

REVIEW ARTICLE

Identification of barriers to insulin therapy and approaches to overcoming them

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Poor glycaemic control in type 2 diabetes (T2D) is a global problem despite the availability of numerous glucose-lowering therapies and clear guidelines for T2D management. Tackling clinical or therapeutic inertia, where the person with diabetes and/or their healthcare providers do not intensify treatment regimens despite this being appropriate, is key to improving patients' long-term outcomes. This gap between best practice and current level of care is most pronounced when considering insulin regimens, with studies showing that insulin initiation/intensification is frequently and inappropriately delayed for several years. Patient- and physician-related factors both contribute to this resistance at the stages of insulin initiation, titration and intensification, impeding achievement of optimal glycaemic control. The present review evaluates the evidence and reasons for this delay, together with available methods for facilitation of insulin initiation or intensification.

KEYWORDS

insulin therapy, type 2 diabetes

1 | INTRODUCTION

The benefits of timely glycaemic control for reducing the risk of micro- and macrovascular complications are well established,^{1–4} yet many people with type 2 diabetes (T2D) remain in poor glycaemic control.⁵ Diabetes care has improved in the USA,⁶ Europe^{7–9} and elsewhere¹⁰ in recent decades, as reflected in the increased proportion of people with diabetes meeting national glycaemic targets; however, there remains a substantial number of people with T2D who have inadequate glycaemic control. In the UK, for example, a third of people with T2D do not achieve glycated haemoglobin (HbA1c) levels $\leq 7.5\%$ (59 mmol/mol).¹¹ This is despite the latest guidelines recommending intensification of current diabetes treatment if a person's individual HbA1c target is not achieved within 3 months,¹² or within 3 to 6 months, after initiation.¹³ Delayed treatment intensification in uncontrolled patients can increase the risk of diabetes-related complications in later life. For example, the 10-year follow-up of the UK Prospective Diabetes Study showed that intensive glucose control (sulphonylurea or insulin or, if obese, metformin) from diagnosis was associated with significantly decreased risks of myocardial infarction,

death from any cause and microvascular disease.³ In addition, a retrospective cohort study revealed that a 1-year delay in treatment intensification in patients with poor glycaemic control significantly increased the risk of myocardial infarction (67%, hazard ratio confidence interval [HR CI 1.39; 2.01], heart failure (64% [HR CI 1.40; 1.91]), stroke (51% [HR CI 1.25; 1.83]) and a composite endpoint of cardiovascular events (62% [HR CI 1.46; 1.80]).¹⁴ This "dysglycaemic legacy" can therefore have a profound effect on a patient's life and it is crucial that this is addressed.

Recent studies show that people often remain above target for several years before treatment intensification.⁵ This is true of every step in the treatment pathway, but clinical or therapeutic inertia appears to be more pronounced when considering addition of insulin, particularly in insulin-naïve people.⁵ Reasons for this can be related to the healthcare professional (HCP) and/or the person with diabetes, and differ depending on which stage of their treatment strategy a person is at. Poor glycaemic control can be partly attributed to delayed initiation of insulin (initiation inertia), lack of dose adjustment (titration inertia) and delayed intensification (intensification inertia), all of which constitute therapeutic inertia.¹⁵ The evidence and

reasons for inertia at these three steps are discussed in further detail below, together with the methods used to tackle barriers to insulin optimization (Figure 1 and Table 1).^{16–43}

2 | INERTIA WITH INITIATION OF INSULIN TREATMENT

2.1 | Evidence of initiation inertia

There are a large number of studies that have found evidence of initiation inertia, as reviewed by Khunti et al^{15,44} and Khunti and Millar-Jones.⁵ For example, findings from the European INSTIGATE study showed that the mean HbA1c level upon insulin initiation was 9.2%.⁴⁵ In a UK cohort study in insulin-naïve people with T2D receiving oral antidiabetic drugs (OADs) who did not meet glycaemic targets, only 25% initiated basal insulin within ~2 years and 50% within ~5 years.⁴⁶ Another UK study in 14 824 people with T2D (on ≥ 2 OADs) found that the median time from initiating the final OAD to beginning insulin treatment was 7.7 years, despite a mean HbA1c $>8\%$ (64 mmol/mol).⁴⁷ Notably, only 847 (26.9%) of the 3153 participants with poor glycaemic control following initiation of their last oral agent were prescribed insulin during the study. More recently, a retrospective cohort study in $>80 000$ people in the UK revealed that the median time for an OAD-treated participant between becoming above target until insulin initiation ranged from 6.0 to 7.1 years.⁴⁴ The evidence therefore suggests that insulin initiation is inappropriately delayed for several years. The majority of studies on clinical or therapeutic inertia in T2D have been conducted in the USA, the UK and Canada; however, there are a small number of multinational

studies, such as the Study of Once Daily Levemir (SOLVE)⁴⁸ and Time2DoMore.⁴⁹ Findings from the SOLVE study, involving 17 374 people globally, confirmed that initiation inertia is a global problem, the extent of which varies between countries. For example, the UK cohort of SOLVE had a higher baseline HbA1c at time of insulin initiation, compared with the global population of SOLVE (9.8% vs 8.9%, respectively), despite having a shorter duration of disease.^{48,50} In addition, the proportion of people with HbA1c $>9\%$ at time of insulin initiation varied from 23% (Poland) to 64% (UK and Turkey), suggesting the level of inertia varies between countries.⁴⁸

2.2 | Reasons for initiation inertia

The reasons that people with diabetes and HCPs often resist or postpone insulin initiation are complex and frequently overlap. For example, both groups often have concerns regarding hypoglycaemia, weight gain and adherence.^{51,52} A global survey of 1250 HCPs found that 75.5% would treat more aggressively were it not for the risk of hypoglycaemia with insulin,⁵³ while “problematic hypoglycaemia” was one of the most frequent patient-reported reasons for avoiding insulin therapy in a survey of 708 insulin-naïve people with T2D.⁵⁴ Similarly, HCPs and people with diabetes worry that insulin regimens will be too burdensome to adhere to,⁵⁴ with 54.5% of HCPs ($n = 1250$) and 27.6% of people with diabetes ($n = 1530$) citing “taking insulin at prescribed time or with meals every day” as difficult.⁵³ Weight gain is another shared concern, and one that does not diminish as patients become more insulin-experienced.⁵⁵ When considering insulin therapy, these issues can manifest as a negative conversation in which HCPs delay insulin initiation while their patient has one last attempt to improve their lifestyle.⁵⁴ Consequently, people with diabetes may perceive insulin therapy as an indication of failure, or as a punishment for their unhealthy behaviours, rather than a solution to obtaining glycaemic control.

The most problematic of patient-related barriers to insulin initiation are largely covered above, but other barriers may be psychological, including fear of injections and/or fear of self-measuring blood glucose,^{56,57} and the misconception that quality of life will worsen considerably.⁵⁵ Concerns may vary from person to person, and may be more severe in a person with depression. For example, a person with diabetes is almost twice as likely to be diagnosed with depression as someone without diabetes and, unsurprisingly, these insulin-related issues are more overwhelming to a patient with comorbid depression.⁵⁸ Comorbid depression is a predictor of poor health outcomes in diabetes,⁵⁹ yet depression only was not associated with postponement of insulin initiation in two longitudinal studies.^{59,60} Nevertheless, individuals with both elevated levels of depression and anxiety were less likely to start insulin therapy.⁶⁰ The patients in this particular group might have experienced insulin-related anxieties, which could explain the apparent disparity between these findings, but replication studies in this area are needed to test this hypothesis. In other cases, HCPs can overestimate patient concerns, particularly fear of injection, and further contribute to this barrier.⁶¹ In terms of barriers solely relevant to the HCP, a lack of experience in initiating insulin – and of the time to do so – often impact treatment decisions,

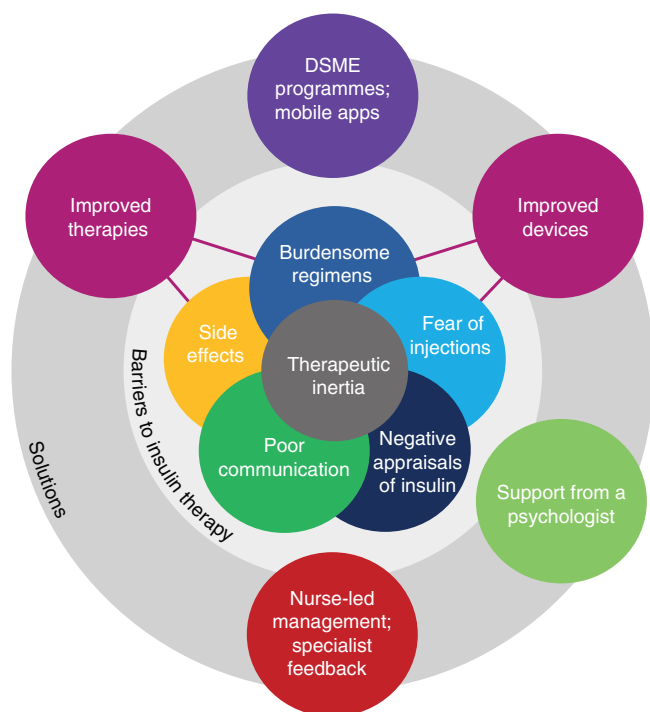


FIGURE 1 Barriers and solutions to therapeutic inertia. Floating spheres can be considered as a general solution to all named barriers

TABLE 1 Barriers and solutions to clinical inertia at the insulin initiation, titration and intensification stages of diabetes management

Barrier	Level	Stage of inertia	Potential solutions	Examples
Fear of hypoglycaemia	Patient	Any	DSME	Gottfredson et al ¹⁶ DAFNE-HART ^{17,18} A study during Ramadan ¹⁹
			Mobile app-based interventions	Glucool Diabetes, OnTrack Diabetes, Dbees, Track3 Diabetes Planner ²⁰
	Physician/System	Any	Nurse-led management	Furler et al ²¹
	Physician	Any	Specialist feedback	IPCAAD ²²
	Physician	Any	Training	MERIT ²³
Weight gain	Any	Intensification	Intensification of people on insulin with agents associated with low risk of hypoglycaemia	GLP-1RA ²⁴ , SGLT2 inhibitors, DPP-4 inhibitors ²⁵
	Patient	Any	Mobile app-based interventions	Few Touch Application ²⁶
	Patient	Any	DSME	DESMOND ²⁷
	Patient	Any	Intensification of insulin with agents associated with a low risk of weight gain	GLP-1RA ²⁴ , SGLT2 inhibitors, DPP-4 inhibitors ²⁵
Burdensome regimens	Patient	Any	Mobile app-based interventions	Use in adolescents ²⁸
	Patient/Physician	Intensification	Fixed-ratio combination therapies	Basal insulin/GLP-1RA combinations ^{29,30} , basal-bolus combinations ³¹
	Patient/Physician	Any	Simpler titration algorithms	Insight ³² AT.LANTUS ³³ DUAL VI ³⁴
	Patient	Any	DSME	DESMOND ²⁷
	Patient	Initiation	Insulin pen devices	Meece ³⁵
	Patient	Initiation	Insulin therapies with once-daily, flexible dosing and lower day-to-day variability	Sorli and Heile ³⁶
	Poor communication	System	Initiation	Nurse-led management
System		Any	Nurse-led management	Litaker et al ³⁷
Physician		Any	Liaison with/feedback from nurses and specialists	Manski-Nankervis et al ³⁸ , Zafar et al ³⁹
Severe psychological insulin resistance	Patient	Any	Improved communication to allay patient fears	Clark ⁴⁰
Anxiety and depression	Patient	Any	Support from a mental HCP	Clark ⁴⁰ ; Pouwer ⁴¹ ; DESMOND ²⁷
Lack of time and resources for GPs	System	Any	Nurse-led or nurse-assisted management	Stepping Up model ²¹ ; Manski-Nankervis et al ³⁸
			Specialist feedback	IPCAAD ⁴²
			Technology-based assistance	Boren et al ⁴³

Abbreviations: AT.LANTUS, A Trial Comparing Lantus Algorithms to Achieve Normal Blood Glucose Targets in Subjects With Uncontrolled Blood Sugar; DESMOND, Diabetes Education and Self-Management for Ongoing and Newly Diagnosed; DUAL, Dual Action of Liraglutide and IDeg in Type 2 diabetes; IPCAAD, Improving Primary Care of African Americans with Diabetes; MERIT, Meeting Educational Requirements, Improving Treatment.

with primary care physicians being more likely to delay insulin initiation vs specialists for these reasons.^{39,62–65}

While hypoglycaemia and weight gain remain important side effects of insulin therapy, the therapeutic landscape of diabetes is continually evolving and many improvements to the absorption kinetics⁶⁶ and delivery^{67,68} of insulin therapy have been observed in recent years, and will be advanced in ongoing and future studies. A detailed look at the fundamental unmet needs with insulin therapy and the advances required to progress towards an ideal agent for diabetes management are beyond the scope of the present review, but the availability and application of recent developments is discussed further in the following sections.

2.3 | Methods to tackle initiation inertia

As chronic disease management is now mainly the responsibility of primary care, research has focused on how to best equip and educate

primary care physicians. One of the most successful methods so far has been to restructure primary care such that insulin initiation is assisted, or led, by a nurse practitioner.⁶⁹ For example, a recent cluster randomized controlled trial in Australia showed that a “Stepping Up” model, which involved nurse-led insulin initiation, resulted in increased insulin initiation rates (odds ratio 8.3 [95% CI 4.5; 15.4]), greater HbA1c reductions (treatment contrast: -0.6% [95% CI -0.9 ; -0.3], -6.6 mmol/mol [95% CI -9.8 ; -3.3]) and no deterioration in emotional wellbeing.²¹ Results from other studies suggest similar success would be observed in Europe⁷⁰ and the USA.³⁷ One reason why nurse-led insulin initiation results in better outcomes compared with usual care might be that nurses are better placed to help administer and titrate insulin and to address any concerns as part of their ongoing contact with patients for similar tasks/procedures, thereby strengthening that relationship. In contrast, GPs might not see patients as often and, when they do, the patient might have several problems they wish to discuss in a single appointment, while GPs

only have a short time available to update patient records, diagnose and prioritize next actions; therefore, the above-mentioned restructuring of primary care might help divide time efficiently without sacrificing or sabotaging the patient's trust in their HCP and propagating non-compliance. There is also a wealth of evidence that education, in the form of either specialist feedback⁴² or computer-based learning/reminders,^{22,43,71,72} facilitates timely intensification by primary care physicians and, therefore, improved glycaemic control in patients. For example, a recent meta-analysis showed that information technology-based interventions were associated with statistically significant HbA1c reductions (mean treatment difference -0.33% [95% CI $-0.40; -0.26$], -3.6 mmol/mol [95% CI $-4.4; -2.8$], $P < .001$) in people with T2D.⁷³ Further education on the improvements in basal insulin therapy and their devices, such as long-acting analogues with lower day-to-day variability and lower risk of hypoglycaemia vs older alternatives, can also help reduce psychological insulin resistance.^{66,74-76} An important point to note is that education relies on effective communication to succeed – both between HCPs and between HCPs and patients.³⁸ For instance, exploring patient beliefs about insulin therapy early in the disease trajectory is key to tackling psychological insulin resistance.⁵⁷ Ideally, these discussions would begin at, or soon after, diagnosis and would explain that insulin therapy is ultimately required in the great majority of cases to control the disease and avoid complications. HCPs should be able to allay their patients' concerns regarding burdensome regimens and quality of life by describing the improvements made to insulin regimens, in terms of devices and dosing, and sharing testimonials of people who have successfully managed their T2D with insulin therapy. This should help the person with diabetes come to terms with insulin therapy before they require it, and avoid delays in initiation. The trend towards a less negative appraisal of insulin therapy by insulin-treated people with diabetes suggests patient fears can be resolved with further information,²⁰ but delays can be avoided by providing this information soon after diagnosis. Indeed, improvements, in terms of achieving a combined outcome of HbA1c $<9\%$ (75 mmol/mol), LDL cholesterol <7.2 mmol/L and systolic blood pressure <140 mm Hg, were observed when combining HCP and patient education vs physician feedback alone in one cluster randomized trial.⁷⁷ These improvements, albeit slight, were across a range of variables and might reflect a significant change in prognosis. Effective communication is also particularly crucial when addressing concerns of people with T2D and anxiety or comorbid depression; therefore, a psychologist with knowledge of diabetes should be readily available to help with severe cases of psychological insulin resistance in people with diabetes⁴⁰ as well as treating depression when required.⁴¹

3 | INERTIA WITH REGARD TO INSULIN TITRATION

3.1 | Evidence of titration inertia

Studies indicate that once treatment with basal insulin has been initiated, glycaemic control is still not achieved in the majority of

cases^{78,79} and that this is partly attributable to insufficient titration of insulin.^{33,44} A study by Blak et al.,⁷⁸ in 2012, revealed that only 17.3% of participants achieved HbA1c $<7\%$ (53 mmol/mol) after a mean follow-up of 2.9 years, while 141 (41%) participants in a study by Dale et al.,⁷⁹ in 2010, achieved the pre-2006/2007 UK Quality and Outcomes Framework target of $\leq 7.4\%$ (57 mmol/mol) after 36 months of basal insulin therapy. In addition, modest titration of basal insulin in a real-world setting has been observed in studies from Germany,⁸⁰ New Zealand⁸¹ and China.⁸² This is in contrast to data from the plethora of clinical trials^{74,75} that entail close monitoring by trial staff of motivated participants following strict titration algorithms.⁸³ In terms of insulin omission, findings from a systematic review indicated that the insulin adherence rate (the proportion of doses taken as prescribed) among people with T2D was 62% to 64%.⁸⁴ In people with T2D initiating insulin therapy, another report found that 4.5% of people had unfulfilled prescriptions and a further 26% never obtained a refill.⁸⁵

3.2 | Reasons for titration inertia

Many of the barriers that delay intensification with insulin continue to pose a problem following initiation. For instance, there is often a lack of HCP resources, assistance and education for patients regarding effective titration.⁵ Ongoing patient fear of hypoglycaemia and weight gain can result in under-titration,⁸⁶ and concerns about impact on daily life can result in insulin omission and infrequent self-measured blood glucose testing by the patient.^{5,39,55} In addition, HCPs might not adequately direct or encourage aggressive titration in patients for whom this would be beneficial, either because of a lack of resources or in response to patient concerns. It is not always clear whether the lack of titration observed in real-world studies is as a result of reluctance/inaction by the HCP or the patient, or both.⁸⁰⁻⁸² A recent systematic review of real-world factors affecting adherence to insulin therapy in people with diabetes identified predictive factors for adherence vs non-adherence. Negative predictors of adherence included being a student, needing a large number of injections, diagnosis of T2D vs type 1 diabetes, and lower HbA1c level. Positive predictors for adherence included support from a diabetes nurse specialist, switching from a traditional formulary scheme to a value-based insurance design, hypoglycaemia awareness, following a healthy diet, perceived self-efficacy, and previous experience of liaison psychiatry or cognitive behavioural therapy.⁸⁷

3.3 | Methods to tackle titration inertia

Alternative titration algorithms can simplify regimen complexity, and thereby help patients to manage their diabetes more conveniently and effectively. For example, patient-led titration using simple titration algorithms has resulted in greater HbA1c reductions vs physician-led adjustment of either OADs (-1.55% vs -1.25% , -17 vs -14 mmol/mol, $P = .005$; the INSIGHT study)³² or insulin glargine (-1.22% vs -1.08% , -13 vs -12 mmol/mol, $P < .001$; AT.LANTUS).³³ In addition to simpler titration algorithms, educational self-management programmes for people with diabetes are key to optimizing clinical outcomes for insulin-naïve and insulin-experienced

patients alike. Indeed, diabetes self-management education (DSME) is an integral aspect of the latest guidelines for management of T2D.^{12,88} A recent meta-analysis showed that mean change in HbA1c was -0.74% (-8 mmol/mol) and -0.17% (-2 mmol/mol) for intervention with DSME and control, respectively. Greater HbA1c reductions were reported with DSME when contact with the patient numbered ≥ 10 hours and/or combined group and individual sessions.⁸⁹ This suggests that DSME helps patients to manage their diabetes treatment and adopt positive behavioural changes. Other studies support this,⁹⁰ with one randomized pragmatic trial showing that structured education (Diabetes Conversation Map™) resulted in a greater proportion of patients achieving their American Association of Diabetes Educators Self-Care Behaviours™ framework (AADE7) behavioural goals at 3 months than was seen with usual care.⁹¹ Adherence, particularly in terms of aggressiveness or intensity of titration, is difficult to quantify, but these studies do show that DSME is effective at tackling one facet of titration inertia. Longer-term studies are required to establish whether these changes in patient behaviours are maintained, as there have been mixed results so far.^{27,92–94} There are several new tools to help people manage their diabetes effectively, which have an in-built dose adjustment algorithm for patients with T2D receiving basal insulin.^{95,96} Full results are yet to be published, but these devices could help a patient manage their insulin regimen safely and more effectively, and require less contact time with physicians. Furthermore, several mobile health applications for diabetes self-management are available to help a patient manage their food intake or insulin dose and aid intensification. Findings from a recent systematic review involving 12 trials and 974 participants showed that app-based interventions were associated with a clinically significant reduction in HbA1c (treatment contrast 0.48% [95% CI $0.19; 0.77$], -5 [95% CI $2; 8$]) without excess adverse events. When apps were grouped according to the presence/absence of different education modules, mobile app-based interventions were associated with significant HbA1c reductions when they included a complication module and/or a structured display, but not when they included a clinical decision-making function, suggesting that this module requires improvement, with input from both the physician and user.⁹⁷ Similarly, studies on app-based interventions for elderly people with diabetes have yielded promising but varying results, depending on the particular app used.⁹⁸ Further adjustments and evaluation are required to help realize the full potential of these novel tools, particularly with respect to insulin management, which was not the primary focus of many of these DMSE and app-based interventions.

4 | THERAPY INTENSIFICATION INERTIA

4.1 | Evidence of intensification inertia

As T2D progresses, intensification of basal insulin therapy may be required. This might be addition of a bolus insulin dose in response to prandial blood glucose excursions, or intensification with a non-insulin agent in response to problems with weight gain, hypoglycaemia or in order to tackle additional underlying pathophysiological defects of T2D.¹² There are relatively few studies that investigate

inertia with insulin intensification, but similar delays have been observed. Blak et al⁷⁸ reported that treatment intensification in 3815 patients receiving basal insulin therapy was associated with high HbA1c concentration (9.2% [77 mmol/mol] before intensification), with only 4.7% of patients intensified, despite a low proportion (17%) achieving HbA1c $< 7\%$ (53 mmol/mol). A more recent retrospective cohort study of 11 696 insulin-treated UK patients showed that less than one-third (31%) of patients who had HbA1c $\geq 7.5\%$ (≥ 59 mmol/mol) had their treatment intensified, and the median time from basal insulin initiation to treatment intensification was 3.7 years [95% CI $3.4; 4.0$]. Of all patients for whom treatment was intensified, 50% were intensified with bolus insulin; 43% were intensified with premix insulin and 7.4% were intensified with glucagon-like peptide-1 receptor agonists (GLP-1RAs).⁹⁹

4.2 | Reasons for intensification inertia

The reasons for delayed intensification can vary depending on which strategy is being considered. When discussing addition of prandial doses of insulin, concerns are often centred around the risk of hypoglycaemia and weight gain, treatment adherence and the impact of more complex or intensive regimens on the patient's quality of life.^{36,39} In addition, injection-related anxiety remains an issue for insulin-experienced patients, as demonstrated by results of a questionnaire completed by 115 insulin-treated people with type 1 diabetes or T2D. The resulting injection anxiety scores were poor (≥ 3) in 28% of patients and were associated with higher levels of general anxiety (Kendall's tau-a 0.30 [95% CI $0.19; 0.41$]; $P < .001$).¹⁰⁰ As with initiation inertia, HCPs can also have concerns that result in intensification inertia. For example, fear of adverse side effects with insulin is a concern often shared by HCPs and patients,^{5,101} and which can deter HCPs from prescribing an additional insulin injection. Continued uptitration of basal insulin may also be favoured over an additional agent because the HCP does not have adequate time available to initiate or does not believe the patient will manage a more complex regimen.⁵

4.3 | Methods to tackle intensification inertia

In addition to the improvements in insulin products discussed earlier, several newer medications for T2D provide alternatives to insulin intensification. These include drugs of the incretin class (GLP-1RAs and dipeptidyl peptidase-4 [DPP-4] inhibitors) and sodium-glucose co-transporter-2 (SGLT2) inhibitors, all of which are associated with a low rate of hypoglycaemia and either weight loss (GLP-1RAs, SGLT2 inhibitors) or weight neutrality (DPP-4 inhibitors).¹² Importantly, basal insulins and GLP-1RAs have been combined in a single pen in titratable, fixed-ratio co-formulations such as insulin degludec/liraglutide (IDegLira)^{29,30,102,103} and insulin glargine U100/lixisenatide (iGlarLixi).^{104–106} Both products are injected once daily, allowing insulin/GLP-1RA intensification without additional daily injections. One important difference is that two co-formulations of iGlarLixi were developed; Pen A, which delivers $10–40$ units (U) at a ratio of 2 U iGlar: 1 μ g lixisenatide in a single injection, and Pen B, which delivers $30–60$ U at a ratio of 3 U iGlar: 1 μ g lixisenatide.^{107,108} Both are

approved for use in Europe¹⁰⁶ but only Pen B, with a starting dose of 15 U, is approved for use in the USA.¹⁰⁵ It is important to note that there are few real-world data published on these relatively recently available therapies,^{109,110} so it is not known whether they are effective at tackling therapeutic inertia. It is sensible to assume, however, that there would be less resistance from patients and HCPs to using an insulin-containing combination therapy with a lower risk of side effects compared with complex insulin regimens, when appropriate. To take full advantage of the advances in diabetes therapy, many of the methods discussed with regard to initiation inertia – such as education of, and effective communication between, HCPs and patients – would also warrant employment at this stage.

5 | SYSTEM-LEVEL BARRIERS TO APPROPRIATE INSULIN INITIATION AND INTENSIFICATION

System-level barriers affect all stages of insulin management, and indeed healthcare in general. These barriers have been discussed briefly in earlier sections and are summarized here. As mentioned earlier, the development of new therapies and devices to meet the unmet needs of diabetes management is key to tackling barriers to initiation and intensification inertia. However, the relative expense of these developments, a system-level barrier, will also be paramount in determining their impact on clinical inertia. The adequacy, according to HCPs, of other medical resources for diabetes management has been evaluated in the two multinational Diabetes Attitudes, Wishes and Needs (DAWN) studies.^{62,111} Key findings of DAWN2, which surveyed 4785 HCPs from 17 countries, were that the majority of HCPs believed that major improvements were required in DSME (60%), specialist nurse availability (64%), psychological support (63%) and earlier diagnosis and treatment (68%).¹¹¹ Unsurprisingly, a large amount of variation was observed between countries that have different healthcare models, needs and services, but it is still possible to glean the relative merit of various system reforms. Healthcare services in general are in urgent need of reform to tackle the changing trends in population and disease burden, and these changes will undoubtedly affect diabetes management. Several possibilities, such as the restructuring of primary care, implementation of various educational platforms and support for self-care, have been discussed here but few have been incorporated into the latest guidelines for management of diabetes. Further investigations, particularly in real-world settings, are required before they can be applied on a wider scale.

6 | CONCLUSION

Therapeutic inertia in T2D is a global issue that impedes achievement of glycaemic control, particularly in patients requiring insulin therapy. Reasons for this span the patient, physician and system levels and include misconceptions surrounding insulin therapy, lack of experience in primary care with managing insulin regimens, affordability, and lack of time, resources and/or motivation to optimize insulin use.

Another major issue is poor communication, which can hinder the exchange of patient fears and potential solutions if communication is lacking, or exacerbate patient fears if communication is unhelpful, for example, when insulin initiation is implied to be a punishment for sub-optimal lifestyle management. Improvements to available guidelines and therapies for management of T2D have been made in recent years, but several strategies are required to improve education of, and communication between HCPs and patients, before these can be employed effectively. Promising results have been observed with implementation of DSME, using algorithms such that titration can be patient-driven, developing web-based titration applications, and facilitating nurse-led insulin management. Some strategies are simpler and less time-intensive than others to implement, but all focus on improving the awareness of the impact of clinical or therapeutic inertia. Further randomized controlled trials with larger samples and observational studies in a real-world setting are required to establish the relative efficacy of different models of care and their long-term success.

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Conflict of interest

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Author contributions

All authors confirm that they meet the International Committee of Medical Journal Editors uniform requirements for authorship and that they have contributed to the conception of the work, drafting and/or critically revising the article and sharing in the final responsibility for

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