ORIGINAL ARTICLE

Adherence to diabetes care process indicators in migrants as compared to non-migrants with diabetes: a retrospective cohort study

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Abstract

Objectives Prevalence rate of diabetes is high among migrants. Whether migrants are correctly addressed to a standard quality of care for diabetes and are properly followed up are the questions addressed by this retrospective cohort study.

Methods Compliance to one or repeated Guideline Composite Indicator (GCI), a standard process indicator of care quality, was tested in migrants compared to non-migrant Italian residents with diabetes, living in Tuscany Region, Italy, in years 2011–2015. For those with no GCI, the analysis was repeated for the chance of being tested by at least one or more HbA1c measurements.

Results GCI compliance, in a single or repeated manner over time, was significantly less likely by about 15–20% among migrants ($n = 3992$) compared to non-migrants ($n = 130{,}874$), even after fully matching both cohorts. For those with no GCI, being tested by HbA1c was still significantly less likely among migrants.

Conclusions Being addressed to a standard quality of care is impaired among migrant patients with diabetes living in Tuscany compared to non-migrants. Migrants, moreover, have a significantly lower probability of adhering to guidelines or to be tested by HbA1c measurement over time.

Keywords Migrants · Quality indicator of diabetes care · Matching analysis · Healthcare system

Introduction

Even in a universalistic healthcare system as the Italian one, socioeconomic inequalities in the quality of care have been documented to exist (Agabiti et al. 2009; Cafagna and Seghieri 2017; Barsanti and Nuti 2014).

With regard to migrants' health inequalities, according to previous studies, migrants have been found to face a worse quality of care as compared with non-migrants in Italy as well as in Europe, being more likely to use urgent care services and, conversely, less likely to visit specialists or to receive preventive care (Giannoni et al. 2010; Rechel et al. 2013). This is even more relevant among migrant diabetic population, even many years after entering the host country, as recently reported in a US study (Srivastava et al. 2018). People with diabetes, in fact, require continuous care and regular use of treatments, and moreover, the prevalence rate of diabetes is much higher among migrants, especially when coming from High Migration Pressure Countries (HMPCs) (Fedeli et al. 2015; Testa et al. 2016). Additionally, the reduction in quality of care could be even more harmful, considering that some diabetic migrants, as, for instance, those of South Asian ancestry, have a markedly increased predisposition to cardiovascular disease compared with Europeans, thus expected to require, for this reason, an especially careful quality of care (Mather et al. 1998).

Nonetheless, in Italy, migrants with diabetes are likely to experience inequalities in utilization of health care and in the access to the recommended treatments with respect

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to their Italian counterparts. In particular, diabetic migrants have been found to under-utilize screening and disease control services and have lower odds to adhere to standards of care such as recommended tests, drugs and visits (Marchesini et al. 2014; Montesi et al. 2016; Marzona et al. 2018; Buja et al. 2013; Ballotari et al. 2015).

Potential causes of the differences in the quality of care for diabetes between non-migrants and migrants, besides the poorly quantifiable role played by linguistic and economic barriers, (Creatore et al. 2010, 2012), may come from different demographic and socioeconomic characteristics as well as their interplay with the regional healthcare system. Indeed, migrants with diabetes may face difficulties in accessing to recommended diseases care and control, but an aspect which, still, remains to be fully elucidated is what happens to their regular use of recommended care after they have met the Regional Health System.

Given these premises, the present study aims at comparing, using administrative healthcare data, the quality of diabetes care among adult migrants and non-migrants in Tuscany Region (Italy). More specifically, the study intends to address the following two research hypotheses (a): whether migrants with diabetes have the same chance, compared to non-migrants, to access care in compliance with recommended standards, and (b): whether migrants are adequately followed up according to these same guidelines' recommended goals once they have intercepted by the health system.

Methods

From the administrative registry of all residents in Tuscany who are beneficiaries of the Regional Health System (RHS) and who had been assigned to a general practitioner, we extracted all individuals, aged 18–100, with diabetes who were resident between January 1, 2011, and December 31, 2015, and who survived until the end of 2015. To assess compliance for quality-of-care processes in chronic diseases such as diabetes, it is necessary to compare exposure periods, as well to acknowledge baseline disease characteristics such as duration or severity of disease. While this latter is not retrievable from available database, in order to homogenize exposure to diabetes we excluded individuals who cannot be observed for the entire period. Of all residents, we extracted information about gender, age, citizenship, area of residence, prescription of glucose-lowering drugs, and number of previous hospitalizations. Diabetes was diagnosed by means of information obtained by administrative databases according to a validated algorithm (Gini et al. 2013). More in detail: a person was defined as having diabetes if by December 31, 2008, he or she met at least one out of three conditions: (a) ≥ 2 prescriptions of

glucose-lowering drugs within 1 year; (b) having an exemption from paying for diagnostic or therapeutic procedures for diabetes (cod. ICD9CM 250*), all of which are free of charge in our region; (c) ≥ 1 hospitalization with a primary or concomitant diagnose of diabetes (cod. ICD9CM 250. *). To avoid possible biases, those who were diagnosed as being diabetic between years 2011–2015 were dropped from the sample.

Citizenships were divided into two main groups: Italian non-migrants and migrants registered with RHS. Migrants were defined as individuals from High Migration Pressure Countries (HMPCs) such as Africa, Asia and Latin America or from Eastern Europe (Buja et al. 2013). Migrants who entered Italy without permission are not registered with the RHS and are not included in this analysis; likewise, foreign patients who acquired the Italian citizenship during the study period were dropped from the sample. Length of stay, for migrants, was at least of 5 years. Beyond this term, it was not possible to exactly compute length of residence due to lack of information in the administrative datasets.

From the data linkage among administrative databases, we were also able to retrieve additional characteristics of the diabetes patients: (a) Local Health Area Unit of residence; (b) Charlson Index of comorbidity (Charlson et al. 1987), based on all hospitalizations until the end of 2010. This index ranges between 0 and 2, being those who never got hospitalized, coded as 0. Besides indicating the presence of comorbidities, Charlson Index has the meaning of tracking a previous approach to the National Health System, and for convenience, analyses were performed by using a dichotomous response: Charlson Index = 0 or > 0; (c) their therapy, if any, with glucose-lowering drugs, coded as none, only oral, insulin or oral + insulin; (d) whether they had performed an ophthalmologic visit or had tested HbA1c, microalbuminuria or serum lipids measurement from the regional dataset of specialist visits and laboratory analyses; (e) whether they have fulfilled at least one Guideline Composite Indicator (GCI): a process indicator used to routinely assess the quality of diabetes care including one annual assessment of HbA1c and at least two among eye examination, serum lipids measurement and microalbuminuria (Giorda et al. 2006, 2012; Seghieri et al. 2016).

Data were anonymized by the assignment, at entrance into regional databases, of a unique identifier ID number to each patient which was the same for all administrative databases and did not allow disclosing the patient's identity as well as any other sensitive information. Because of such formal protection, no approval by an Ethics Committee was required.

In order to compare the access and the subsequent adherence to quality health care (as measured through

guidelines-based indicators for diabetes) between migrants and non-migrants, two different regression models have been performed including a logit and a zero-truncated Poisson regression. More specifically, the probability of fulfilling at least one GCI along the observation period was compared between migrants and non-migrant residents, through a logistic regression analysis, after adjusting for gender, age, therapy, Charlson Index, and having received an antidiabetic drug therapy at the baseline. A fixed effect for the local health area of residence was also included in the model. Additionally, the expected number of GCIs, conditioning on having already fulfilled at least one GCI, during the period under observation, was estimated through a truncated Poisson model (Cameron and Trivedi 2013) after adjusting for the same covariates used for the logistic regression. The analysis was finally completed by comparing migrants and Italian residents with diabetes, after fully matching forage, sex, Charlson Index and type of therapy by means of the Coarsened Exact Matching (CEM) nonparametric approach (n = 3922 for both) (Iacus et al. 2011a, b).

All statistical analyses, including logistic regression, truncated Poisson regression analysis and matching procedures by means of CEM method, were carried out by using STATA ver. 12.0 (STATA, College Station, TX, USA).

Results

On January 1, 2011, a cohort has been identified, composed of 126,882 Italian individuals and of 3992 migrants with diabetes fulfilling all requested characteristics. About two-thirds of migrant population were coming from HMPC. Main characteristics of Italian residents and of migrants are presented in Tables 1, 2 and 3a.

Migrants were on average younger (age 51.5 ± 0.9 vs. 67 ± 13 year; $p < 0.0001$), with females outnumbering males (50% vs. 47%) in agreement with previous observations evidencing that migrants are on average younger than Italian residents and with a different gender distribution, this latter depending on each individual country of origin (Marzona et al. 2018).

Compared to the Italian residents, migrants had a lower amount of previous comorbidities as testified by a Charlson Index > 0 in 24.3% vs. 45.9%: $p < 0.0001$. Therapy at baseline was different between the two groups with migrants having a higher prevalence of those without any therapy (22.9% vs. 17.5%) and of those with only insulin (10% vs. 7.9%; $p = 0.0001$). Oral therapy was significantly more prevalent in Italian residents (66.1% vs. 58.8%; $p = 0.0001$) and no difference between those in treatment with insulin in association with oral drugs (8.4% vs. 8.1%;

p = ns); Table 1. Metformin treatment, alone or in association with other glucose-lowering drugs, included 65% of subjects without significant differences between Italian residents and migrants. Compliance to at least one GCI as well as to any of its components was significantly lower in migrants than among Italian residents; $p < 0.0001$ for all comparisons (Table 1). After full matching of migrants and Italian residents, by CEM method, two cohorts were obtained, each of 3992 subjects, as evidenced in Table 2.

Among migrants, the country of origin is shown in Table 3: Most of them came from High Migration Pressure Countries (HMPCs), with some differences among countries of origin regarding gender and age (Table 3a). More than 50% of migrants, independently from their origin country, did not perform any GCI along the whole period of observation (Table 3b).

The probability of having at least one GCI was significantly lower in migrants than in non-migrants (OR 0.736; 95% CI 0.685–0.790; $p = 0.0001$; Fig. 1). Even the chance of having more than one GCI, as evaluated by the incidence rate ratio (IRR) after truncated Poisson analysis, was significantly lower in migrants, after adjusting for age, gender, therapy and comorbidities (IRR: 0.839; 0.808–0.872; $p = 0.0001$; Fig. 1).

After exactly matching the two cohorts for age, gender, previous hospitalizations and baseline therapy by CEM, the probability of complying with at least one GCI remained lower in migrants compared to Italian residents: OR 0.873 (95% IC 0.791–0.964; $p = 0.008$), and the adjusted chance of having further incident GCIs in those with at least one GCI was confirmed as significantly reduced in migrants than in Italian residents with an IRR 0.879 (0.834–0.925); $p < 0.0001$ (Fig. 1).

Since testing HbA1c is a mandatory condition in defining GCI, we measured the probability of having performed at least one HbA1c test in those with no GCI, a further indicator of "minimally essential" quality of care in patients with diabetes. Such probability was significantly lower in migrants as compared with Italian residents either in unmatched analysis OR 0.745 (0.677–0.819); $p = 0.0001$; or after matching procedure (OR 0.811; 0.711–0.926; $p = 0.002$; Fig. 2).The probability of having more HbA1c tested during the period, for those with no GCI, was again lower among migrants IRR 0.864 (0.827–0.902); $p = 0.0001$, remaining this gap is significant after the matching analysis: IRR 0.901 (0.849–0.955); $p = 0.0001$; Fig. 2.

Finally, after considering as a unique group diabetic people whose origin countries were Africa and Asia (HMPC), results did not change confirming a disadvantage for migrants, as compared to Italian residents. When individuals from Africa ($n = 1053$) and from Asia ($n = 1096$)

Table 1 Characteristics of Italian residents and of migrants in Tuscany, Italy, years 2012–2016

	Italian residents		Migrants		*p*
No.	126,882	95% CI	3992	95% CI	
Age (mean $\pm$ SD)	66.7 $\pm$ 13.1	66.70–66.85	51.5 $\pm$ 12.9	51.15–51.95	0.0001
Males (%)	49.9	49.63–50.18	46.8	45.28–48.40	0.0001
Charlson Index > 0 (%)	45.9	45.65–46.20	24.3	23.07–25.76	0.0001
No drug therapy at baseline (%)	17.6	17.31–17.72	22.9	21.61–24.22	0.0001
Only insulin (%)	7.9	7.76–8.06	10.0	9.12–11.01	0.0001
Only oral drugs (%)	66.1	65.86–66.38	58.8	57.32–60.39	0.0001
Insulin + oral drugs (%)	8.4	8.30–8.60	8.1	7.33–9.01	0.5217
Adherence to at least one GCI (%)	50.0	49.78–50.33	43.5	41.99–45.09	0.0001
Percentage of measured HbA1c (%)	85.8	85.65–86.04	74.2	72.84–75.58	0.0001
Test of urinary albumin excretion (%)	50.3	50.07–50.62	44.1	42.61–45.72	0.0001
Lipid profile assay (%)	85.7	85.53–85.92	74.3	72.96–75.70	0.0001
Eye examination (%)	63.2	62.93–63.46	55.7	54.15–57.26	0.0001

CI confidence interval, *GCI* Guideline Composite Indicator, *SD* standard deviation

Table 2 Characteristics of Italian residents and of migrants after matching for age, sex, Charlson Index and type of therapy, by Coarsened Exact Matching (CEM) nonparametric approach, in Tuscany, Italy, years 2012–2016

	Italian residents	Migrants	*p*
No.	3992	3992	
Age (mean)	51.5	51.5	1.000
Males (%)	46.8	46.8	1.000
Charlson Index > 0 (%)	24.3	24.3	1.000
No drug therapy at baseline (%)	22.9	22.9	1.000
Only insulin (%)	10.0	10.0	1.000
Only oral drugs (%)	58.8	58.8	1.000
Insulin + oral drugs (%)	8.1	8.1	1.000
Adherence to at least one GCI (%)	44.9	43.5	0.191
Percentage of measured HbA1c (%)	76.7	74.2	0.009
Test of urinary albumin excretion (%)	44.8	44.1	0.543
Lipid profile assay (%)	79.7	74.3	0.000
Eye examination (%)	55.7	55.7	0.072

GCI Guideline Composite Indicator

were compared separately to Italian residents, the trend was similar even if not fully significant (data not shown).

Discussion

The principal aim of this study was to compare access and longitudinal use of recommended care for diabetes between migrants and non-migrants in Italy. The main result is that quality of diabetes care, here evaluated by measuring the compliance to a process indicator such as GCI, is significantly lower in migrants than in Italian residents, in agreement with other Italian studies, even if the comparison with other Italian studies is someway difficult since the percentage of migrants from different origin countries

is dissimilar among studies, due to differences in distribution of migrants across Italian territories (Marchesini et al. 2014; Montesi et al. 2016; Fedeli et al. 2015; Marzona et al. 2018; Buja et al. 2013; Ballotari et al. 2015).

More specifically, even after applying a strict matching procedure, migrants showed a 20% disadvantage in complying with at least one GCI compared to Italian residents. A novel finding of the study is that, also after a first GCI, the adjusted probability of accomplishing further GCIs remained significantly lower in migrants, suggesting that they are less likely to be properly followed up, even after being fully intercepted by the Regional Health System. Moreover, even among those patients with a more uncertain capture by the Regional Health System as testified by having done no GCI along the whole observation period,

Table 3 Country of provenience and main characteristics of migrants (a); number of performed GCIs (b) in Tuscany, Italy, years 2012–2016

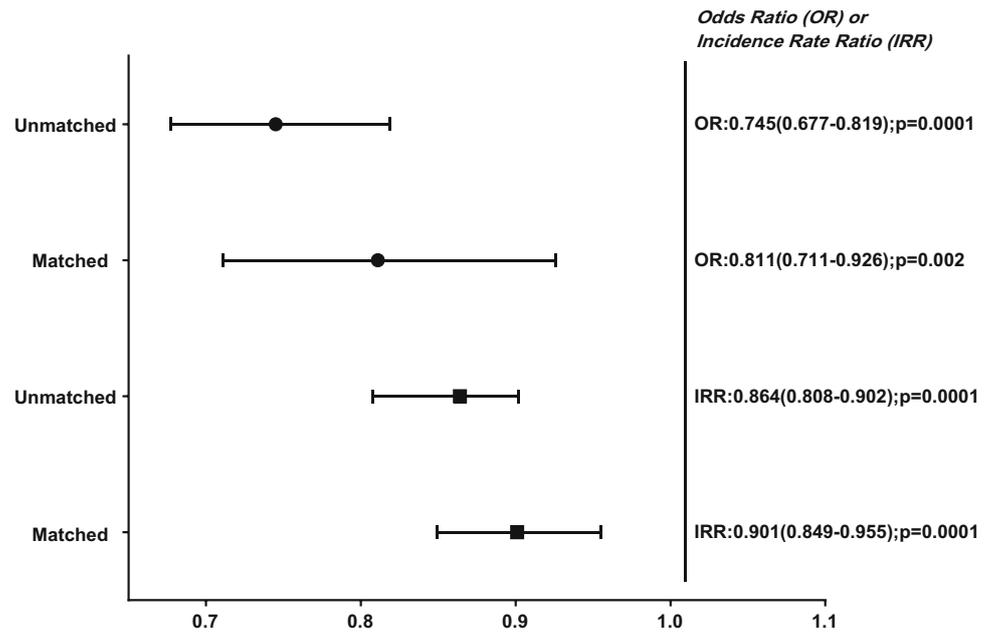|	No.	Mean age (year)	% male
(a)			
Africa	1053	49.9	57.7
European countries (Non-European Union)	937	54.7	43.8
Latin America	268	51.8	29.1
Asia	1096	48.9	50.9
Eastern Europe (European Union)	637	53.4	34.6
	GCI = 0 No. (%)	GCI > 0 No. (%)	Total no.
(b)			
Africa	584 (56.5)	449 (43.5)	1033
European countries (Non-European Union)	552 (58.9)	380 (41.1)	937
Latin America	144 (53.7)	124 (46.3)	268
Asia	623 (56.8)	473 (43.2)	1096
Eastern Europe (European Union)	340 (53.4)	297 (46.6)	637

GCI Guideline Composite Indicator

Fig. 1 Probability of having at least one Guideline Composite Indicator (GCI) performed expressed as odds ratio (OR, filled circle), or of more incident GCI expressed as incidence rate ratio (IRR, filled square), comparing populations of migrants and Italian residents unmatched and matched for age, sex, Charlson Index and type of therapy, in Tuscany, Italy, years 2012–2016
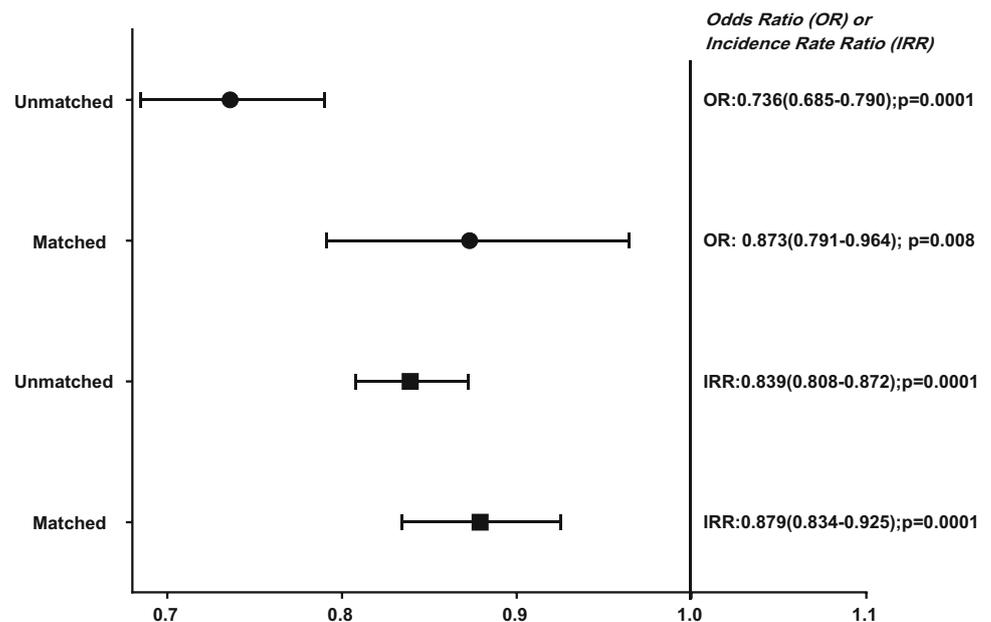
the chance of fulfillment of at least one HbA1c test, or repeated HbA1c tests, dropped by about 10–15% among migrants compared to Italian residents. Additionally, with regard to differences at baseline in the drug therapy, this study shows that migrants have a lower chance to receive any treatment compared to the Italian residents. These results are in line with the previous studies (Marzona et al. 2018; Marchesini et al. 2014) although the study also shows that those who are treated with insulin only are more represented among migrants (10% vs. 7.9%). This last result could suggest a greater prevalence of type 1 diabetes among migrants, also considering their younger mean age.

Use of insulin was, however, similar in another Italian study (Marzona et al. 2018) who found a higher percentage of users of insulin among African migrants (about 18%) with respect to Italian residents. Further investigation is, however, needed to confirm and eventually explain this finding.

Plausible reasons for health migrants' inequalities could derive from socioeconomic, ethnic, cultural differences and linguistic barriers (Rechel et al. 2013; Norredam et al. 2010) as well as possible barriers in communication between patients and physicians, as observed in other settings (Meeuwesen et al. 2006). Additionally, migrants,

Fig. 2 Probability of having at least one HbA1c measured in those with no Guideline Composite Indicator (GCI), expressed as odds ratio (OR, filled circle), or of more incident HbA1c after the first one expressed as incidence rate ratio (IRR, filled square), comparing populations of migrants and Italian residents unmatched and matched for age, sex, Charlson Index and type of therapy, in Tuscany, Italy, years 2012–2016

Odds Ratio (OR) or Incidence Rate Ratio (IRR)

OR:0.745(0.677-0.819);p=0.0001

OR:0.811(0.711-0.926);p=0.002

IRR:0.864(0.808-0.902);p=0.0001

IRR:0.901(0.849-0.955);p=0.0001

compared to the Italian residents, might lack of knowledge of how the regional healthcare system works; for instance, in relation to that fact that they can take advantage of a universalistic health system which allows them to have a direct access to the recommended treatment. This means that chronic patients don't need a referral from either the specialist of the GP to access to diseases treatments and controls.

This study has some limitations: The first is that it utilizes only administrative data and therefore no information can be given about clinical (duration or severity of disease) and socioeconomic details and specially about health outcomes of these two distinct populations with diabetes. Secondly, as with all observational data, we are unable to make inferences about causation, and for this reason, effect estimates should be cautiously interpreted. Moreover, we could not control for length of residence in Italy due to technical reasons as stated in Methods. This study, however, refers to a population of immigrants with a duration of stay longer than 5 years; although it is not possible to control for longer residence durations beyond this limit, a threshold of 5 years for length of residence seems robust enough to draw conclusions about the quality of care in our sample. Moreover, compared to other countries, immigration to Italy is a recent phenomenon and most immigrants have relatively short spells of permanence. This is the reason why we have chosen to include those who remained in the study for the whole period of observation.

As to the strengths, this is a population study covering a homogeneous, large and well-characterized population with diabetes which has been observed for 5 years. It has, in addition, the advantage of using a validated process

indicator of adherence to guidelines such as GCI (Seghieri et al. 2016), as well as statistical matching techniques, that appear in this case opportune, in light of the innumerable differences that characterize both populations at baseline. The above-mentioned Italian studies, in fact, besides being limited by a cross-sectional design did not, in fact, fully adjust for some constitutive differences, in addition to age and gender. In this case, we compared the results after full matching for multiple variables such as age, gender, previous hospitalizations and antidiabetic therapy.

The study also, to the best of our knowledge, is the first in Italy exploring the relationship between migrant status and both access to and routine use of recommended care. In particular, analyzing whether the immigrants, once having get in contact with the healthcare provider, receive adequate follow-up for disease control can help managers and policy makers to identify targeted strategies to reduce patients' unmet needs and equity gaps.

In conclusion, these findings highlight that, even in a healthcare system that is built on a principle of equity and equality, poor longitudinal continuity of care is demonstrated to exist for migrants with diabetes (Montesi et al. 2016). Indeed, failures of the healthcare systems in assuring that migrant patients adhere to routine control for chronic diseases might produce worse outcomes for the patients (i.e., higher hospitalization rates) due to disease progression and complications and, therefore, higher costs for the regional healthcare system.

For these reasons, our study suggests the importance of examining and monitoring health equity, especially with regard to the socioeconomic disaggregation of statistical data (vertical equity) both in the access and regular use of

recommended care in order to identify groups or areas in need and promoting a more proactive behavior by regional healthcare professionals to both ensure equitable access to health services and a continuing interaction between healthcare providers and patients for the diabetes control and management.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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