Percent increased risk versus adherent PwD | Complication |
|---|---|
| 132% | More likely to have end stage renal disease |
| 10% | More likely to have a heart attack |
| 10% | More likely to have a stroke |
| 26% | More likely to have an amputation |
| 31% | More likely to go blind (severe vision loss) |
| **~£12,500** | **Estimated extra cost to the healthcare system over their lifetime** |

Source: IMS CORE Diabetes Model

Notes: Increased lifetime risk of various complications and healthcare costs for non-adherent PwD in comparison to an adherent PwD, based on the average 50-64 year old PwD.

# The path to optimal adherence and persistence relies on effective patient activation

## Action is needed

By 2025, the U.K. is set to have 4.5 million people with T2D.[3] In 2015, direct expenditure for type 1 and type 2 diabetes accounted for 10% of the NHS budget. Of this, it is estimated that around 5% (£0.5 billion) is being driven by sub-optimal T2D therapy adherence and persistence.[3] Absence of action to tackle this problem now, when prevalence of T2D continues to rise,[3] will result in a growing build-up of costs. A set of practical and action-oriented recommendations has been proposed in this paper to raise levels of adherence and persistence in T2D therapy, including diet, exercise and glucose-lowering medicines, by:

- Identifying and profiling PwD in need of help
- Improving access to and customising T2D education
- Maximising HCP/PwD engagement
- Using digital technology to maintain effective disease self-management

These recommendations are presented to inspire collaborative discussion and health outcome-oriented pilots that, if found successful, should be expanded to improve treatment outcomes and help reduce the significant cost burden of sub-optimal T2D therapy adherence and persistence.

## Effective patient activation

### What is patient activation?

Activation is defined as how well a person understands his or her role in the care process and, whether that person has the knowledge, skills, capacity and confidence to follow through with this role.[36] As such, PwD activation relates to the individual's willingness and ability to take independent actions to manage his or her health and care.

Research shows that increased degrees of activation are positively correlated with an increase in adherence to therapy and a reduction in healthcare expenditure.[37, 38, 39] For example, one study, which considers T2D among other conditions, found that patients with lowest activation levels were predicted to cost 21% more than highly activated patients.[38]

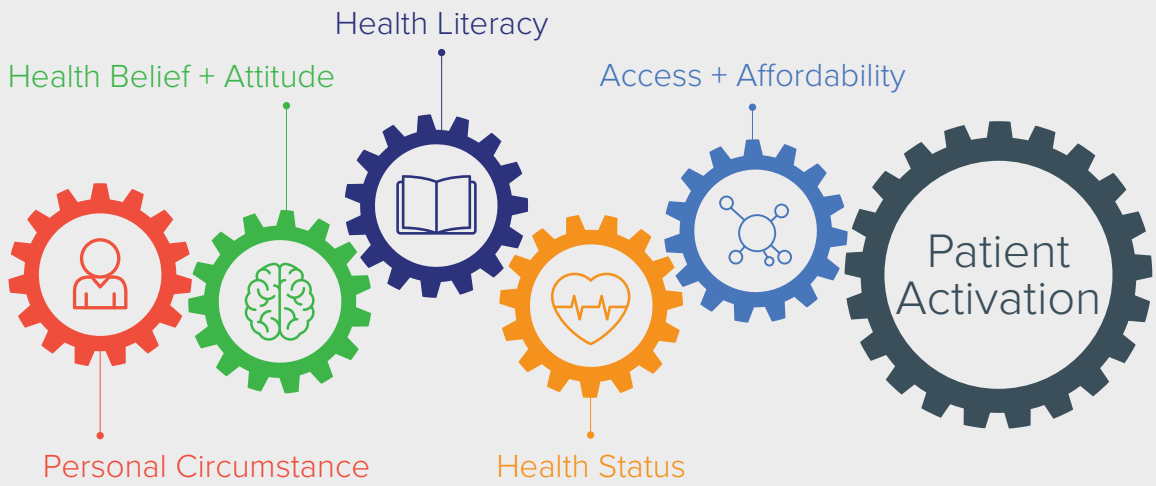
Consequently, T2D therapy adherence and persistence will remain sub-optimal as long as PwD activation remains inadequate. Effective PwD activation is difficult to achieve as it stems from the synergistic impact of multiple underlying drivers and stakeholders. Hence, a tailored, individualistic approach is needed to improve adherence.

Based on literature and qualitative expert interviews, 'health beliefs and attitude', 'personal circumstances', 'health status', 'health literacy' and 'access and affordability' have been identified as the five key drivers of PwD activation (see Exhibit 3).[40, 41, 42, 43, 44] While these five distinct drivers work in concert to influence overall degree of PwD activation, they are also intertwined such that changes in one driver impact others (see Exhibit 3). For example, improving health literacy may positively impact health beliefs and attitude, thus enabling PwD to identify opportunities for overcoming burdens associated with barriers to access and affordability.

Effective PwD activation also requires multi-stakeholder involvement, including policy makers, payers, healthcare providers, the private sector, caregivers, family, and PwD themselves. All of these stakeholders influence PwD activation and can promote T2D therapy adherence and persistence. Policy makers, for instance, play key roles in improving access, health literacy, health beliefs and attitude by addressing barriers in integration and provision of care.

PwD activation is therefore the sum of personal circumstances, attitudes, behaviours, and motivations, which are themselves influenced by a variety of stakeholders. The combination of these factors results in a spectrum of PwD activation degrees that stem from different root causes. As a result, it is critical to not only quantify PwD activation but also identify its associated underlying causes. This will enable HCPs to address an individual's specific support and information needs and develop a customised, PwD-centric approach that positively impacts adherence and persistence in T2D therapy and reduce the avoidable T2D complication cost of approximately £0.5 billion per year associated with this (see Exhibit 1).

## Exhibit 3: The Five Drivers of Patient Activation and Their Definition




**Personal circumstances** constitute the social factors, including age, gender, social network, socioeconomic factors that have an impact on the individual's health.[40,45,46]

**Health beliefs and attitude** relate to whether PwD accept their condition and believe in the benefits of their overall therapy.[41,47,48]

**Health literacy** relates to the extent "to which individuals have the capacity to obtain, process, and understand basic information and services needed to make appropriate decisions regarding their health."[42,49,50,51]

**Health status** relates to a variety of factors such as diet, exercise, and number of co-morbidities.[43,52,53]

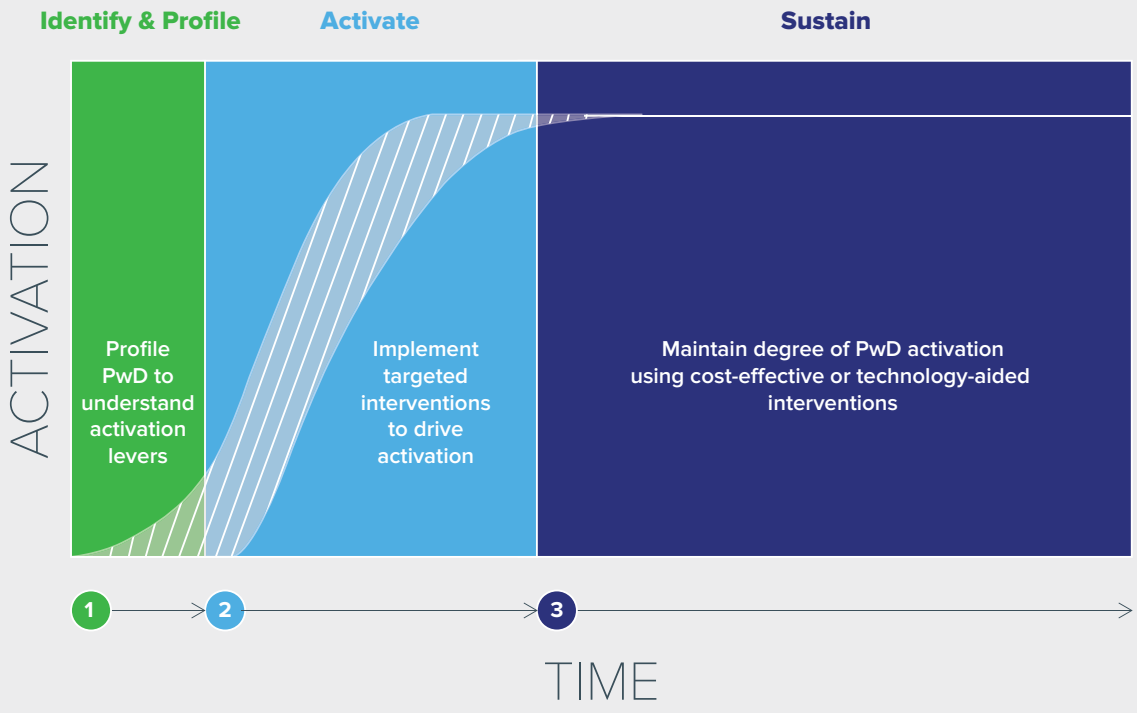
**Access and affordability** concerns access to and affordability of healthcare, healthy food, and exercise facilities.[44,54,55]

Source: IMS Consulting Group research and analysis

# The path to optimal adherence and persistence

PwD activation relates to an individual's willingness and ability to take action to manage their own health and care. It is therefore paramount to improving therapy adherence and persistence and, in turn, clinical outcomes.[57] Through literature research and qualitative interviews with expert stakeholders, it has been determined that effective PwD activation, and therefore a PwD' journey to optimal adherence and persistence, requires progression through three key phases identified as 'identify and profile', 'activate', and 'sustain' (see Exhibit 4).

## Exhibit 4: A PwD Path to Optimal Adherence and Persistence




1. Profiling PwD and establishing the causes for their degree of activation
2. Action-oriented, targeted interventions to optimally activate PwD
3. Sustain PwD activation degrees via cost-effective engagement solutions

Source: IMS Consulting Group research and analysis

In the 'identify and profile' phase, PwD need to be assessed by HCPs to determine their degree of activation as well as the health-related attributes (including attitudes, motivations, behaviours and logistical challenges) that lead to this degree of activation. In the 'activate' phase, to effectively improve activation and successfully set PwD on the path to optimal adherence and persistence, interventions, goals and action steps need to be customised based on the individual's degree of activation. Finally, in the 'sustain' phase, PwD who have reached high degrees of activation and therefore proficient self-management behaviours in therapy adherence and persistence can be transitioned to cost-effective T2D management solutions.

Customised interventions within each of these phases have been designed to overcome the varied challenges related to activation and support U.K. PwD on the path to optimal adherence and persistence in T2D therapy. To effectively promote and sustain these at a country level, it is essential that interventions are assessed, validated, consolidated and embedded appropriately in the healthcare system or governing body. This will require alignment between healthcare and government leaders and involvement from voluntary associations and private stakeholders. It will also require improvements in information technology (IT) infrastructure, which should be addressed by the pledged £4.2 billion NHS investment in healthcare IT infrastructure,[58] in order to allow for better communication and data capture across the healthcare system. With this view, it has been suggested that a number of assessment metrics and outcomes could be used to validate each intervention proposed in the paper (see Appendix, Exhibit A). By implementing these interventions, it will be possible to reduce the avoidable complication costs resulting from sub-optimal T2D therapy adherence and persistence in the U.K., estimated to be an £0.5 billion per year (see Exhibit 1).

# Recommended interventions to improve T2D therapy adherence and persistence in the U.K.

## Identify and profile

### Recommendation 1

Use predictive analytics to identify PwD at risk of low adherence and persistence

Healthcare IT is well recognised as a critical enabler of improved care and efficiency across healthcare,[59] which has led to major and on-going investments in U.K. IT systems.[58] The NHS is currently well positioned to take advantage of healthcare IT benefits as comprehensive electronic patient records (EPR, defined as a series of software applications, which bring together key clinical and administrative data in one place[60]) already exist in the U.K. Additionally, EPR in the U.K. are becoming more centralised and normalised than in many other countries due to on-going investments.[58, 61] For example, Southwark and Lambeth have recently joined forces to improve patient care by sharing EPR through a new secure system.[61] This allows different HCPs to instantly and securely review critical patient information before making informed treatment decisions. Although patient records are already shared between local NHS organisations via traditional methods such as secure post, fax or email,[61] this is much slower and can lead to delays in treatment or less informed treatment decisions.

Recently, there has been an increasing focus across the NHS on the need to account for the benefits enabled by investment in IT systems.[60, 58] Due to the significant economic impact of sub-optimal T2D therapy adherence and persistence (see Exhibit 1), EPR could be leveraged to rapidly and accurately identify which PwD have or are at risk of low therapy adherence and persistence. For example, data could be used to perform "predictive analytics", a process whereby software algorithms mine compiled data based on set criteria. This would make identification quick and accurate thus narrowing down the pool of PwD for further profiling and intervention.

The use of predictive analytics solutions in healthcare are already being explored by the Nuffield Trust[62] and piloted in the NHS in Heywood, Middleton, Rochdale as well as Birmingham and Solihull Mental Health NHS Foundation Trust among others.[63] There are a number of providers available for partnering and examples of their use include analysing people with chronic conditions to predict who is at the highest risk of complications as well as when a particular person may reach a crisis point or complication thus allowing HCPs to intervene.[63] The U.K. healthcare system and government leadership could continue to explore possibilities with such organisations and apply predictive analytics methods to identify PwD who have or are at risk of low therapy adherence and persistence, thus continuing to further leverage the benefits (cost reduction and improved patient care) of EPR.

## Recommendation 2

Use validated psychometric assessment models to evaluate identified PwD activation as related to their diabetes care

Once PwD have been identified as having or at risk of low therapy adherence and persistence, they can then be profiled using psychometric assessment tools to determine their actual degree of activation and the underlying drivers of this. This would act as a prerequisite to setting realistic goals and actions and put PwD on the path to optimal therapy adherence and persistence (see Exhibit 4). Such tools have been shown to increase adherence to therapy, reduce healthcare expenditure[38] and predict costs and outcomes for PwD.[37, 39] The Patient Activation Measure (PAM) Survey, an example of such a tool, assesses beliefs, knowledge, and confidence in managing one's condition and assigns individuals to one of four activation levels, ranging from 'disengaged and overwhelmed' (level 1) to 'maintaining behaviours and pushing further' (level 4). On a 100 point scale, each point increase in PAM score translates into a 2% increase in adherence to medicine and a 2% decrease in hospital admissions and readmissions.[64]

Due to the benefits of these tools in helping physicians personalise chronic disease treatment[57, 64] as well as measure the success of interventions, the NHS could look to increase uptake and usage of similar tools and build on the success of early pilots of the PAM tool in the U.K. for weight management and various chronic conditions including diabetes.[65] For example, the PAM tool is being used across the primary-care setting in the NHS Islington CCG with patients with long-term conditions while NHS Tower Hamlets CCG use the PAM tool with PwD to help make decisions on service procurement as well as particular services an individual PwD can access.[65] Increased uptake would allow assessment of the on-going need and expected scale for interventions to improve PwD activation.

# Activate

Once PwD activation has been evaluated, there is still a considerable challenge to engage PwD. However, there are a number of actions that can be taken in order to improve PwD engagement and these revolve around improving access to T2D education, maximising HCP/PwD engagement and increasing exposure of PwD to specialists. These interventions could also be tailored to the degree of PwD activation so that goals and action steps are realistic and build towards greater activation.

### Improve access to T2D education

## Improve access to T2D education and tailor education to individual PwD

Group-based education courses for PwD improve a range of clinical, lifestyle and psychosocial outcomes that are key to PwD activation.[66, 67, 68] There are a number of these courses available in the U.K. and, due to their effectiveness, NICE guidelines and the Quality and Outcomes Framework (QOF – part of the General Medical Services; rewards practices for the provision of 'quality care' and helps to fund further improvements in the delivery of clinical care[69]) both suggest all newly diagnosed PwD attend one.[70, 71] However, the 2014-2015 National Diabetes Audit (NDA) found that 20% of PwD were not offered these courses while only 20% of those offered actually attended.[4] Furthermore, T2D education should be timely and provided within the first 90 days post diagnosis or therapy change to effectively set PwD off to a good start.[72] This is especially important for PwD with low activation as these individuals fundamentally have a low probability of therapy adherence and persistence. In order to improve uptake, a number of actions which could be taken have been identified and presented below. However, to provide further evidence and specificity for the education-related recommendations and, identify any other reasons for poor uptake of diabetes education, a survey among PwD could be conducted or a method such as lean six sigma could be applied.

Additionally, to be fully effective, T2D education should also be tailored upon a PwD' degree of activation and its root causes. This is to avoid providing information that is not adapted to an individual's level of health knowledge or self-management skills as this could result in sub-optimal PwD activation and, in turn, greater healthcare service use and costs. At the moment, changing T2D group education course content, length and structure is difficult as they have been validated in trials.[68] However, when courses do come to be reviewed, relevant stakeholders could look into making full use of identifying and profiling PwD by tailoring course content, length and structure to different PwD.

## Recommendation 3

Secure HCP buy-in by demonstrating the importance and content of T2D structured group education to HCPs

According to a recent survey conducted by academic researchers, around half of GPs in the U.K. do not think group education could change behaviour or improve self-management and the majority of HCPs think of it as a 'tick-box exercise'. Additionally, QOF only incentivises the act of offering the course, rather than attendance.[71] If HCPs knew more about T2D structured group education and its benefits they would be more inclined to actively endorse them. Ideally, this could be achieved if CCGs encouraged relevant HCPs to attend a course themselves to see what they involve and how they benefit PwD first hand. Additionally, presentations or workshops describing T2D structured group education content and benefits could be included on study days and conferences such as the Diabetes U.K. conferences or the PCDS (Primary Care Diabetes Society) conference. These simple actions could transform the poor attendance conversion rate and could be easily measured by counting attendance and comparing it to the number of people offered (recorded via QOF). Additionally, predictive analytics could help identify PwD who are most in need and prioritise them to go on these courses while content/approach could be altered depending on individual reasons for low activation as profiled by a psychometric assessment tool.

## Recommendation 4

Offer T2D structured group education courses at a broader range of times

Enthusiastic endorsement from a knowledgeable HCP alone is not enough to ensure all PwD attend T2D structured group education. Courses need to be accessible to all PwD and suit differing personal circumstances, which can be ensured by offering repeat education courses adapted to PwD schedules, such as evenings and weekends. Extra funding would need to be released by CCGs to cover the extra payment for facilitators to hold some weekend/evening courses for PwD who cannot make day courses. Additionally, nurses could be commissioned as full-time facilitators in areas with high numbers of PwD, which would have the dual benefit of saving money and improving consistency of quality, thus lowering drop-out rates. Attendance and drop-out rates could be measured in areas piloting such a scheme to ensure this was improving uptake. Furthermore, increasing the availability and usage of educational tools on digital platforms will help capture more PwD and provide opportunities for

consolidation of learnings and self-education (see Recommendation 9 for more on technology and digital offerings). By improving availability of courses and therefore uptake, this would give more PwD the chance to engage with their condition and improve health outcomes.

## Maximise HCP/PwD engagement

A lack of primary care HCPs trained in PwD behavioural change, overburdened general practices and appointment schedules that are not optimally managed mean that critical opportunities for activating PwD may be missed.

### Recommendation 5

Increase number of HCPs trained in behavioural change

One of the core competencies of the Royal College of General Practitioners (RCGP) curriculum is 'communication and consultation skills'.[74] However, there could be more emphasis on refreshing and further developing these skills in order to effectively persuade and influence PwD to change their behaviour.

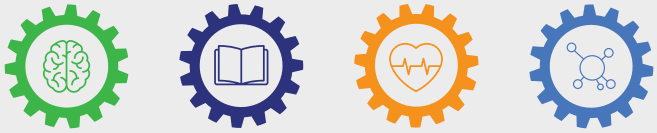
There are a number of ways to do this, for example:

- HCPs could learn how to give advice on habit formation which, when paired with a 'small changes' approach, has been proven as an effective long-term behaviour change strategy.[75, 76, 77] Habit formation starts with selecting a new behaviour (e.g. eat one more fruit a day or walk) and the context in which it will be done and culminates with the establishment of automaticity, which happens on average about 66 days or about 10 weeks after initiation.[78]
- More effective interactions between HCPs and PwD could also be achieved via the use of decision aids.[79] Here, nurses could identify decision points along the PwD journey, using motivational interviewing and the 'teach-back' method to effectively expand and consolidate learnings.[80, 81]
- A single, short counselling session conducted by a HCP, which emphasised self-care was found to improve both therapy adherence and clinical outcomes, including HbA1c levels, for PwD.[82]

Although there are numerous materials and courses on communication and behavioural change available for both practising GPs and nurses in the U.K.,[83, 84] they are not mandatory and information from extensive qualitative expert interviews suggests that many of these HCPs do not attend. More could be done to persuade HCPs to attend such courses and this could be achieved by building modules on behavioural change into widely attended study days such as Diabetes U.K. conferences or the PCDS, or, by making attendance at one behavioural change module/course per year mandatory for HCPs. For the latter approach, a targeted system could be utilised so as not to overburden the system. For example, at least one GP and nurse from every practice could attend along with all HCPs who look after a high number of PwD with low degrees of activation, as identified by predictive analytics and profiled by a psychometric assessment tool. By increasing the number of HCPs armed with this training, this would improve health outcomes and PwD activation.[86]

## Recommendation 6

Capitalise on clinical pharmacists in general practice



Recently, there has been acceptance that pharmacists are under-utilised and their expertise could help relieve the burden on primary care. A recent review has reported that pharmacists practising in various outpatient environments can improve a variety of clinical outcomes for PwD, including HbA1c, low-density lipoprotein (LDL) and blood pressure (BP),[87] while another has noted various successful and scalable pharmacist-driven but healthcare system-based interventions (among others), which can improve therapy adherence in PwD.[88, 89, 82] Additionally, U.K.-based studies such as PINCER and PRACtICe, as well as numerous case studies,[92] have also demonstrated the benefits of pharmacists in general practice. For example, The Old School Surgery in Bristol has had a practice-based prescribing pharmacist and practice partner since 2006 who helps manage PwD and takes on many roles including medicines management, medicines optimisation and agreeing adherence plans with PwD who are struggling with adherence and persistence.[92] This practice-based prescribing pharmacist also deals with correspondence from secondary care, liaises with consultants, conducts audits, runs patient engagement forums, shares medicine management updates with the clinical team and provides training for practice staff while addressing medicines-related queries from patients, community pharmacists, receptionists or GPs.[92] These studies and further lobbying led to a joint proposal from the Royal Pharmaceutical Society and the Royal College of General Practitioners in March 2015 helped bring this need to the attention of the NHS.[93] Following this and in order to support the GP Workforce 10 Point Plan and the 5 Year Forward View, a three-year pilot to test the role of clinical pharmacists working in general practice started in Spring 2016.[11, 94, 95]

While this pilot will greatly help primary care, continual expansion of both the programme and the roles of the pharmacists, including pharmacist-driven interventions, could help support more PwD and maximise benefit, respectively. For example, as well as some of their primary roles on medicine regimens, usage, dosing and side-effects, these pharmacists could also be well-placed to use psychometric assessment tools to assess PwD and log the results for the GPs. Additionally, retail pharmacists could also be further leveraged.[88] For example, they could carry out simple validated surveys such as the 'Beliefs about Medicines Questionnaire' where results could be fed back to primary care, thus helping future prescribing decisions.[96] Retail pharmacists are also easily accessed by PwD who should be encouraged to drop by their local pharmacy when they have queries about best practice medicine use.Furthermore, pharmacy-based SMS and telephone call interventions have also proven to be successful at increasing medication adherence without the need of additional resources and staff.[88, 97, 98] Continual broadening of pharmacist roles and increasing awareness of their expertise and value amongst both other HCPs will help give more PwD access to specialist and individualised advice while helping to reduce the burden currently placed on other HCPs across the primary care setting.

## Recommendation 7

Adapt appointment plans depending on PwD activation

Combined use of predictive analytics and a PwD activation measurement would serve as powerful pieces of information and would help optimise allocation of resources to those PwD most in need. As mentioned previously, those with low therapy adherence and low degrees of activation could be targeted for more frequent appointments or could be granted priority on T2D structured group education courses. They could also be targeted to a variety of other models of care. For example, many CCGs have launched their own models of integrated/intermediate care for diabetes in order to take specialists into the community setting, thus reducing the bureaucracy and costs associated with hospital referrals.[99] These PwD could therefore be referred to integrated/intermediate care models before complications arise. Additionally, psychometric assessment tools measuring PwD activation could be used to target PwD to pilot schemes such as the Year of Care, a model for people with complex needs and long-term chronic conditions.[100, 101]

# Sustain

The preceding recommendations are designed to activate PwD so that they are empowered to effectively self-manage their condition and adhere to their therapy, thus prolonging life and reducing the risk of complications. However, these interventions all require a high degree of human involvement, which is costly and no longer necessary to the same extent once a PwD exhibits a high degree of activation. Therefore, in order to maintain activation, a sustainable approach must be adopted to reduce unnecessary human involvement and associated costs. Technology and digital offerings can be phased in throughout the PwD path to optimal adherence and persistence where, at the point of maximal activation, they will be sufficient to keep PwD engaged at a minimum cost to the healthcare system.

## Recommendation 8

Monitor high PwD activation and repeat or adapt activation strategy for PwD with dropping activation or diabetes control

Even once fully activated, a PwD' degree of activation will vary over time, notably as a result of natural disease progression or a change in the person's external environment that impacts on their ability to independently self-manage their condition. Consequently, it is critical to periodically reassess PwD activation and take appropriate actions with these PwD that are experiencing a temporary decrease in their degree of activation. Similarly, those that are self-managing their condition well by sustaining their degree of activation need positive reinforcement that what they are doing is having a beneficial impact on their health.

Clinical outcomes could be used to cost-effectively identify PwD experiencing a temporary setback in activation. For instance, highly activated PwD who move outside the normal range for HbA1c levels, number of hypoglycaemic events, number of hospitalisations and/or infection rates should be offered to retake a psychometric assessment to re-quantify their degree of activation and identify its associated root causes. Review of clinical outcomes would ideally occur every 90 to 120 days in order to rapidly take action with those PwD who need further support while continuing with the existing strategy and giving continual HCP-led feedback on progress on clinical outcomes for those PwD whose condition remains satisfactorily controlled.

## Recommendation 9

Leverage technology and digital offerings to maintain PwD activation

A multi-pronged, structured approach could be used to help HCPs gradually encourage PwD to start adopting technology to help them manage their condition. Such an approach could leverage multiple tools which, in some instances, are already being piloted. For example, the Hounslow and Richmond Community Healthcare NHS Trust has launched and encourages use of a new Diabetes Tracker App, which is free and allows PwD to log meals and medication, plot glucose levels against lifestyle variables, set reminders and track trends.[102] There are also online health and wellbeing platforms, such as Puffell, which is currently being tested in the Wirral CCG and facilitates peer-to-peer support and goal-setting.[103] HCPs in the Wirral CCG are given information packs to help them describe and encourage use of the website and, they can also hand these out to patients.[104] More T2D education apps and websites could also be designed to help PwD learn more about understanding and managing their condition, while online forums or Tweet chats could act as easy refreshers and ways for peers to connect.[105] For example, diabetes specialist nurses who already run T2D structured group education courses could hold hour-long weekly Tweet chats for their 'graduates'. This would allow people to consolidate friendships created with peers as well as their learning all in an interactive and easy manner. T2D education course content could also be adapted for recordings and put online as podcasts for people to listen to in their own time. Additionally, for older generations who may be less comfortable with digital tools, these could be played on a radio frequency communicated by their doctor, nurse or pharmacist.

All the above recommendations could be initiated as pilot projects, which would allow assessment of outcomes and capture of the learnings. Involvement from relevant stakeholders including government stakeholders, payers and healthcare administrators, including all of those in both the NHS and NICE among other organisations will be crucial for the success of such initiatives. Successful pilots could then be scaled up to a national level to fully realise the potential cost savings.

# Conclusion

The economic and societal burden of low T2D therapy adherence and persistence in the U.K. is high and rising. T2D-related complications are thought to make up 80% of T2D costs to the healthcare system[6] and it is predicted that over 7% of these complication costs, estimated to be £0.5 billion per year, are due to sub-optimal therapy adherence and persistence (see Exhibit 1).[32] With over 3.1 million PwD in the U.K. today, estimated to grow to ~4.5 million by 2025,[3] it is imperative that structured action is taken to improve T2D therapy adherence and persistence on a war footing.

In light of this, a comprehensive and coordinated set of actions has been laid out in this paper to identify and profile PwD struggling to engage with their condition, activate them, and then sustain that degree of activation. By making steps to pilot these recommendations and measure their benefits in CCGs, the NHS could make informed decisions on how and what interventions to scale up for successful reduction of significant and unnecessary costs of sub-optimal T2D therapy adherence and persistence, as well as improve health of millions of PwD.

**Additional Information:**

For further details on methodology, sources, calculations, and generation of recommendations, please refer to the separate Appendix document.

# References


1. Hex N, Bartlett C, Wright D, Taylor M, Varley D. Estimating the current and future costs of Type 1 and Type 2 diabetes in the United Kingdom, including direct health costs and indirect societal and productivity costs. Diabetic Medicine. 2012;29(7):855-862
2. Cade WT. Diabetes-Related Microvascular and Macrovascular Diseases in the Physical Therapy Setting. Physical Therapy. 2008;88(11):1322–1335
3. Diabetes UK. Facts and stats. November 2015. Available at https://www.diabetes.org.uk/Documents/Position%20statements/Diabetes%20UK%20Facts%20and%20Stats_Dec%202015.pdf. Last accessed on 29 April 2016
4. HSCIC National Diabetes Audit 2012-2013. Report 1: Care Processes and Treatment Targets. Available at http://www.hscic.gov.uk/catalogue/PUB14970/nati-diab-audi-12-13-care-proc-rep.pdf. Last accessed on 29 April 2016
5. Diabetes.co.uk. Diabetes Drugs, A-Z of diabetes drugs. Available at http://www.diabetes.co.uk/Diabetes-drugs.html#atoz. Last accessed on 29 April 2016
6. Diabetes UK. State of the Nation: Challenges for 2015 and beyond, England. Available at https://www.diabetes.org.uk/Documents/About%20Us/What%20we%20say/State%20of%20the%20nation%202014.pdf. Last accessed on 29 April 2016
7. House of Commons Committee of Public Accounts. Management of adult diabetes services in the NHS: progress review. Seventeenth Report of Session 2015-16
8. All-Party Parliamentary Group for Diabetes. Taking Control: Supporting people to self-manage their diabetes. March 2015. Available at https://jdrf.org.uk/wp-content/uploads/2015/10/APPG-Diabetes-Report-Education-Final-Report.pdf. Last accessed on 29 April 2016
9. All-Party Parliamentary Group for Diabetes. Delivering Better Diabetes Outcomes in the New NHS. 2013. Available at https://www.diabetes.org.uk/Documents/campaigning/Work%20in%20Parliament/appg-delivering-diabetes-outcomes-report-2013.pdf. Last accessed on 29 April 2016
10. Diabetes UK. Diabetes education: the big missed opportunity in diabetes care. 2015. Available at https://www.diabetes.org.uk/Upload/Get%20involved/campaigning/Taking%20Control/0630D%20Case%20for%20Diabetes%20Education%20Update%20FINAL%20for%20web.pdf. Last accessed on 29 April 2016
11. NHS. Five Year Forward View. October 2014. Available at https://www.england.nhs.uk/wp-content/uploads/2014/10/5yfv-web.pdf. Last accessed on 29 April 2016
12. NHS. Innovation into Action: Supporting delivery of the NHS Five Year Forward View. 2015. Available at https://www.england.nhs.uk/wp-content/uploads/2015/10/nhs-inovation-into-action.pdf. Last accessed on 29 April 2016
13. NHS Health Check. Available at http://www.nhs.uk/Conditions/nhs-health-check/Pages/NHS-Health-Check.aspx. Last accessed on 29 April 2016
14. NHS England. NHS Diabetes Prevention Programme (NHS DPP). Available at https://www.england.nhs.uk/ourwork/qual-clin-lead/diabetes-prevention/. Last accessed on 29 April 2016
15. Cramer JA, Roy A, Burrell A, Fairchild CJ, Fuldeore MJ, Ollendorf DA, Wong PK. Medication Compliance and Persistence: Terminology and Definitions. Value in Health. 2008;11(1):44-47
16. Cramer JA. A systematic review of adherence with medications for diabetes. Diabetes Care. 2004;27:1218–1224
17. Garcia-Perez LE, Alvarez M, Dilla T, Gil-Guillen V, Orozco-Beltran D. Adherence to Therapies in Patients with Type 2 Diabetes. Diabetes Therapy. 2013;4:175-194
18. Krass I, Schieback P, Dhippayom, T. Systematic Review or Meta-analysis Adherence to diabetes medication: a systematic review. Diabetic Medicine. 2015;32:725-737
19. IMS survey of >50 physicians, Jan 2016
20. Donnelly LA, Morris AD, Evans JMM. Adherence to insulin and its association with glycaemic control in patients with type 2 diabetes. Q JM: An International Journal of Medicine. 2007;100:345-350
21. Donnan PT, MacDonald TM, Morris AD. Adherence to prescribed oral hypoglycaemic medication in a population of patients with Type 2 diabetes: a retrospective cohort study. Diabetic Medicine 2002;19:279-284
22. Doggrell SA, Warot S. The association between the measurement of adherence to anti-diabetes medicine and the HbA1c. International Journal of Clinical Pharmacy. 2014;36:488-497
23. Krapek K, King K, Warren SS, George KG, Caputo DA, Mihelich K, Holst EM, Nichol M, Shi SG, Livengood KB, Walden S, Lubowski T. Medication adherence and associated hemoglobin A1c in type 2 diabetes. Annals of Pharmacotherapy. 2004;38(9):1357-1362
24. Stolar M. Glycemic Control and Complications in Type 2 Diabetes Mellitus. The American Journal of Medicine. 2010;123(S3):S3-S11
25. Wild H. The economic rationale for adherence in the treatment of type 2 diabetes mellitus. American Journal of Managed Care. 2012;18(S3):S43-48
26. McEwan P, Foos V, Palmer JL, Lamotte M, Lloyd A, Grant D. Validation of the IMS CORE Diabetes Model. Value in Health. 2014;17:714-724
27. Palmer AJ, Roze S, Valentine WJ, Minshall ME, Foos V, Lurati FM, Lammert M, Spinas GA. The CORE Diabetes Model: Projecting Long-term Clinical Outcomes, Costs and Cost-effectiveness of Interventions in Diabetes Mellitus (Types 1 and 2) to Support Clinical and Reimbursement Decision-making. Current Medical Research and opinion. 2004;20(S1):S5-S26
28. Dawoud D, Fenu E, Wonderling D, O'Mahony R, Pursey N, Cobb J, Amiel SA, Higgins B. Basal insulin regimens: systematic review, network meta-analysis, and cost-utility analysis for the National Institute for Health and Care Excellence (NICE) Clinical Guideline on type 1 diabetes mellitus in adults. Value Health 2015;18(7):A339
29. Amiel S. Type 1 diabetes in adults: new recommendations support coordinated care, 2016. Available at https://www.guidelinesinpractice.co.uk/type1-diabetes-in-adults-new-recommendations-support-coordinated-care. Last accessed on 29 April 2016
30. Diabetes.co.uk. Guide to HbA1c. Available at http://www.diabetes.co.uk/what-is-hba1c.html. Last accessed on 29 April 2016
31. WHO. Use of Glycated Haemoglobin (HbA1c) in the Diagnosis of Diabetes Mellitus. 2011. Available at http://www.who.int/diabetes/publications/report-hba1c_2011.pdf?ua=1. Last accessed on 29 April 2016
32. IMS CORE Diabetes Model
33. The King's Fund. The NHS budget and how it has changed. 2016. Available at http://www.kingsfund.org.uk/projects/nhs-in-a-nutshell/nhs-budget. Last accessed on 29 April 2016

34. IMS. Total market diabetes sales (Class A10), UK. Proprietary data 2015
35. Fowler MJ. Microvascular and Macrovascular Complications of Diabetes. Clinical Diabetes. 2008;26(2):77-82
36. Nutting PA, Miller WL, Crabtree BF, Jaen CR, Stewart EE, Strange KC. Initial lessons from the first national demonstration project on practice transformation to a patient-centered medical home. Ann Fam Med. 2009;7(3):254-260
37. Remmers C, Hibbard J, Mosen DM, Wagenfield M, Hoye RE, Jones C. Is patient activation associated with future health outcomes and healthcare utilization among patients with diabetes? The Journal of Ambulatory Care Management. 2009;32(4):320-327
38. Hibbard JH, Greene J, Overton V. Patients with lower activation associated with higher costs; delivery systems should know their patients' 'scores'. Health Affairs. 2013;32(2):216-222
39. Begum N, Donald M, Ozolins IZ, Dower J. Hospital admissions, emergency department utilisation and patient activation for self-management among people with diabetes. Diabetes Research and Clinical Practice. 2011;93(2):260-267
40. Griffith LS, Field BJ, Lustman PJ. Life stress and social support in diabetes: association with glycemic control. The International Journal of Psychiatry in Medicine. 1990;20:365-372
41. Brownlee-Duffeck M, Peterson L, Simonds JF, Goldstein D, Kilo C, Hoette S. The role of health beliefs in the regimen adherence and metabolic control of adolescents and adults with diabetes mellitus. Journal of Consulting and Clinical Psychology. 1987;55(2):139-144
42. Wallace AS, Seligman HK, Davis TC, Schillinger D, Arnold CL, Bryant-Shilliday B, Freburger JK, DeWalt DA. Literacy-appropriate educational materials and brief counseling improve diabetes self-management. Patient Education and Counseling. 2009;75(3):328-333
43. Bos-Touwen I, Schuurmans M, Monninkhof EM, Korpershoek Y, Spruit-Bentvelzen L, Ertugrul-van der Graaf I, de Wit N,Trappenburg J. Patient and disease characteristics associated with activation for self-management in patients with diabetes, chronic obstructive pulmonary disease, chronic heart failure and chronic renal disease: a cross-sectional survey study. PLoS One. 2015;10(5):e0126400
44. Chernew ME, Shah M, Wegh A, Rosenberg S, Juster IA, Rosen AB, Sokol MC, Yu-Isenberg K, Fendrick AM. Impact of decreasing copayments on medication adherence within a disease management environment. Health Affairs (Millwood). 2008;27(1):103-112
45. Delamater AM, Jacobson AM, Anderson BJ, Cox D, Fisher L, Lustman P, Rubin R, Wysocki T. Psychosocial therapies in diabetes: report of the Psychosocial Therapies Working Group. Diabetes Care. 2001;24:1286-1292
46. Glasgow RE, Toobert DJ. Social environment and regimen adherence among type II diabetic patients. Diabetes Care. 1988;11:377-386
47. Boston University School of Public Health. The Health Belief Model. Available at http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/SB721-Models/SB721-Models2.html. Last accessed on 29 April 2016
48. Farmer A, Kinmonth AL, Sutton S. Measuring beliefs about taking hypoglycaemic medication among people with Type 2 diabetes. Diabetic Medicine. 2006;23(3):265-270
49. Institute of Medicine. Health Literacy: A Prescription to End Confusion. 2004. Available at http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2004/Health-Literacy-A-Prescription-to-End-Confusion/healthliteracyfinal.pdf. Last accessed on 29 April 2016
50. Zeber JE, Manias E, Williams AF, Hutchins D, Udezi WA, Roberts CS, Peterson AM. ISPOR Medication Adherence Good Research Practices Working Group. A systematic literature review of psychosocial and behavioral factors associated with initial medication adherence: a report of the ISPOR Medication Adherence & Persistence Special Interest Group. Value Health. 2013;16(5):891-900
51. Woodard LD, Landrum CR, Amspoker AB, Ramsey D, Naik AD. Interaction between functional health literacy, patient activation, and glycemic control. Journal of Patient Preference and Adherence. 2014;8:1019-1024
52. Aung E, Donald M, Williams GM, Coll JR, Doi SAR. Influence of patient-assessed quality of chronic illness care and patient activation on health-related quality of life. International Journal for Quality in Health Care. 2016; DOI: http://dx.doi.org/10.1093/intqhc/mzw023. [Epub ahead of print]
53. Kato A, Fujimaki Y, Fujimori S, Isogawa A, Onishi Y, Suzuki R, Yamauchi T, Ueki K, Kadowaki T,Hashimoto H. Association between self-stigma and self-carebehaviors in patients with type 2 diabetes: a cross-sectional study. BMJ Open Diabetes Research and Care. 2016;4(1):e000156
54. Gellad WF, Grenard J, McGlynn EA. A review of barriers to medication adherence: a framework for driving policy options. No. TR-765-MVC. Rand Corporation. Santa Monica, CA. 2009. Available at http://www.rand.org/pubs/technical_reports/TR765.html. Last accessed on 29 April 2016
55. Goldman DP, Joyce GF, Zheng Y. Prescription drug cost sharing: associations with medication and medical utilization and spending and health. JAMA. 2007;298(1):61-69
56. IMS research and analysis
57. Hibbard JH, Gilburt H. Supporting people to manage their health, An introduction to patient activation. Available at: http://www.kingsfund.org.uk/sites/files/kf/field/field_publication_file/supporting-people-manage-health-patient-activation-may14.pdf. Last accessed on 29 April 2016
58. BBC News. NHS to get £4bn in drive for 'paperless' health service. February 2016. Available at http://www.bbc.co.uk/news/health-35514382. Last accessed on 29 April 2016
59. National Information Board. Personalised Health and Care 2020: Using Data and Technology to Transform Outcomes for Patients and Citizens A Framework for Action. November 2014.
60. Oxford University Hospitals NHS Trust. Electronic Patient Record (EPR) Benefits realisation case study. Available at http://www.ouh.nhs.uk/patient-guide/documents/epr-case-study.pdf. Last accessed on 29 April 2016
61. NHS Southwark Clinical Commissioning Group. Joining up patient care in Southwark and Lambeth. February 2016. Available at http://www.southwarkccg.nhs.uk/news-and-publications/news/Pages/Sharing-electronic-patient-records-in-Southwark-and-Lambeth.aspx. Last accessed on 29 April 2016
62. Nuffield Trust. Uses of predictive risk adjustment in the NHS. Available at http://www.nuffieldtrust.org.uk/our-work/projects/risk-adjustment-nhs. Last accessed on 29 April 2016
63. NHS England. Health service embracing innovation as NHS England announces major trials to improve patient care. Available at https://www.england.nhs.uk/2016/01/embracing-innovation/. Last accessed on 29 April 2016
64. Insigna Health. Fact: The PAM® Survey is a predictive powerhouse. Available at http://www.insigniahealth.com/products/pam-survey. Last accessed on 29 April 2016
65. University of Leicester, The Health Foundation, NHS England. Independent evaluation of the feasibility of using the Patient Activation Measure in the NHS in England. 2015. Available at https://www.england.nhs.uk/wp-content/uploads/2015/11/pam-evaluation.pdf. Last accessed on 29 April 2016

66. Steinsbekk A, Rygg LO, Lisulo M, Rise MB, Fretheim A. Group based diabetes self-management education compared to routine treatment for people with Type 2 diabetes mellitus. A systematic review with meta-analysis. BMC Health Services Research. 2012;12:213

67. Deakin T. The diabetes pandemic: is structured education the solution or an unnecessary expense? Practical Diabetes. 2011;28(8):1-14

68. Davies MJ, Heller S, Skinner TC, Campbell MJ, Carey ME, Cradock S, Dallosso HM, Daly H, Doherty Y, Eaton S, Fox C, Oliver L, Rantell K, Rayman G, Khunti K; Diabetes Education and Self Management for Ongoing and Newly Diagnosed Collaborative. Effectiveness of the diabetes education and self management for ongoing and newly diagnosed (DESMOND) programme for people with newly diagnosed Type 2 diabetes: cluster randomised controlled trial. British Medical Journal. 2008;336:491-495

69. NHS Employers. Quality and outcomes framework. Available at http://www.nhsemployers.org/your-workforce/primary-care-contacts/general-medical-services/quality-and-outcomes-framework. Last accessed on 29 April 2016

70. NICE. Diabetes in adults, NICE quality standard (QS6), Quality statement 1: Structured education, 2011 (last updated August 2015). Available at https://www.nice.org.uk/guidance/qs6/chapter/quality-statement-1-structured-education. Last accessed on 29 April 201

71. BMA, NHS Employers, NHS England. 2015/16 General Medical Services (GMS) contract Quality and Outcomes Framework (QOF): Guidance for GMS contract 2015/16. March 2015. Available at http://www.nhsemployers.org/~/media/Employers/Documents/Primary%20care%20contracts/QOF/2015%20-%2016/2015%2016%20QOF%20guidance%20for%20stakeholders.pd. Last accessed on 29 April 2016

72. Yeaw J, Benner JS, Walt JG, Sian S, Smith DB. Comparing adherence and persistence across 6 chronic medication classes. Journal of Managed Care Pharmacy. 2009;15(9):728-740

73. Winkley K, Evwierhoma C, Amiel SA, Lempp HK, Ismail K, Forbes A. Patient explanations for non-attendance at structured diabetes education sessions for newly diagnosed Type 2 diabetes: a qualitative study. Diabetic Medicine. 2015;32(1):120-128

74. Royal College of General Practitioners Online Curriculum. Available at http://www.rcgp.org.uk/training-exams/gp-curriculum-overview/online-curriculum.aspx. Last accessed on 29 April 2016

75. Lally P, Chipperfield A, Wardle J. Healthy habits: Efficacy of simple advice on weight control based on a habit-formation model. International Journal of Obesity. 2008;32(4):700-707

76. McGowan L, Cooke LJ, Croker H, Wardle J, Gardner B. Habit-formation as a novel theoretical framework for dietary change in pre-schoolers. Psychology & Health. 2012;27(Suppl1):89

77. Lally P, Gardner B. Promoting habit formation. Health Psychology Review. 2013;7:S137-S158

78. Lally P, van Jaarsveld CHM, Potts HWW, Wardle J. How are habits formed: modelling habit formation in the real world. European Journal of Social Psychology. 2010;40(6):998–1009

79. Malloy-Weir LJ, Charles C, Gafni A, Entwistle VA. Empirical relationships between health literacy and treatment decision making: A scoping review of the literature. Patient Education and Counseling 2015;98(3):296-309

80. Elwyn G, Dehlendorf C, Epstein RM, Marrin K, White J, Frosch DL. Shared Decision Making and Motivational Interviewing: Achieving Patient-Centered Care Across the Spectrum of Health Care Problems. Annals of Family Medicine. 2014;12(3):270-275

81. Negarandeh R, Mahmoodi H, Noktehdan H, Heshmat R, Shakibazadeh E. Teach back and pictorial image educational strategies on knowledge about diabetes and medication/dietary adherence among low health literate patients with type 2 diabetes. Primary Care Diabetes. 2013;7(2):111-118

82. Shah M, Norwood CA, Farias S, Ibrahim S, Chong PH, Fogelfeld L. Diabetes transitional care from inpatient to outpatient setting: pharmacist discharge counseling. Journal of Pharmacy Practice. 2013;26(2):120-124

83. Royal College of General Practitioners: Courses and events. Available at http://www.rcgp.org.uk/learning/courses-and-events.aspx. Last accessed on 29 April 2016

84. University of Leeds, Institute of Psychological Sciences, Faculty of Medicine and Health. HEALTH BEHAVIOUR CHANGE: An evidence-based approach, A two-day course for health and social care professionals. Available at http://www.psyc.leeds.ac.uk/10/cpd/healthbehav/leaflet.pdf. Last accessed on 29 April 2016

85. IMS Expert Interviews with practising physicians, December 2015

86. Avery L, Flynn D, van Wersch A, Sniehotta FF, Trenell MI. Changing physical activity behavior in type 2 diabetes: a systematic review and meta-analysis of behavioral interventions. Diabetes Care. 2012;35(12):2681-2689

87. Conley MP, Chim C, Magee CE, Sullivan DJ. A review of advances in collaborative pharmacy practice to improve adherence to standards of care in diabetes management. Current Diabetes Reports. 2014;14(3):470

88. Zullig LL, Gellad WF, Moaddeb J, Crowley MJ, Shrank W, Granger BB, Granger CB, Trygstad T, Liu LZ, Bosworth HB. Improving diabetes medication adherence: successful, scalable interventions. Patient Preference and Adherence. 2015;9:139–149

89. Obreli-Neto PR, Guidoni CM, de Oliveira Baldoni A, Pilger D, Cruciol-Souza JM, Gaeti-Franco WP, Cuman RK. Effect of a 36-month pharmaceutical care program on pharmacotherapy adherence in elderly diabetic and hypertensive patients. International Journal of Clinical Pharmacy. 2011;33(4):642-649

90. Avery AJ, Rodgers S, Cantrill JA, Armstrong S, Boyd M, Cresswell K, Eden M, Elliott R, Franklin M, Hippisley-Cox J, Howard R, Kendrick D, Morris CJ, Murray SA, Prescitt RJ, Putman K, Swanwick G, Tuersley L, Turner T, Vinogradova Y, Sheikh A. PINCER trial: a cluster randomised trial comparing the effectiveness and cost-effectiveness of a pharmacist-led IT based intervention with simple feedback in reducing rates of clinically important errors in medicines management in general practices, A report for the Department of Health Patient Safety Research Portfolio, 2010. Available at http://www.birmingham.ac.uk/Documents/college-mds/haps/projects/cfhep/psrp/finalreports/PS024PINCERFinalReportOctober2010.pdf. Last accessed on 29 April 2016

91. Avery T, Barber N, Ghaleb M, Franklin BD, Armstrong S, Crowe S, Dhillon S, Freyer A, Howard R, Pezzolesi C, Serumaga B, Swanwick G, Talabi O. Investigating the prevalence and causes of prescribing errors in general practice: The PRACtICe Study, A report for the GMC, May 2012. Available at http://www.gmc-uk.org/Investigating__the__prevalence__and__causes__of__prescribing__errors__in__general__practice____The__PRACtICe__study__Reoprt__May__2012__48605085.pdf. Last accessed on 29 April 2016

92. NHS England. Supporting Sustainable General Practice, Innovation in Primary Care – Examples and Case Studies for General Practice. 2015. Available at https://www.england.nhs.uk/south/wp-content/uploads/sites/6/2015/12/examples-innovation-gp.pdf. Last accessed on 29 April 2016

93. Royal Pharmaceutical Society England. Pharmacists and GP surgeries. September 2015. Available at http://www.rpharms.com/policy-pdfs/pharmacists-and-gp-surgeries.pdf. Last accessed on 29 April 2016

94. RCGP, BMA, NHS. Building the Workforce – the New Deal for General Practice, 10 point plan. 2015. Available at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/01/building-the-workforce-new-deal-gp.pdf. Last accessed on 29 April 2016

95. RCGP, BMA, NHS. Clinical Pharmacists in General Practice Pilot. 2015. Available at https://www.england.nhs.uk/commissioning/wp-content/uploads/sites/12/2015/07/clinical-pharmacists-gp-pilot.pdf. Last accessed on 29 April 2016

96. Horne R, Weinman J, Hankins M. The Beliefs about Medicines Questionnaire: The development and evaluation of a new method for assessing the cognitive representation of medication. Psychology and Health. 1999;14(1):1-24

97. Vervloet M, van Dijk L, Santen-Reestman J, van Vlijmen B, van Wingerden P, Bouvy ML, de Bakker DH. SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored. International Journal of Medical Informatics. 2012;81(9):594-604

98. Odegard PS, Christensen DB. MAP study: RCT of a medication adherence program for patients with type 2 diabetes. Journal of the American Pharmacists Association. 2012;52(6):753-762

99. NHS London Strategic Clinical Networks. Improving the management of diabetes care: A toolkit for London clinical commissioning groups. 2015. Available at http://www.londonscn.nhs.uk/publication/1269/. Last accessed on 29 April 2016

100. NHS. Year of Care, The process. Available at http://www.yearofcare.co.uk/process. Last accessed on 29 April 2016

101. NHS. Long Term Conditions Year of Care Commissioning Programme: Delivering quality and better outcomes for patients. 2014. Available at http://www.nhsiq.nhs.uk/media/2603762/ltc_year_of_care_final_oct_14.pdf. Last accessed on 29 April 2016

102. Hounslow and Richmond NHS Community Centre. Trust launches innovative new Diabetes App for local people. Available at http://www.hrch.nhs.uk/news/press-releases/launching-our-new-diabetes-mobile-app/. Last accessed on 29 April 2016

103. Wirral HCC. The launch of Puffell. 2013. Available at http://www.wirralhcc.org.uk/news/news/2013/05/the-launch-of-puffell.aspx#. Last accessed on 1 April 2016

104. NHS. Supporting Puffell. Available at http://www.wuth.nhs.uk/patients-and-visitors/your-health/supporting-puffellcom/. Last accessed on 1 April 2016

105. Our Diabetes. Explaining Tweetchats. Available at http://www.our-diabetes.org.uk/tweetchats/explaining-tweetchats/. Last accessed on 29 April 2016

106. IMS Institute for Healthcare Informatics. Avoidable Costs in US Healthcare: The $200 Billion Opportunity from Using Medicines More Responsibly. 2013

# Authors

**Murray Aitken**
**Executive Director, IMS Institute for Healthcare Informatics**

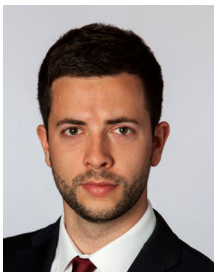
Murray Aitken is Executive Director, IMS Institute for Healthcare Informatics, which provides policy setters and decision makers in the global health sector with objective insights into healthcare dynamics. He assumed this role in January 2011. Murray previously was Senior Vice President, Healthcare Insight, leading IMS Health's thought leadership initiatives worldwide. Before that, he served as Senior Vice President, Corporate Strategy, from 2004 to 2007. Murray joined IMS Health in 2001 with responsibility for developing the company's consulting and services businesses. Prior to IMS Health, Murray had a 14-year career with McKinsey & Company, where he was a leader in the Pharmaceutical and Medical Products practice from 1997 to 2001. Murray writes and speaks regularly on the challenges facing the healthcare industry. He is editor of Health IQ, a publication focused on the value of information in advancing evidence-based healthcare, and also serves on the editorial advisory board of Pharmaceutical Executive. Murray holds a Master of Commerce degree from the University of Auckland in New Zealand, and received an M.B.A. degree with distinction from Harvard University.

**Dr Srikanth Rajagopal**
**Senior Principal and Global Client Partner, IMS Consulting Group, London**

Dr Srikanth Rajagopal is a Senior Principal and Global Client Partner at IMS Consulting Group, based in London. His areas of interest and expertise include health policy, portfolio strategy, due diligence, market access, new business models and emerging markets. Prior to joining IMS Consulting Group, Srikanth headed the Asia-Pacific Life Sciences Practice of Strategic Decisions Group, a strategy consulting boutique focused on high-risk, high-return industries and was based in Singapore. Srikanth holds an MBA from the Indian Institute of Management at Ahmedabad, India and an MBBS from the University of Mumbai, India.

**Gaelle Marinoni, MSc, PhD**
**Senior Consultant, IMS Consulting Group, London**

Gaelle Marinoni is a Senior Consultant at IMS Consulting Group, a strategy and management consultancy focused solely on the healthcare industry. She assumed this role in May 2015. Gaelle previously was manager at IHS Lifesciences, leading the business' syndicated research practice between 2010 and 2015. Before that, she served as a market access consultant for Brandtectonics Access and as a healthcare analyst at Global Insight. Gaelle has authored multiple reports on pharmaceutical pricing and reimbursement and market access strategies as well as publications in peer-reviewed journals. Gaelle holds a PhD in Microbiology from the University of Western Ontario in Canada as well as a MSc in Microbiology and a Masters in Genetics from the University Denis Diderot in France.



**Daniel Houslay, PhD**
**Associate Consultant, IMS Consulting Group, London**

Daniel Houslay is an Associate Consultant at IMS Consulting Group, a strategy and management consultancy focused solely on the healthcare industry, which he joined in 2015. Prior to this, Daniel obtained his PhD in Molecular Biology at the University of Cambridge where he was also a member of Cambridge Consulting Network. He has authored multiple publications in peer-reviewed scientific journals and holds a Bachelor's degree in Pharmacology from the University of Edinburgh.

# About the Institute

The IMS Institute for Healthcare Informatics leverages collaborative relationships in the public and private sectors to strengthen the vital role of information in advancing healthcare globally. Its mission is to provide key policy setters and decision makers in the global health sector with unique and transformational insights into healthcare dynamics derived from granular analysis of information.

Fulfilling an essential need within healthcare, the Institute delivers objective, relevant insights and research that accelerate understanding and innovation critical to sound decision making and improved patient care. With access to IMS Health's extensive global data assets and analytics, the Institute works in tandem with a broad set of healthcare stakeholders, including government agencies, academic institutions, the life sciences industry and payers, to drive a research agenda dedicated to addressing today's healthcare challenges.

By collaborating on research of common interest, it builds on a long-standing and extensive tradition of using IMS Health information and expertise to support the advancement of evidence-based healthcare around the world.

## Research Agenda

The research agenda for the Institute centers on five areas considered vital to the advancement of healthcare globally:

The effective use of information by healthcare stakeholders globally to improve health outcomes, reduce costs and increase access to available treatments.

Optimizing the performance of medical care through better understanding of disease causes, treatment consequences and measures to improve quality and cost of healthcare delivered to patients.

Understanding the future global role for biopharmaceuticals, the dynamics that shape the market and implications for manufacturers, public and private payers, providers, patients, pharmacists and distributors.

Researching the role of innovation in health system products, processes and delivery systems, and the business and policy systems that drive innovation.

Informing and advancing the healthcare agendas in developing nations through information and analysis.

## Guiding Principles

The Institute operates from a set of Guiding Principles:

The advancement of healthcare globally is a vital, continuous process.

Timely, high-quality and relevant information is critical to sound healthcare decision making.

Insights gained from information and analysis should be made widely available to healthcare stakeholders.

Effective use of information is often complex, requiring unique knowledge and expertise.

The ongoing innovation and reform in all aspects of healthcare require a dynamic approach to understanding the entire healthcare system.

Personal health information is confidential and patient privacy must be protected.

The private sector has a valuable role to play in collaborating with the public sector related to the use of healthcare data.

IMS INSTITUTE
FOR
HEALTHCARE INFORMATICS

**IMS Institute for Healthcare Informatics**
100 IMS Drive, Parsippany, NJ 07054, USA
info@theimsinstitute.org
www.theimsinstitute.org

We invite you to download
IMS Institute reports in iTunes