SYSTEMATIC REVIEWS

Barriers that practitioners face when initiating insulin therapy in general practice settings and how they can be overcome

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Abstract

AIM
To explore primary care physicians' perspectives on possible barriers to the use of insulin.

METHODS
This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Eight electronic databases were searched (between January 1, 1994 and August 31, 2014) for relevant studies. A search for grey literature and a review of the references in the retrieved studies were also conducted. Studies that focused on healthcare providers' perspectives on possible barriers to insulin initiation with type 2 diabetic patients were included, as well as articles suggesting solutions for these barriers. Review articles and studies that only considered patients' perspectives were excluded.

RESULTS
A total of 19 studies met the inclusion criteria and were therefore included in this study: 10 of these studies used qualitative methods, 8 used quantitative methods and 1 used mixed methods. Studies included a range of different health care settings. The findings are reported under four broad categories: The perceptions of primary care physicians about the barriers to initiate insulin therapy for type 2 diabetes patients, how primary care physicians assess patients prior to initiating insulin, professional roles and possible solutions to overcome these barriers. The barriers described were many and covered doctor, patient, system and technological aspects. Interventions that focused on doctor training and support, or

IT-based decision support were few, and did not result in significant improvement.

CONCLUSION
Primary care physicians' known delay in insulin initiation is multifactorial. Published reports of attempts to find solutions for these barriers were limited in number.

Key words: Diabetes; Insulin; Initiation; Delay; Barriers; Primary care physicians

Core tip: There are several barriers to primary care physicians in initiating insulin therapy when it is required for type 2 diabetes patients. The main purpose of this systematic review is to explore these barriers in depth. Published reports of attempts to find solutions to these barriers were limited in number. Given the increasing burden of this chronic disease, and the need to optimize and standardize management, it is expected research in this area will remain intense. The research that remains patient-centered and takes a system approach can be expected to yield best results.

INTRODUCTION
Diabetes is a major world health problem. The most recent report from the International Diabetes Federation estimates that 415 million people have diabetes worldwide (8.8% of the adult population). Of these, 193 million people have undiagnosed diabetes, which allows the disease to progress untreated causing many complications. In 2015, diabetes was responsible for 11.6% of total global adult health expenditure and yet there were 5 million deaths from this disease. In addition, the number of people with diabetes is expected to increase to more than 642 million by 2040[1].

Type 2 diabetes is characterized by defects in both insulin secretion (due to a progressive decline in beta cell functioning), and insulin resistance. It is aggravated by obesity and sedentary lifestyle. Untreated hyperglycemia increases the risk of mortality and morbidity, *via* a higher risk of macro-vascular and micro-vascular complications[2-4].

With already high numbers of patients and a relatively small number of diabetes specialists worldwide, 90% of patients receive care for their diabetes from primary care physicians (PCPs)[5,6].

Several trials[7,8] have shown that improving glycemic control, *via* lifestyle modifications and the use of medications, reduces micro-vascular and possibly macro-vascular complications and mortality related to diabetes. However, over time, the progressive nature of beta cell dysfunction results in the inability of oral hypoglycemic agents to control hyperglycemia and achieve HbA1c targets[9]. This gradual loss in beta cell function would indicate that insulin therapy is almost always required at some point to treat diabetic patients[10].

Although most PCPs believe that the initiation of insulin therapy is an essential component in the management of type 2 diabetes, many still consider it to be the "last option" and indicate that their patients are reluctant to accept this therapy. In the seminal Diabetes Attitudes, Wishes, and Needs (DAWN) study, Peyrot *et al*[11] reported that approximately 50% of healthcare professionals delay insulin initiation until it is "absolutely necessary".

Similarly, the SOLVE™ (Study of Once Daily Levemir), a multicenter observational study that involved over 17374 patients with type 2 diabetes in 10 countries (Europe, Asia and North America), showed that insulin initiation is generally delayed until an average HbA1c level of approximately 9%[12]. Several other studies across many countries have confirmed that there is significant delay in the initiation of insulin therapy[13-15]. This reluctance to initiate insulin treatment may be related to patient, provider or system factors.

Reported patient-related barriers include a sense of personal failure, a negative impact on social life, injection phobia, myths and misconceptions about the drug, the permanence of the therapy, difficulties in fulfilling responsibilities at home and at work, limited insulin self-management training, inadequate provider explanation about the risks and benefits of the intervention - and concerns over weight gain and hypoglycemia[16-21]. Most of these negative attitudes and perceptions are described in the literature under the term "psychological insulin resistance". Studies in Various countries have found variable rates of such resistance amongst patients - from 5.9% to nearly 50% of patients[17-25].

System barriers to the use of insulin therapy may include a lack of resources (*e.g.*, staff and materials), a lack of continuity of care, as well as the workload and time constraints of PCPs[26].

As for the providers, part of the problem has been attributed to "therapeutic or clinical inertia; a recognition (by the PCP) of a lack of glycemic control - but a failure to act"[27-29]. These PCPs blame (perceived) patient reluctance, language barriers, their concern for patients' comorbidities and their own lack of training[26].

A few systematic reviews have been published related to patients' perspectives on the delay in insulin initiation or to psychological insulin resistance[30-33]. This study focuses on PCP's perspectives on their barriers to initiating insulin therapy in primary care/general practice. It will also explore the literature for possible solutions.

MATERIALS AND METHODS
This literature search was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-

9757 potentially records identified through database search
- PubMed: 2060 records
- Cinahl: 885 records
- Embase: 896 records
- Ovid: 1464 records
- ProQuest: 1798 records
- Psychinfo: 235 records
- Scopus: 966 records
- Cochrane: 1453 records

6 additional records identified through cross reference and grey literature searching

6683 records remained after duplicates were

6683 records were screened (titles and abstracts) → 6551 records excluded Irrelevant to the research objectives

132 full-text articles were assessed for eligibility

19 studies were included in the final analysis → 111 records excluded
- 78 only considered patients' perspective
- 32 were review articles and/or only considered patients' perspective
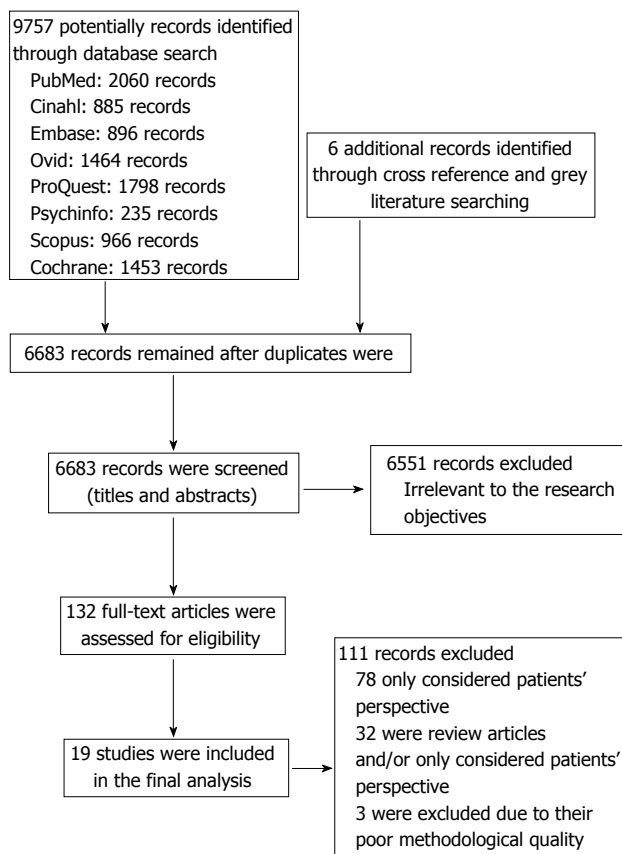- 3 were excluded due to their poor methodological quality

Figure 1 Flow diagram of the studies included in this analysis.

Analyses guidelines[34]. As this research doesn't involve experiments on humans or animals, ethical approval is not required.

A variety of scholarly databases (PubMed, EMBASE, Psychinfo, Cinahl, Ovid, Scopus, ProQuest and the Cochrane library) were searched. The search was conducted using a combination of medical subject headings and text words: Insulin, physician, general practitioner, general practice, primary care, health care, professional, provider, psychological, clinical inertia, attitude, delay, refusal, refuse, perception, postpone, worry, initiation, compliance, knowledge, fear, belief and barrier.

A search in Google and Google Scholar engines were then conducted to look for "grey" literature and the bibliographies of the retrieved articles were also reviewed to identify further relevant studies.

Studies that satisfied the following selection criteria were included: Only original articles, quantitative or qualitative methods, descriptive or analytical, written in English and published between January 1, 1994 and August 31, 2014.

This review was restricted to studies that focused on PCP's perspectives to the barriers they faced regarding the initiation of insulin for type 2 diabetic patients. Articles suggesting solutions for these barriers were also included. Review articles or studies that only explored patients' perspectives were excluded.

The screening and selection of the studies were done independently by the two authors, and the final

number of the studies used for this review was reached by consensus between them. The authors assessed the methods used in the various studies: The Critical Appraisal Skills Program checklist[35] was used for the qualitative studies, the STROBE checklist[36] was used for the observational studies, the Mixed Methods Appraisal Tool[37] was used for the mixed-methods studies and the Centre for Evidence-Based Medicine tool[38] was used for the randomized control trials.

The authors had to be in agreement for an article to be included in the systematic review. Both authors also collaborated to extract the data from each article. These are summarized in table form according to authors' name, year of publication, aim of the study, sample size, the setting, instruments used, results and conclusion (Table 1).

RESULTS

The initial search process resulted in 9757 studies. After removing any duplicates and adding articles by searching the cross-references and grey literature, this number dropped to 6683 studies. Titles and abstracts of these studies were then screened, and the two authors narrowed the results down to 132 articles for full-text assessment (78 articles were then excluded because they looked only at patients' perspectives, and a further 32 were excluded because they were review studies).

The remaining 22 articles were critically appraised by the two authors, and three more articles were excluded because of their poor overall quality. Thus, a total of 19 articles were included in the final analysis. Figure 1 is a flow diagram of this process.

Characteristics of the studies

The publication dates of the final 19 studies ranged from 2005 to 2014 and included 10 qualitative studies, 7 observational studies, 1 mixed-method studies and 1 randomised controlled trial.

One study was international and multicentre; three studies were conducted in both the United States and Malaysia; two studies were conducted in the United Kingdom and Australia; and one study was conducted in each of the following countries: Japan, Pakistan, Singapore, South Africa, Israel, Belgium, Canada and Middle Eastern Arab countries. These articles are summarized in Table 1.

The perceptions of primary care physicians

Several researchers tried to explore PCP's barriers to initiating insulin therapy using qualitative methods (*e.g.*, focus group discussions or semi-structured interviews). Hayat *et al*[39], Patel *et al*[40], Lee *et al*[41], Tan *et al*[42] and Haque *et al*[26] conceptualized that the decision to initiate insulin therapy can be influenced by three types of barriers: Physician barriers, patient barriers and system barriers.

From these studies we can say that PCP's barriers may include: A lack of knowledge, training and experience by the PCP; language barriers between PCP

Table 1 Summary of the articles included in this study

Ref.	Design	Study aims	Sample and setting	Tools and outcome measures	Results and conclusions
Hayat *et al*[39] (2010)	Qualitative	To explore barriers and myths regarding initiating insulin therapy in poorly controlled type 2 diabetic patients in primary care centres in Hyderabad District, Pakistan	6 to 20 medical officers per each focus group and 12 medical officers for semi-structured interviews Conducted in primary care centres in the Hyderabad District, Pakistan	6 focus group discussions 12 semi-structured individual interviews	Patients barriers: Mistaken beliefs about insulin; fear of needles and excessive belief in traditional healers Doctors' barriers: Skill and knowledge deficiencies, language barriers and fear of hypoglycaemia and obesity risks System's barriers: High workload, insufficient consultation time, lack of continuity of care and financial barriers
Manski-Nankervis *et al*[51] (2014)	Qualitative	To study the effect of communications and relationships between health care professionals in general practice toward the issue of insulin initiation and to clarify how multidisciplinary teams work in practice	21 GPs, practice nurses, diabetes nurse educators and specialist physicians Conducted in Melbourne, Victoria, Australia	Semi-structured interviews face-to-face or *via* the telephone	Barriers for initiating insulin aren't solely due to medical or training issues; communication and relationships among health care professionals also have a strong influence 4 themes identified from the study: Uncertain roles, unreliable competency, relationships and communication between healthcare workers and the development of trust and respect
Grant *et al*[46] (2007)	Cross-sectional	To study physicians' considerations and preference when selecting medications for patients with type 2 diabetes	886 academic generalists and specialists Conducted in the United States	Questionnaire-based survey	The major considerations for academic generalists when staring insulin are the patient's HbA1c level, adherence and motivation, health assessment and glucose level patterns Major barriers to beginning insulin for generalists are patient derived (patients' fear and preferences), while the specialists didn't specify any major barriers
Yoshioka *et al*[48] (2013)	Cross-sectional	To identify differences in the perceptions of patients and their physicians regarding insulin initiation (using data from the DAWN Japan study)	148 patients with type 2 diabetes and 68 physicians Conducted in Japan	Questionnaire-based survey	There are perceptions gaps regarding insulin initiation between patients and physicians, especially regarding its social impact Physicians tend to overestimate the barrier of the injections being painful and patients' fear and to underestimate its social impact
Peyrot *et al*[11] (2005)	Cross-sectional	To study patients' and healthcare professionals' (physicians and nurses) attitudes toward insulin therapy and its correlation with delaying insulin therapy initiation	2061 type 2 diabetic patients and 1109 providers (physicians and nurses) Conducted in 13 countries in Asia, Australia, Europe and North America	Structured interviews conducted face-to-face or over the telephone	Most healthcare professionals (50%-55%) delay insulin initiation until it is absolutely required Delay in insulin initiation is significantly less likely when providers consider that their patients are adherent to appointments and medication regimens Delay of starting oral hypoglycaemic drugs is the strongest correlation with insulin therapy initiation

Study	Design	Aim	Participants	Method	Findings
Lee et al[47] (2014)	Qualitative	To determine how healthcare professionals assess their patients when initiating insulin therapy for type 2 diabetic patients	41 health care professionals (physicians, nurses, diabetic educators and pharmacists) Conducted in Malaysia	4 focus group discussions and 10 individual interviews	Healthcare professionals' assessment of diabetic patients when considering insulin initiation are based on their perceptions rather than objective evaluation of patients' backgrounds, knowledge and abilities
Ratanawongsa et al[43] (2012)	Cross-sectional	To explore primary care physicians' perceptions about barriers of initiating insulin for patients with type 2 diabetes	83 primary care physicians Conducted in United States (Indiana, New jersey and California)	Structured interviews that contained open-ended questions	Participants reported that at least 10% of their patients would reject to start insulin 64% of the clinicians believed that their patients' reluctance was the cause of delaying insulin initiation; 43% believed it was due to their patients' poor self-management skills 97% of physicians thought that fear of the injections was the cause of their patients' resistance to starting insulin
Patel et al[40] (2012)	Qualitative	To identify healthcare professionals' perspectives on delaying insulin initiation for type 2 diabetic patients in a multi-ethnic setting	14 healthcare professionals (general practitioners, specialists and nurses) Conducted in the United Kingdom	Semi-structured, face-to-face, interviews	Barriers for initiating insulin therapy for South Asian diabetic patients could be over-accentuated by the presence of language barrier and the lack of patients' understanding about the disease and its therapy South Asian patients seem to be more likely to be negatively influenced by observations and experiences about insulin treatment within their community
Lee et al[41] (2012)	Qualitative	To explore healthcare professionals' opinions on barriers of initiating insulin therapy in Malaysian multi-ethnic patients with type 2 diabetes	38 healthcare professionals (general practitioners, family medicine specialists, medical officers, policy makers, diabetes educators and endocrinologists) Conducted in Malaysia	Focus group discussions and semi-structured interviews	Patients' barriers: Patients' fear and misconceptions about insulin, lack of knowledge and self-efficacy Healthcare professionals' barriers: Negative attitude toward insulin; lack of training, motivation and confidence System barriers: Lack of continuity of care, shortage of resources and language barriers
Lee et al[52] (2012)	Qualitative	To explore the strategies suggested by healthcare professionals to improve insulin initiation in the Malaysian dual-sector (public-private) healthcare system	38 healthcare professionals (general practitioners, family medicine specialists, medical officers, policy makers, diabetes educators and endocrinologists) Conducted in Malaysia	Focus group discussions and semi-structured interviews	Developing an integrated system for patients' referral from the private sector to the public health sector for insulin initiation services Involving nongovernmental organisations, the media and pharmaceutical industry in supporting insulin initiation Establishing multidisciplinary teams
Lakkis et al[44] (2013)	Cross-sectional	To investigate family physicians' attitudes towards insulin therapy in type 2 diabetic patients in Middle Eastern Arab countries	122 family physicians Conducted in Middle Eastern Arab countries	Online questionnaire-based survey	73.6% of family physicians chosen to delay insulin initiation until it is absolutely necessary 64% of family physicians reported hesitancy to start insulin mostly due to apparent patient reluctance

Nakar *et al*[49] (2007)	Case-control study	To study the barriers that delay a shift to insulin from the perspectives of type 2 diabetic patients and family physicians	Study group: 92 patients who needed insulin Control group: 101 patients who had begun insulin 157 family physicians Conducted in Israel	Telephone interviews with participating patients Written questionnaire obtained from the physicians	Referral to endocrinologists for initiating insulin therapy was correlated with a lack of experience and concerns about risks, mainly with elderly patients A clear perception gap regarding the insulin initiation barriers between patients and physicians Physicians exaggerate the importance of patients' physical fear of pain associated with injections and blood tests, while patient barriers seem to be related more to their concept of the illness
Furler *et al*[50] (2011)	Qualitative	To describe barriers and facilitators to insulin initiation in general practice	14 healthcare professionals (general practitioners and diabetes nurse educators) and 12 type 2 diabetic patients Conducted in Australia	Semi-structured interviews	Insulin initiation could be influenced by the way patients and healthcare professionals Interact There was a disagreement and uncertainty about the healthcare workers' role in initiating insulin
Hayes *et al*[45] (2008)	Cross-sectional	To explore primary care physicians' attitudes toward insulin initiation for type 2 diabetic patients and to determine the areas where there is a clear lack of consensus between them	505 primary care physicians Conducted in the United States	Online questionnaire-based survey	Highest consensus was attitudes related to risk and benefits of insulin therapy, positive experiences of diabetic patients on insulin and patient worries about insulin initiation Clear lack of consensus was seen in attitudes related to the metabolic effects of insulin, the necessity for insulin therapy, the duration needed for training and the fear of hypoglycaemia risk especially in elderly patients
Tan *et al*[42] (2011)	Qualitative	To explore the barriers to insulin initiation for diabetic patients managed in primary care polyclinics in Singapore	18 healthcare professionals (physicians and nurses) and 11 type 2 diabetic patients Conducted in Singapore	Focus group discussions	Patient barriers to insulin initiation were denial the need for insulin therapy, perception of social stigma, inconvenience, worries of needles pain, fear from side effects and complications Physician attitude and experience with insulin therapy were also a possible barrier
Haque *et al*[26] (2005)	Qualitative	To explore the barriers to initiating insulin therapy for type 2 diabetic patients in public-sector primary health care centres in Cape Town, South Africa	46 medical officers working at community health centres Conducted in Cape Town, South Africa	5 focus group discussions and 10 individual semi-structured interviews	Physician barriers: Lack of knowledge and experience, language barriers and exaggerated fear of hypoglycaemia Patient barriers: False beliefs about insulin, poor compliance, lack of understanding of the disease, belief in traditional herbs, fear of injections and poor socioeconomic status System barriers: Time limitations, lack of continuity of care and financial restraints

Sunaert *et al*[53] (2014)	Qualitative	Related to a program supporting the initiation of insulin therapy in primary care in Belgium, this study determined factors influencing the general practitioners to be involved in insulin therapy initiation and explored factors relevant for future program development	9 general practitioners for focus group discussions 20 general practitioners for individual interviews 10 type 2 diabetic patients for individual interview Conducted in Belgium	Focus group discussions Individual semi-structured interviews	General practitioners whom engaged in insulin initiation program differ from those not engaged in: Attitude, subjective norm and perceived behavioural control regarding insulin initiation Factors to consider include: Job boundaries between the diabetes nurse educators and general practitioners, job boundaries between general practitioners and specialists and protocol adherence
Burden *et al*[54] (2007)	Mixed	To evaluate the "Insulin For Life" training course for general practitioners and practice nurses in the Heart of Birmingham Teaching Primary Care Trust by exploring the attitudes of the patients, nurses and GPs toward initiating insulin therapy	39 type 2 diabetic patients using a questionnaire 3 to 6 mo after starting insulin 17 general practitioners and practice nurse surveyed using a questionnaire after course completion 37 GPs and practice nurses attended focus group discussions Conducted in Birmingham, United Kingdom	Questionnaire-based survey Focus group discussion	Post-course completion: Type 2 diabetic patients reported that starting insulin in general practice is acceptable and were confident and self-management Most general practitioners and practice nurses were confident about initiating insulin
Harris *et al*[55] (2013)	Randomised control trial	To determine the effectiveness of an insulin initiation strategy utilising a diabetes specialist and community retail pharmacy support to increase family physician insulin-prescribing rates	73 family physicians in the intervention group were provided with diabetes specialists/educators consultation support for 12 mo and community retail pharmacist support 78 family physicians in the control group had usual care Conducted at 15 sites across Canada	Primary outcome was insulin-prescribing rate (IPR) per physician defined as the number of insulin starts of insulin-eligible patients during the 12-mo period	No significant differences were found between the two groups: Mean IPR of 2.28 compared to 2.29 for Intervention group physicians and the control group physicians, respectively. And an estimated adjusted RR (95%CI) of 0.99 (0.80 to 1.24); $P = 0.96$ An insulin initiation support program utilising support from diabetes specialists, diabetic educators and community retail pharmacists to improve insulin prescribing in family practice was unsuccessful

DAWN: Diabetes Attitudes, Wishes, and Needs

and patient; accentuated concern by the PCP about the risk of hypoglycemia and weight gain; and PCP concerns about patient noncompliance.

In one of the DAWN studies, Peyrot *et al*[11] found that a delay in beginning insulin therapy is significantly less frequent among specialists in comparison to PCPs and that healthcare providers (PCPs, specialists and nurses) usually underestimate a patient's feelings of self-blame and personal failure when insulin is needed.

In another study, Ratanawongsa *et al*[43] reported that 64% of PCPs cited patients' resistance as the major cause for delaying insulin initiation, and 97% of these physicians believed that this resistance was due to a fear of injections.

In Arab countries, 73% of PCPs prefer to delay insulin therapy until it is "absolutely essential"[44]; this percentage is higher than the data from the DAWN report (*i.e.*, 50% to 55%)[11].

In an earlier study in the United States, Hayes *et al*[45] explored the attitudes of 505 PCPs in the United States regarding initiation of insulin. Most reported that initiation of insulin is the most difficult part of managing type 2 diabetes, due to the need for injections.

How PCPs assess patients prior to initiating insulin

The way in which PCPs assess their diabetic patients could highly impact their decision to start insulin. Grant *et al*[46] surveyed 886 academic PCPs and specialists in the United States. They reported that when initiating insulin, PCPs usually consider their patients' HbA1c levels, adherence, motivation to improve, overall health assessments and blood glucose level patterns. Patients' age, weight and hospital protocol or guidelines had less impact on their decisions. They appeared to consider

patient concerns in their assessments of barriers, whereas few specialists pointed to any major barriers in insulin initiation at all[46].

In a similar approach a qualitative study conducted in Malaysia of over PCPs explored what assessment they made of patients requiring insulin. They concluded that the decision to start insulin therapy was influenced by assessments of their patients' characteristics, not just their HbA1C or pattern of random glucose readings[47].

Two studies discussed the existence of a perception gap between physicians and patients when initiating insulin. Physicians tend to underestimate the social issues related to insulin usage, they also tend to underestimate patients' understanding of the illness, including concerns that the disease will worsen, self-blame and feelings of personal failure in controlling disease progression. Rather, physicians seemed to overestimate patients' fear and concerns that the injections will be painful[48,49].

Professional roles

The initiation of insulin could be influenced by the way that patients and healthcare providers interact. The impact of roles, communication and the relationships between healthcare professionals and their patients was explored in two qualitative studies conducted in Australia.

Furler *et al*[50] interviewed 14 general practice healthcare providers and 12 patients with type 2 diabetes and concluded that there was uncertainty regarding whose role it was to initiate insulin, *e.g.*, the patients were unclear if the diabetes nurse or diabetes educators were allowed to initiate insulin therapy or whether they only had support roles. The study concluded that there were differing perceptions of what is to be done, who does it, how it is done, and how it is supported. To quote: "...initiating insulin for the treatment of diabetes in the setting of general practice is a complex social intervention".

Manski-Nankervis *et al*[51] interviewed 21 PCPs, practice nurses, diabetes nurse educators and specialists. Both specialists and PCPs agreed that insulin initiation can be undertaken by general practitioners supported by diabetes educators, with specialists backing them up for the complicated cases. They found (again) concerns regarding the ambiguous roles and involvement of nurses (especially practice nurses *vs* diabetes nurse educators) in insulin initiation. However, there was a general feeling that nurses could play a vital role by providing specific training and education[51].

Possible solutions

Our review found four studies that explored solutions to the barriers to insulin initiation. In one study, healthcare professionals and health policy makers in Malaysia were interviewed and participated in focus group discussions. The participants concluded that there is a need to establish multidisciplinary teams and to develop an integrated system for collaboration between the private and public sectors, particularly regarding insulin initiation programs, to decrease the workload (especially of the public sector).

The participants also emphasized the importance of the involvement of nongovernmental organizations, the media and the pharmaceutical industry in insulin initiation programs through the provision of training, education and financial support[52].

In another qualitative study conducted in Belgium, PCPs were invited to attend a support program addressing barriers to insulin initiation; this program involved education and specialist coaching. Comparing PCPs who participated with those who did not, the authors analyzed their findings in terms of the theory of planned behavior. This social cognition model includes consideration of attitude, subjective norm and perceived behavioral control when exploring determinants of professional behavior. Compared to PCPs who did not participate in the program, PCPs who participated noticed the following changes in their behaviors: They were more satisfied with their jobs, more interested in becoming involved in insulin initiation, felt strengthened by the appreciation of their patients and had higher self-esteem levels due to their roles in diabetes care being acknowledged by health policy makers[53].

Similarly, a 2007 study conducted in the United Kingdom to partially evaluate a training course for insulin initiation found that most of the healthcare providers thought that the course was useful and made them more confident in dealing with diabetic patients[54].

Finally, Harris *et al*[55] in 2013 reported a randomized controlled trial of over 151 PCPs in 15 locations across Canada to determine the effectiveness of a 12-mo insulin initiation strategy within primary care. This strategy included diabetes specialists and community retail pharmacists supporting PCPs in their initiation of insulin therapy. The primary outcome they measured was insulin prescribing rates. Surprisingly, their results showed no significant difference when using this strategy; the mean insulin prescribing rates for the intervention group PCPs and the control group PCPs were 2.28 and 2.29 respectively. The authors suggested these results might be influenced by some factors: It may be underpowered by having a smaller than estimated sample size, or the possibility of contamination (although it was limited) or the delay of recruitment and participation of the pharmacists. In addition, they considered the "Hawthorne" effect could be operating (where physicians tend to improve their behavior in response to their knowledge of being observed); and that this could explain some of the lack of difference between the two groups.

DISCUSSION

To the best of our knowledge, the present study is the first systematic review of published work that has explored primary care physicians' points of view regarding the noticeable delay in insulin therapy initiation in primary care settings.

This clinical inertia affects approximately one-third of patients with type 2 diabetes, and this failure of

Table 2 Barriers reported by primary care physicians to initiate insulin

Physicians' related barriers
  PCP's lack of knowledge, training and experience
  Language barriers between PCP and patient
  PCP's concern over the risk of hypoglycemia and weight gain
  Perceived patient resistance - esp. fear of injections
  PCP's concern about patient noncompliance
System barriers
  Lack of resources (*e.g.*, staff and materials)
  Lack of continuity of care
  The workload and time constraints of PCPs
  Ambiguity of roles in the primary care team

PCP: Primary care physician.

PCPs to act, coupled with patients' prolonged exposure to hyperglycemia, leads to a higher risk of chronic complications and mortality[28].

Our review finds that PCPs report many barriers to the initiation of insulin and these range across doctor, patient and system issues. Others have also pointed to this complexity[26,39,41,51]. Table 2 listed the main barriers reported by PCPs to initiate insulin as found in this review.

Clearly, the knowledge, training and experience of the PCP is an important factor, and must affect patient management in more domains than just insulin initiation[11]. This factor may also overlap with an over-concern (by the PCP) about their patient's ability to cope with injections or about possible patient side-effects such as weight-gain and hypoglycemia[26,39,42-44].

Less obviously connected to training and experience is the finding that PCPs under-estimate their patient's feelings of guilt and personal failure when faced with insulin initiation. About 40% of diabetic patients report poor psychological well-being; guilt and self-blame may well be included in this[56].

And PCPs may assess their insulin-requiring diabetic patients in ways different to their specialist colleagues - considering patient adherence and motivation (as well as general health status, HbA1C and blood glucose levels)[46,47]; thus delaying insulin initiation. Yet a concern for this wider assessment seems to miss relevant patient concerns such as the impacts (of insulin use) on their social, marital, occupational or financial situations, as well as causing inconvenience and social stigma. Patients also report lack of understanding of the illness and the role of insulin[48,49]. Perhaps PCPs hear this patient reluctance and assume it is mainly about the use of injections.

Counter to this is the reassuring findings of two studies that suggest patients' negative attitudes toward insulin are mostly temporary and improve after they begin using insulin[57,58]. Perhaps patients need education and reassurance earlier in their diabetic journey; that insulin will most probably be needed at some stage, despite their best efforts, and that this is part of the natural history of the disease - not a sign of their poor management and certainly not a reason for self-blame.

There have been various opinions and suggestions for improving the timeliness of insulin initiation. These have included better delineation of roles within the primary health care team, better integration of health care services, improved communications within the health care setting, improved education of patients (including in groups), wider use of nursing staff, decision support for PCPs, or harnessing new technologies[52-55]. These are all consistent with the suggested approach captured within the Chronic Care Model[59].

Some of the above ideas have attracted intervention studies, with varying success and/or methodological rigor: Some interventions have targeted the PCP (including how to deal with barriers to insulin initiation) but there are few in the literature that report clinically positive effects. Two have evaluated such interventions and found that PCPs reported "increased confidence" in using insulin therapy[53,54].

But with a definite clinical outcome measure (HbA1C over three years), Dale *et al*[60] demonstrated a sustained effect from a brief training course on insulin initiation for healthcare professionals. The training involved "presentations, small group work, case studies and practical demonstrations".

On the other hand, Harris *et al*[55] (in a randomized controlled trial) could not demonstrate any clinical effect from an intervention that provided external expert consultation support to PCPs by community pharmacists and specialists.

Another controlled trial used a decision-support tool aimed at helping PCPs make decisions about insulin therapy. They found no difference in insulin initiation between control and intervention groups - though physicians were allowed not to consult the decision support tool[61].

Clearly, interventions aimed at the PCP will need further refinement, especially if they are to be scaled up for the future increasing numbers of diabetic patients.

Of course technology may change the discourse about clinical inertia or psychological insulin resistance in other ways. For example prefilled insulin pens could reduce the time needed for patient education and training. This method is associated with increased patient convenience and persistence[62]. Other technical developments can also be expected. Table 3 listed the possible solutions for insulin initiation delay proposed in the literature.

Limitations
This systematic review concentrated only on studies of Primary Care Physicians.

It integrates the findings from a variety of research designs; thus a meta-analysis couldn't be used. Sampling varied greatly amongst the studies: Some included patients as well as healthcare providers (even health policy experts), and some didn't report how the subjects were recruited. Moreover, the research was restricted by the use of articles written in English, which could miss some studies related to this review subject.

In conclusion, PCPs' known delay in insulin initiation

Table 3 Possible solutions for insulin initiation delay proposed in literature

Establish multidisciplinary teams and an integrated system for insulin initiation programs

Involve non-governmental organisations through provision of training and education for both patients and healthcare workers

Reinforce healthcare workers skills and knowledge through training courses and workshops

Consider Involving clinical pharmacists and specialists in insulin initiation programs as kind of support or backup

Consider using the aid of electronic decision-support tool

Adopting technology like prefilled insulin pens

is multifactorial, but our understanding of these is getting better, *e.g.,* perceptions of PCPs about patient reluctance may be missing important details such as patient guilt and self-blame. Upskilling of PCPs remains an attractive approach, while the particular elements of teamwork, clinic processes, clinic resources and decision support will need further study and refinement.

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COMMENTS

Background
The reluctance of many general practitioners to initiate insulin treatment could be related to patient, provider and/or system factors. The purpose of this study is to explore general practitioners' perspectives on possible barriers to the use of insulin therapy and to look for solutions to this dilemma in the current literature.

Research frontiers
A few systematic reviews have been published previously related to patients' perspective on the delay in insulin initiation or to psychological insulin resistance. What is unique in this study is the focus on primary healthcare providers' perspectives on barriers to the initiation of insulin therapy in primary care/general practice, and the investigation of possible solutions.

Innovations and breakthroughs
There are several barriers to primary care physicians initiating insulin therapy when it is required. Of these, patients' perceived reluctance seems to be a prominent factor, though it is only one of many aspects of this complex issue.

Applications
Published reports of attempts to find solutions to these barriers were limited in number. Given the increasing burden of this chronic disease, and the need to optimize and standardize management, it is expected research in this area will remain intense. The research that remains patient-centered and takes a systems approach can be expected to yield best results.

Terminology
Clinical inertia could be defined as the failure of healthcare provider to initiate or intensify therapy when it is clinically required.

Peer-review
In this systematic review, the authors tried to explore primary care physicians' perspectives on possible barriers to the use of insulin therapy and to look for solutions to this dilemma in the current literature. The authors concluded that primary care physicians' known delay in insulin initiation is multifactorial. Published reports of attempts to find solutions for these barriers were limited in number. This is an interesting systematic review.

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