Received: 16 August 2021 | Revised: 3 April 2022 | Accepted: 25 April 2022

DOI: 10.1111/jnu.12781

JOURNAL OF NURSING SCHOLARSHIP

ORIGINAL MANUSCRIPT

Reducing health inequalities among most disadvantaged type 2 diabetes patients: A cross-sectional exploratory pilot study

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Abstract

Background: Demographic changes and the increased chronical diseases burden are global challenges that cannot go unnoticed by healthcare systems, which must be organized without losing sight of the increasing influence of social determinants.

Aim: To evaluate the results of a primary care program implemented to reduce health inequalities associated with social determinants in patients with type 2 diabetes.

Method: An exploratory pilot retrospective cross-sectional study that includes secondary data of 404 nonrandomized patients belonging to socially depressed areas and conventional areas. Descriptive, bivariate, and multivariate analyses were performed.

Results: The age of the subjects included in the study was 66.80 ± 9.7 years with a proportion of 56.7% men. Proportions of patients from socially depressed areas and adherence to the Nursing Follow-up Program were around 33% and 60%, respectively. The obesity rate was 51%, percentage of patients with HbA1c<7% was 59%. No significant differences were found between patients belonging to socially depressed areas and those who do not, except for greater adherence to nursing follow-up programs. Multivariate models assessed chronical complications as health outcomes (cardiovascular diseases, retinopathy, and nephropathy) as health outcomes showing the influence of previously described risk factors. However, in none of the models did belonging to a socially depressed area or adherence to the Nursing Follow-up Program were predictors.

Conclusions: The program has proven to be efficient in equating the health outcomes related with cardiovascular risk of patients from both types of areas. Well-directed health policies could bring primary care systems closer to sustainable development goals through the reduction of health disparities that affect socially vulnerable groups.

Clinical relevance: To introduce a risk strategy and to adopt a family approach, contemplating the sociocultural and educational differences that diversely affect men and women in their health status has proven to be useful in reducing health disparities due to social determinants in patients with type 2 diabetes.

KEYWORDS
diabetes mellitus type 2, health status disparities, primary health care, social determinants of health

BACKGROUND

In 2015, the United Nations adopted a series of objectives whose purpose was to achieve, within a period of 15 years, an improvement in the situation of individuals, communities, and, ultimately, the planet's global situation in socioeconomic, environmental, and health terms. That is why its implementation must be carried out at different scales (neighborhoods, cities, countries) (Morton et al., 2017). Of the 17 proposed objectives, objective 3 is to achieve good health and well-being and objective 10 is to reduce inequalities. Both objectives are linked through social determinants that have been an important factor in establishing a gap in health between individuals and families with different social realities.

The concept of social determinants of health refers to the socioeconomic factors related to the place of a person in society (schooling, occupation, or income). The World Health Organization (WHO) defines them as "the conditions in which people are born, grow up, work, live and age, as well as the systems established to deal with the disease". According to WHO, these are in turn shaped by broader forces, namely: economy, social policies, and politics, including money, power and resource distribution at the global, national, and local levels (Hill-Briggs et al., 2020).

The inequalities in health due to social determinants are potentiated in urban centers as environmental quality is lost from the physical point of view or as certain socioeconomic imbalances are accentuated, both changes are closely related with each other and with urban governance (Borrell et al., 2013).

In Andalusia, and through the Preferential Neighborhood Action Plan of the Andalusia Government (Decree 202/1989), the regional government established an administrative unit called Area with Social Transformation Needs (ASTN) that applies to urban spaces in which many of the inhabitants are in conditions of social exclusion, severe structural poverty, and marginalization.

One of the objectives of the Andalusia Government is to improve the social conditions in these spaces by means of comprehensive interventions (Equality and Social Policies Andalussian Council, 2018; Egea et al., 2008). For a correct adaptation to the ASTNs' health needs, the elaboration of a specific service offer has been denied, which is against the search for the desired normalization (the implementation of these ad hoc services could be stigmatizing since they become a way of identifying the existence of its social situation). Instead, the answer proposed has been to introduce the risk strategy in all the services contemplated in the offer and to adopt a family approach in all the interventions, contemplating the sociocultural and educational differences that diversely affect men and women in their health status and perception (General Directorate of Health Assistance. Andalusian Health Service, 2004).

The interventions are aimed at exerting an influence at different levels. For example, at the primary health care center level, efforts are made to attain an improvement in accessibility and organizational flexibility; at the level of the professionals, they receive specific guidance, however, interventions are established to improve coordination between primary and specialized assistance, thus ensuring care continuity. In this setting, specific action plans for diseases like COPD, hypertension, or diabetes are designed (General Directorate of Health Assistance. Andalusian Health Service, 2004).

Diabetes mellitus is a chronic disease of high sociosanitary importance due to the associated morbidity and mortality that affect 366 million people worldwide and which, in Andalusia, presents 16.3% prevalence against the Spanish mean of 12.5% (Valdés et al., 2014). In Type 2 diabetes (T2D), the impact of the social determinants seems to have special significance, as shown by the increase in the number of studies conducted in this area in recent years, where it is shown how the economic vulnerability and low educational level that usually characterize this population segment exert a negative influence on disease management through changes in the eating pattern, greater consumption of toxic products, and worse self-care levels. This translates into a deficient control of the disease, which is manifested through the change in clinical parameters, such as cholesterol, blood pressure, or glycated glycaemia, linked to an increase in the number of the chronic complications inherent to this disease (Fan et al., 2019; Patel, 2020; Walker et al., 2014).

Nurses have become aware of this problem and, due to their important role in community management of the diabetic patient, they have directed their research toward the assessment of social support in the health outcomes of this type of patients (Arda Sürücü et al., 2018; Bech et al., 2019; Wu et al., 2013).

With all of the above, we can verify that a major coordinated effort has been made among healthcare workers, managers, and legislators in the sociosanitary scope to improve the health situation of these patients. However, few studies directly or indirectly assess the result of such efforts in our region. Such results should be seen through the equalization of the health status of the citizens living in ASTNs when compared to that of those who live outside these socially underprivileged areas. This is precisely the objective of this study, which is to determine the possible effect of the intervention applied in ASTN through the evaluation of the existence of disparity in six binary health outcomes with respect to conventional areas. Additionally, the possible influence of adherence to follow-up programs led by primary care nurses will be assessed, since the intervention could positively influence this aspect, potentially turning it into a mediator of improved outcomes.

METHODS

Design and setting

An exploratory pilot, observational, retrospective, and cross-sectional study that includes secondary data of patients with T2D treated in various primary care retinography services of the city of Seville. For the design and communication of the results of this study, the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement for cross-sectional studies will be employed, in order to improve quality and transparency (Vandenbroucke et al., 2014).

Setting and primary care program implemented

Our regional Public Health System is organized into territorial demarcations called Healthcare Areas. They were defined taking into account geographical, sociodemographic, epidemiological, environmental factors, homogeneous roads, and media, as well as existing healthcare facilities and taking into account territorial planning established by the regional government. The Healthcare Area constitutes the framework for planning and developing health actions, and must have the necessary funding and endowments to provide Primary and Specialized Care services, ensuring accessibility and continuity of care at different levels.

Each Healthcare Area is divided into Basic Healthcare Zones. A Basic Healthcare Zone is the basic territorial framework for the provision of Primary Health Care, with direct access to the population, and ability to provide continuous, comprehensive, permanent, and accessible assistance.

The declaration of Zones with Social Transformation Needs (ASTN) was carried out jointly between the managers of the Health Areas with the social workers of the different basic areas that comprise them. Thus, several meetings were held to coordinate and set the inclusion criteria for a neighborhood or area as ASTN. The population of areas classified as ASTN received educational interventions in health literacy, addressing different topics depending on their needs. Likewise, families with special care needs due to their vulnerability and risk were identified. A professional (doctor, nurse, or social worker) was assigned to each of these families to supervise the health care received and assess their needs. Among specific nursing staff, the figure of liaison nurses or case management nurses were implemented. They were specifically trained in order to expand the skills related to clinical and motivational interviewing, detection of both health and social risks, family care, and the management of highly complex care in the community. This training has been continued to be imparted over different years.

The city of Seville has 688,592 inhabitants (January 1st, 2019, according to the National Statistics Institute [*Instituto Nacional de Estadística*, INE). Its primary care system is articulated across 35 primary care centers, of which five are equipped with a retinograph. Retinographs are key recruitment points because they can be used to recruit patients referred from different areas of the city. Sometimes, the same retinograph is used both by patients from ASTNs and from areas without these needs. Thus, establishing these five recruitment points, a sample of patients with broad geographical dispersion could be assembled, including people coming from both ASTNs and conventional areas. A convenience sampling was carried out.

Information source

Appointment lists from the primary care retinopathy screening services were used to identify patients with T2D. From these lists, the numbers of electronic medical histories used by the Andalusia Health Service (Diraya) were obtained, which were employed as secondary data source to obtain sociodemographic, clinical and lifestyle information recorded by the nurses in the specific module known as "Nursing consultation follow-up sheet" and in a module shared with the medical personnel, called "Sheet for the collection of constants."

Inclusion criteria

The individuals included will be patients diagnosed with T2D who attended the retinopathy screening between March and June 2019 and whose medical history contained all the information related to the study variables described below. Those excluded were patients with diseases, both somatic and mental, or with some important social problem that rendered them incapable of correctly adhering to the treatment or its follow-up (enolism or other addictions, cognitive decline, language barriers, lack of knowledge regarding the operation of the health system [immigrants]).

Health outcomes assessed

According to the study objectives, the chronic complications usually associated with diabetes and some associated risk factors were collected as dependent variables. They were all collected as dichotomous variables based on the presence/absence of the condition. These variables were as follows: cardiovascular disease (CVD), arterial hypertension (AHT), dyslipidemia, nephropathy, retinopathy, and high risk foot to develop ulcer.

Possible associated factors

Sociodemographic (gender, age, retinograph, and referring health center, as well as belonging to an ASTN), lifestyle (diet, physical exercise, smoking habit), and clinical variables (BMI, HbA1c, adherence to the Nursing follow-up program (NFP) (defined as attending at least one of the two consultations per year), as well as progression time since the diagnosis of diabetes, were collected as

independent variables. Since AHT and dyslipidemia are risk factors for various chronic diseases, they were also employed as independent variables.

Data analysis

The statistical analysis was performed with IBM's SPSS v 25.0 software. Univariate descriptive analysis and statistical inference were performed to determine the possible statistical association of health outcomes based on belonging to an ASTN or on nursing consultation follow-up, as well as possible associations with sociodemographic or lifestyle variables. For the qualitative variables, Pearson's chi-square test or Fisher's exact test were employed, according to convenience. For the comparison of means of dichotomous variables, the Student's *t* test or the Wilcoxon test for nonpaired samples were used based on previously tested parametric criteria. For the polytomic variables, the ANOVA test was applied if there were parametric criteria; otherwise, the Kruskal–Wallis test was used. When necessary (insufficient absolute frequencies), the polytomic variables were dichotomized. Finally, multivariate regression models were implemented to control confusion risk, as sampling was not at random. 95% ($p < 0.05$) statistical significance was adopted and the OR and their 95% confidence intervals were calculated to determine the effect size. Post hoc power was calculated with Gpower 3.1 to verify the adequacy of the sample size (Faul et al., 2009).

Ethical considerations

The exemption of informed consent was requested from the regional ethics committee which, according to regional regulations, it was justified because the study required a high sample size without any risk intervention being carried out on the patients since it was an observational study retrospective, which analyzes variables derived from the routine healthcare practice carried out on these patients. In addition, the publication of images of the patients was not required and the design allowed the communication of results in an aggregate way. All records were made in accordance with current national and European legislation regarding the protection of personal data, as well as the security of automated files containing personal data, and access to confidential data for scientific purposes: (i) Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016 regarding the protection of natural persons with regard to the processing of personal data and the free circulation of these data, (ii) Organic Law 3/2018 of December 5, Protection of Personal Data and guarantee of digital rights.

RESULTS

The clinical information of 404 patients with T2D was included in the study. The distribution of the patients by each of the five retinographs was not equal, with 53.22% allocated to a single retinograph that included patients from both types of areas, whereas the rest of the patients came from the other 4 collection points with the following percentages: 8.66%, 19.55%, 8.42%, and 10.15%.

Table 1 shows the sociodemographic and clinical profile of the total number of patients included, while Tables 2 and 3 does so based on their belonging to an area with or without social transformation needs, as well as adherence to the NFP as defined in the Methods section.

The population included is aged from 38 to 89 years old, with a mean and standard deviation of 66.80 ± 9.7 and a proportion of 56.7% of men. Regarding its distribution by areas, one third came from areas with social transformation needs and adherence to the NFP was around 60% of the subjects included. In general, the profile of the T2D patient was that of a person with low physical activity, who follows a normo-caloric diet, and who was able to cease tobacco consumption. The prevalent risk factors were AHT and dyslipidemia, associated with CVD and retinopathy as the most frequent ones, with a prevalence of 25% each. A proportion of 51% of obese individuals was observed, and the percentage of patients with HbA1c<7% was 59%.

No statistically significant differences were observed in the bivariate analysis between the patients who complied or did not comply with the NFP (Table 3) or between the individuals from areas with or without social transformation needs (Table 2). ASTN patients showed significantly higher adherence to NFP than those from conventional areas. In addition, patients adhering to NFP showed that they followed hypercaloric diets in a lower proportion than those without adherence (Table 3).

The post hoc powers were: CVD (0.67), AHT (0.93), dyslipidemia (0.94), nephropathy (0.48), foot ulcer risk (0.49), retinophaty (0.52) in Table 2, and CVD (0.66), AHT (0.49), dyslipidemia (0.90), nephropathy (0.52), foot ulcer risk (0.70), retinopathy (0.50) in Table 3.

Table 4 shows the multivariate logistic regression models that were established to avoid the possible confusion bias resulting from nonrandomization of the sample for each of the health outcomes evaluated. The model to assess CVD showed that the sociodemographic characteristics (age and male gender), as well as the presence of AHT and dyslipidemia and being a smoker or former smoker (both categories were joined to make up a dichotomous variable against nonsmokers) were associated as risk factors to this complication.

The model to assess nephropathy as a health outcome showed that this complication was associated with the presence of CVD and high risk foot. As a health outcome, nephropathy was associated with the HbA1c values, to the presence of high risk foot and to the time of disease progression. The AHT and dyslipidemia risk factors were clearly associated with each other and with the presence of CVD. However, in none of the models did belonging to an ASTN or adherence to the NFP appear as variables associated with the different health outcomes.

TABLE 1 Descriptive analysis

Qualitative variables			
	Subjects	**Percentage**	**(CI95%)**
Gender (men)	229	56.7	52–61
ASTN	133	32.9	29–38
NFP	236	58.4	54–63
Diet			
Hypocaloric	36	8.9	7–12
Normo-caloric	315	77.9	74–82
Hypercaloric	53	13.1	10–17
Physical activity			
Sedentary	6	1.5	1–3
Low	206	50.9	46–56
Moderate	155	38.4	34–43
High	37	9.2	7–12
Smoking habits			
Smoker	111	27.5	23–32
Ex-smoker	83	20.5	17–25
Nonsmoker	210	51.9	47–57
CVD	101	25.0	21–29
AHT	320	79.2	75–83
Dyslipidemia	251	62.1	57–67
Diabetic nephropathy	19	4.7	3–7
Diabetic foot ulcer risk	29	7.2	5–10
Diabetic retinopathy	103	25.5	21–30
Quantitative variables			
	Median ± SD	**Me [P25-P75]**	**Max-Min**
Age (years)	66.80 ± 9.7	68.0 [60.8–73.0]	38.0–89.0
BMI (kg/m^2)	30.4 ± 65.2	30.0 [26.9–33.0]	3.0–50.1
HbA1C test (%)	6.97 ± 1.1	6.7 [6.2–7.4]	5.1–13.0
Time of evolution	8.7 ± 5.0	9.0 [4.0–13.0]	0–24.0

Abbreviations: AHT, arterial hypertension; ASTN, Area with Social Transformation Needs; BMI, body mass index; CVD, cardiovascular disease; HbA1C, Glycated hemoglobin A; Max, maximum; Me, median; Min, minimum; NFP, Nursing Follow-up program; P, percentile; SD, standard deviation.

Table 4 reports the goodness of fit of the models (HL test, Hosmer and Lemeshow test). The goodness of fit of the models was also evaluated through the chi-square test, obtaining p-value <0.001 for all models except for the nephropathy model ($p = 0.01$) and the risk foot model ($p = 0.002$).

The predictive capacity of the models has been evaluated through the area under the curve and its confidence interval: CVD model 0.8 (0.75–0.84), AHT model 0.83 (0.79–0.88), dyslipidemia model 0.66 (0.61–0.71), nephropathy model 0.73 (0.61–0.84), retinopathy model 0.74 (0.66–0.82), and foot model 0.73 (0.64–0.84). Additionally, the overall percentage of correctly classified patients was calculated: CVD model 76.5%, AHT model 81.6%, dyslipidemia model 68.6%, nephropathy model 95%, retinopathy model 89.6%, and foot model 92.8%.

DISCUSSION

The increase in the prevalence of chronic diseases due to the demographic change experienced by societies, especially those with greater socioeconomic development, has turned this type of diseases into the target of clinicians, researchers, and policy makers (Li et al., 2020). Another significant change in the field of health sciences has been the increasing importance gained by the social determinants that have evidenced how certain health problems are more related to the ZIP than with the genetic code (Tornero Patricio et al., 2017). These, together with those associated with climate and the environment, are global changes that cannot go unnoticed by institutions in general and health systems in particular, which must be organized within the framework of sustainable development

TABLE 2 Differences between patients from both types of areas

ASTN				
Variables	**Yes, *n* (%)**	**No, *n* (%)**	***p*-value**	**OR**
Gender (men)	67 (50.4)	162 (59.8)	0.073	0.68 (0.44–1.10)
Diet			0.445	
Hypocaloric	14 (10.5)	22 (8.1)		0.79 (0.37–1.73)
Normo-caloric	105 (78.9)	210 (77.5)		1
Hypercaloric	14 (10.5)	39 (14.4)		1.39 (0.70–2.90)
Physical activity			0.484	
Sedentary	2 (1.5)	4 (1.5)		1
Low	75 (56.4)	131 (48.3)		0.87 (0.08–6.26)
Moderate	46 (34.6)	109 (40.2)		1.18 (0.10–8.59)
High	10 (7.5)	27 (10)		1.34 (0.11–11.17)
Smoking habit			0.644	
Smoker	40 (30.1)	71 (26.2)		0.80 (0.48–1.34)
Ex-smoker	28 (21.1)	55 (20.3)		0.88 (0.50–1.58)
Nonsmoker	65 (48.9)	145 (53.5)		1
Physical Activity (active)	56 (42.1)	136 (50.2)	0.127	0.72 (0.46–1.12)
Smoker	68 (51.1)	126 (46.5)	0381	1.20 (0.78–1.86)
Normo-caloric diet	105 (78.9)	210 (77.5)	0.740	1.10 (0.64–1.88)
CVD	35 (26.5)	66 (24.4)	0.639	1.12 (0.67–1.85)
AHT	105 (78.9)	215 (79.3)	0.928	0.98 (0.57–1.70)
Dyslipidemia	83 (62.4)	168 (62)	0.936	1.02 (0.65–1.60)
Nephropathy	10 (7.5)	9 (3.3)	0.061	2.36 (0.84–6.75)
Foot ulcer risk	14 (10.5)	15 (5.5)	0.068	0.5 (0.22–1.16)
Retinopathy	16 (12)	24 (8.9)	0.316	1.41 (0.77–2.88)
Drug therapy	115 (90.6)	253 (95.5)	0.057	0.46 (0.18–1.15)

Abbreviations: AHT, arterial hypertension; ASTN, area with social transformation needs; CVD, cardiovascular disease; OR, odds ratio.

objectives, including health and well-being and reduction of inequalities (Kruk et al., 2018).

The organizational framework of Healthy People 2020 for the evidence-based approach to the social determinants presents five key areas of the social determinants of health, namely: (i) neighborhood and environment built, (ii) health and health care, (iii) social and community context, (iv) education, and (vi) economic stability (Hill-Briggs et al., 2020). In the European Union, the Health 2010 health policy framework is directed toward fighting against inequalities in health with a social basis by empowering the citizens and creating support environments and resilient communities (Asvall, 2000). All of the above evidences the relevance of this topic at the international level.

In our region, this is addressed by paying special attention to the areas identified as with social transformation needs (ASTN). In these areas, within the offer of primary care services, assistance to chronicity is one of the health problems to be prioritized and it, therefore, requires special attention from the aforementioned new double approach: (i) the risk strategies approach, and (ii) the family approach (General Directorate of Health Assistance. Andalusian Health Service, 2004).

This study is the first to show positive results related to the effectiveness of the policies and health organization implemented to mitigate the negative effects generated by the social determinants that are inherent to the most underprivileged sectors of the community on the health outcomes in T2D in an urban area. The main result of the exploratory analysis focuses on a substantial improvement in cardiovascular risk factors, which is related to the main causes of morbidity and mortality in patients with type 2 diabetes. Secondary trends are shown that could point to the fact that these benefits could also be observed in other types of health outcomes for this group of patients.

The profile of the population under study showed a slightly higher proportion of men over women, which coincides with the epidemiological data derived from studies conducted with western and Asiatic populations. Regarding age, we found a range from 38 to 89 years old. Although the age of 45 years has traditionally been established as the threshold of onset for type two diabetes, its

TABLE 3 Differences between patients with adherence to the nursing follow-up program

Adherence to NFP				
Variables	**Yes, *n* (%)**	**No, *n* (%)**	***p*-value**	**OR**
Gender (men)	133 (54.6)	96 (57.1)	0.875	0.97 (0.64–1.49)
ASTN	94 (39.8)	39 (23.2)	<0.001	2.19 (1.38–3.55)
Diet			0.021	
Hypocaloric	24 (10.2)	12 (7.1)		0.76 (0.33–1.65)
Normo-caloric	190 (80.5)	125 (74.4)		1
Hypercaloric	22 (9.3)	31(18.5)		2.14 (1.14–4.10)
Physical Activity			0.264	
Sedentary	3 (1.3)	3 (1.8)		1
Low	112 (47.5)	94 (56.0)		0.85 (0.11–0.48)
Moderate	100 (42.4)	55 (32.7)		0.55 (0.07–4.26)
High	21 (8.9)	16 (9.5)		0.77 (0.09–6.51)
Smoking			0.943	
Smoker	66 (28)	45 (26.8)		0.93 (0.56–1.52)
Ex-smoker	49 (20.8)	34 (20.2)		0.94 (0.54–1.63)
Nonsmoker	121 (51.3)	89 (53)		1
Physical Activity (active)	121 (51.3)	71 (42.3)	0.074	1.44 (0.95–2.15)
Smoker	115 (48.7)	79 (47)	0.735	1.07 (0.71–1.72)
Normo-caloric diet	190 (80.5)	125 (74.4)	0.145	1.42 (0.86–2.34)
CVD	61 (26)	40 (23.8)	0.624	1.12 (0.69–1.83)
AHT	180 (76.3)	140 (83.3)	0.085	0.64 (0.37–1.10)
Dyslipidemia	146 (61.9)	105 (62.5)	0.897	0.97 (0.63–1.50)
Nephropathy	13 (5.5)	6 (3.6)	0.365	1.57 (0.54–5.16)
Foot ulcer risk	18 (7.6)	11 (6.5)	0.679	0.85 (0.35–1.96)
Retinopathy	19 (8.1)	21 (12.5)	0.140	0.61 (0.30–1.25)
Drug therapy	215 (94.3)	153 (93.3)	0.682	1.19 (0.47–2.96)

Abbreviations: AHT, arterial hypertension; ASTN, area with social transformation needs; CVD, cardiovascular disease; NFP, nursing follow-up program; OR, odds ratio.

diagnosis is increasingly frequent below 40 years of age (Magliano et al., 2020).

The profile of T2D patients described in a systematic review that included 4,549,481 individuals was 52.0% men, 47.0% obese, aged 63.6 ± 6.9 years old and with T2D time of 10.4 ± 3.7 years (Einarson et al., 2018), reason why, according to our results, it can be asserted that our study sample follows the general profile of this population.

T2D patients develop macro- and microvascular complications. The former is manifested as CVD whose association with these patients is clear and widely described, being related with risk factors such as AHT and dyslipidemia (Viigimaa et al., 2020). Although these risk factors seem to be quite prevalent in our sample (62% and 79%, respectively), the prevalence of CVD remains lower (25% in our sample) when compared to the 32.2% (53 studies; N = 4,289,140) reported by the aforementioned review (Einarson et al., 2018).

Regarding the microvascular complications, the prevalence of nephropathy observed was 4.7%, a value much lower than the 30%–34% previously reported in our country (Coll-de-Tuero et al., 2012; Rodriguez-Poncelas, 2013) and then those notified globally (Koye, Magliano, Nelson & Pavkov, 2018), which might be influenced by the sample size. In addition, our logistic regression model for this health outcome showed a clear association between the presence of nephropathy and CVD, as previously reported in our area (Rodriguez-Poncelas, 2013).

The reported prevalence of retinopathy in T2D patients is 25.8% and it is associated with the time of disease progression, being 24% for patients with 10 to 15 years of progression (Voigt et al., 2018). Our findings are in consonance with this information since, we observed 25% of retinopathy in patients with around 9 years of progression, with a mean and standard deviation of 11.4 ± 5.32 years in the group of patients with retinopathy and with progression time resulting as a risk factor in our multivariate model for this health outcome.

The social determinants seem to be involved in the control of the disease, being a very important factor to upset the morbidity and mortality balance to the detriment of patients from families with fewer resources (Walker et al., 2014). According to the American

TABLE 4 Logistic multivariate models

HL test	CVD model ($p = 0.762$)		AHT model ($p = 0.526$)		DLP model ($p = 0.999$)	
Variables	**coef**	**OR (CI95%)**	**coef**	**OR (CI95%)**	**coef**	**OR (CI95%)**
Age	0.07Ϯ	1.07 (1.04–1.11)	0.05Ϯ	1.05 (1.02–1.09)		
Dyslipidemia	0.67*	1.95 (1.11–3.57)	1.30Ϯ	3.67 (2.11–6.48)		
Smoking	0.64*	1.89 (1.04–3.49)				
Gender (female)	−1.12Ϯ	0.33 (0.18–0.60)				
AHT	2.63Ϯ	13.89 (4.06–87.35)			1.30Ϯ	2.62 (2.17–6.22)
BMI			0.14Ϯ	1.14 (1.07–1.23)		
CVD			2.70Ϯ	14.88 (4.33–93.99)	0.61*	1.85 (1.09–3.23)
ASTN	−0.46	0.63 (0.23–1.64)	0.47	1.61 (0.54–5.50)	0.1	1.10 (0.51–2.44)
NFP	−0.04	0.96 (0.52–1.79)	0.04	1.04 (0.51–2.12)	0.1	1.1 (0.66–1.86)
ASTN*NFP (interaction)	0.87	2.39 (0.74–8.20)	−0.67	0.51 (0.12–1.90)	−0.16	0.85 (0.32–2.21)
HL test	**Nephropathy Model ($p = 0.773$)**		**Retinopathy Model ($p = 0.948$)**		**Foot type Model ($p = 0.638$)**	
	coef	**OR (CI95%)**	**coef**	**OR (CI95%)**	**coef**	**OR (CI95%)**
CVD	1.48**	4.39 (1.71–11.74)				
Foot type			1.37**	3.93 (1.46–9.94)		
Time of Evolution			0.13Ϯ	1.14 (1.06–1.22)		
Retinopathy					−1.34**	3.83 (1.46–9.36)
Physical Activity					0.96 *	2.62 (1.12–6.87)
ASTN	0.62	1.86 (0.25–10.20)	0.32	1.38 (0.44–3.88)	−0.31	0.73 (0.11–3.11)
NFP	0.15	1.16 (0.30–4.85)	−0.57	0.57 (0.22–1.36)	−0.28	0.76 (0.24–2.22)
ASTN*NFP (interaction)	0.27	1.31 (0.17–13.12)	0.21	1.23 (0.29–5.50)	1.29	3.64 (0.6031.90)

Note: Significance codes: under 0.001 'Ϯ', 0.001 to 0.01 '**', 0.01 to 0.05 '*'.

Abbreviations: AHT, arterial hypertension; ASTN, area with social transformation needs; BMI, body mass index; CI95%, confidence interval 95%; coef, coefficient; CVD, cardiovascular disease; DLP, dyslipidemia; HbA1, glycohemoglobin; HL test, Hosmer–Lemeshow test; NPF, nursing follow-up program; OR, odd ratio.

Diabetes Society, the medical expenses for this type of patients are 2.3 times above the mean. In this study, low-income families can face problems finding good management of the disease (American Diabetes Association, 2018). Due to the complexity of the self-care regimes inherent to T2D, patients with low schooling levels find greater difficulties to implement them, with negative repercussions on their health outcomes (Dupre et al., 2015).

The social and community context is also a factor that mars the quality of the health outcomes in diabetic patients, which is made evident by a number of studies conducted by nurses indicating that empowerment and social support are positive predictive factors for glycemic control and to maintain life habits which favor the control of T2D (Arda Sürücü et al., 2018).

The patients from ASTN belong to low-income families and with marked economic instability, their schooling level is low, and the social and community context in which they live is not adequate to favor proper self-management of their disease. Thus, it was expectable that we would observe differences in the disease control variables or prevalence of complications regarding the patients from conventional zones. However, we have not found significant differences between both population groups for any of these variables in the bivariate analysis, and belonging to an ASNT has not shown results as a predictive factor in any of the multivariate models implemented either. Thus, in the absence of specific interventions, health inequalities would be expected results. However, the results (Tables 2, 3 and 4) show that there were no health inequalities for patients due to belonging to one or another type of area which mean that the intervention implemented in ASTN has successfully equaled the health outcomes of citizens of conventional areas.

The profile of the patients analyzed is similar to the one described in larger studies and, sometimes, such as at the CVD level, we observed better results regarding the previously reported global prevalence values and, also, against the expected, the health outcomes in people from ASTNs are comparable to those from conventional zones.

Strengths and limitations

This is an observational study and, as such, it has the limitations inherent to this design to establish causal relationships. However, this

design is cost-effective and turns out to be useful if the objective is to determine prevalence values or to identify risk factors, as in our case. A retrospective design was considered appropriate to avoid possible artifacts derived from the collapse of primary care that the COVID-19 pandemic has caused in our region.

The main limitation has been the nonrandomized exploratory design with a sample size that has not allowed sufficient power to evaluate all the proposed health outcomes.

Once a partial success has been visualized, this study opens the door to the organization of subsequent studies with better methodologies that allow confirming the results presented and determining if the success definitively extends to other health outcomes.

Given all of the above, and although the profile of our sample is similar to the one reported by studies that included samples which were 10,000 times larger, we cannot ensure the external validity of our study. However, we encourage other public health services to implement programs similar to the one described with the relevant socioeconomic and cultural adaptations, since they could be useful to alleviate the effect of social determinants on the health of their most vulnerable population.

CONCLUSION

This is the first study conducted in southern Spain that shows, against the expected, an equalization of health outcomes related with cardiovascular risk, among T2D patients from socially depressed environments when compared to those who live in conventional areas in our society. This allows showing the effectiveness of implementing health policies in primary care focused on the families and on the risk strategies when it comes to mitigating or annulling the negative effect of the social determinants in health for this collective group. In addition, it contributes indirect evidence about the importance of the follow-up programs led by primary care nurses, which might exert a positive influence on the fulfillment of such objectives, at least in the typology of patients analyzed.

To introduce a risk strategy and to adopt a family approach, contemplating the sociocultural and educational differences that diversely affect men and women in their health status and perception has proven to be useful in reducing health disparities due to social determinants in patients with type 2 diabetes. These premises should be taken into account in nursing practice, both in care planning and by those nurses who participate in the development, implementation, or evaluation of health policies.

AUTHOR CONTRIBUTIONS

Barrios Quinta, AN: Conceptualization, clinical information recording, Data curation, Writing—original draft, Writing—original draft, Writing—review and editing. Morilla Romero de la Osa, R: Methodology, Data curation, Formal analysis, Writing-original draft, Writing—review and editing. Bueno Ferrán, M: Conceptualization, Methodology, Writing—original draft, Writing—review and editing.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

CLINICAL RESOURCES

Area with Social Transformation Needs [Zonas con necesidades de trasformación social]https://www.ASTN.es/

School of patients. Andalusian Health and Families Council: Diabetes [escuela de pacientes de la consejería de salud y Familias de Andalucía].

https://escueladepacientes.es/mi-enfermedad/diabetes/diabetes

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REFERENCES

American Diabetes Association. (2018). Economic costs of diabetes in the U.S. in 2017. *Diabetes care*, *41*(5), 917–928. https://doi.org/10.2337/dci18-0007

Arda Sürücü, H., Büyükkaya Besen, D., & Erbil, E. Y. (2018). Empowerment and social support as predictors of self-care behaviors and glycemic control in individuals with type 2 diabetes. *Clinical Nursing Research*, *27*(4), 395–413. https://doi.org/10.1177/1054773816688940

Asvall, J. (2000). Health for all in the 21st century a policy framework for the WHO European Region. *International Journal of Occupational Medicine and Environmental Health*, *13*, 5–13.

Bech, L. K., Borch Jacobsen, C., Mathiesen, A. S., & Thomsen, T. (2019). Preferring to manage by myself: A qualitative study of the perspectives of hardly reached people with type 2 diabetes on social support for diabetes management. *Journal of Clinical Nursing*, *28*(9–10), 1889–1898. https://doi.org/10.1111/jocn.14783

Borrell, C., Pons-Vigués, M., Morrison, J., & Díez, È. (2013). Factors and processes influencing health inequalities in urban areas. *Journal of Epidemiology and Community Health*, *67*(5), 389–391. https://doi.org/10.1136/JECH-2012-202014

Coll-de-Tuero, G., Mata-Cases, M., Rodriguez-Poncelas, A., Pepió, J. M., Roura, P., Benito, B., Franch-Nadal, J., & Saez, M. (2012). Chronic kidney disease in the type 2 diabetic patients: Prevalence and associated variables in a random sample of 2642 patients of a Mediterranean area. *BMC Nephrology*, *13*, 87. https://doi.org/10.1186/1471-2369-13-87

Dupre, M. E., Silberberg, M., Willis, J. M., & Feinglos, M. N. (2015). Education, glucose control, and mortality risks among U.S. older adults with diabetes. *Diabetes Research and Clinical Practice*, *107*(3), 392–399. https://doi.org/10.1016/j.diabres.2014.12.013

Egea, C., Nieto, J. A., Domínguez, J., & González, R. A. (2008). *Vulnerabilidad del tejido social de los barrios desfavorecidos de Andalucia*. Vulnerabilidad del tejido social de los barrios desfavorecidos de Andalucia.

Einarson, T. R., Acs, A., Ludwig, C., & Panton, U. H. (2018). Prevalence of cardiovascular disease in type 2 diabetes: A systematic literature review of scientific evidence from across the world in 2007-2017. *Cardiovascular Diabetology*, *17*(1), 83. https://doi.org/10.1186/s12933-018-0728-6

Equality and Social Policies Andalussian Council (2018). *The Andalusian Regional Strategy for Social Cohesion and Inclusion. Intervention in*

Disadvantaged Areas [La Estrategia Regional Andaluza para la Cohesión e Inclusión Social. Intervención en Zonas Desfavorecidas (ERACIS)]. Ministry of Equality and Social Policies. https://doi.org/10.37230/cytet.2021.m21.09

Fan, H., Wang, J., & Gu, X. (2019). Association between social determinants and the presence of essential hypertension in type 2 diabetes mellitus patients. *Australian Journal of Primary Health*, *25*(2), 146–151. https://doi.org/10.1071/PY18091

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149–1160.

General Directorate of Health Assistance. Andalusian Health Service. (2004). Health care in areas with social transformation needs [Atención a la salud en zonas con necesidades de transformación social]. https://www.ASTN.es/course/view.php?id=4

Hill-Briggs, F., Adler, N. E., Berkowitz, S. A., Chin, M. H., Gary-Webb, T. L., Navas-Acien, A., Thornton, P. L., & Haire-Joshu, D. (2020). Social determinants of health and diabetes: A scientific review. Diabetes Care, 44(1), 258–279. Advance online publication. https://doi.org/10.2337/dci20-0053

Koye, D. N., Magliano, D. J., Nelson, R. G., & Pavkov, M. E. (2018). The Global Epidemiology of Diabetes and Kidney Disease. *Advances in chronic kidney disease*, *25*(2), 121–132. https://doi.org/10.1053/j.ackd.2017.10.011

Kruk, M. E., Gage, A. D., Arsenault, C., Jordan, K., Leslie, H. H., Roder-DeWan, S., Adeyi, O., Barker, P., Daelmans, B., Doubova, S. V., English, M., García-Elorrio, E., Guanais, F., Gureje, O., Hirschhorn, L. R., Jiang, L., Kelley, E., Lemango, E. T., Liljestrand, J., … Pate, M. (2018). High-quality health systems in the sustainable development goals era: Time for a revolution. *The Lancet. Global Health*, *6*(11), e1196–e1252. https://doi.org/10.1016/S2214-109X(18)30386-3

Li, X., Cao, X., Guo, M., Xie, M., & Liu, X. (2020). Trends and risk factors of mortality and disability adjusted life years for chronic respiratory diseases from 1990 to 2017: Systematic analysis for the global burden of disease study 2017. *BMJ (Clinical Research ed.)*, *368*, m234. https://doi.org/10.1136/bmj.m234

Magliano, D. J., Sacre, J. W., Harding, J. L., Gregg, E. W., Zimmet, P. Z., & Shaw, J. E. (2020). Young-onset type 2 diabetes mellitus - implications for morbidity and mortality. Nature Reviews. *Endocrinology*, *16*(6), 321–331. https://doi.org/10.1038/s41574-020-0334-z

Morton, S., Pencheon, D., & Squires, N. (2017). Sustainable development goals (SDGs), and their implementation: A national global framework for health, development and equity needs a systems approach at every level. *British Medical Bulletin*, *124*(1), 81–90. https://doi.org/10.1093/bmb/ldx031

Patel, M. R. (2020). Social determinants of poor management of type 2 diabetes among the insured. Current Diabetes Reports, 20(11). 10.1007/s11892-020-01354-4, 67

Rodriguez-Poncelas, A., Garre-Olmo, J., Franch-Nadal, J., Diez-Espino, J., Mundet-Tuduri, X., Barrot-De la Puente, J., Coll-de Tuero, G., & RedGDPS Study Group. (2013). Prevalence of chronic kidney disease in patients with type 2 diabetes in Spain: PERCEDIME2 study. *BMC Nephrology*, *14*, 46. https://doi.org/10.1186/1471-2369-14-46

Tornero Patricio, S., Charris-Castro, L., Granero Asencio, M., & Daponte Codina, A. (2017). Influencia del código postal en las hospitalizaciones pediátricas en Sevilla [influence of postcode on paediatric admissions in Seville]. *Anales de pediatria (Barcelona, Spain: 2003)*, *87*(6), 320–329. https://doi.org/10.1016/j.anpedi.2016.12.001

Valdés, S., García-Torres, F., Maldonado-Araque, C., Goday, A., Calle-Pascual, A., Soriguer, F., Castaño, L., Catalá, M., Gomis, R., Rojo-Martínez, G., & Di@bet.es study group. (2014). Prevalence of obesity, diabetes and other cardiovascular risk factors in Andalusia (southern Spain). Comparison with national prevalence data. The di@bet.es study. *Revista espanola de cardiologia (English ed.)*, *67*(6), 442–448. https://doi.org/10.1016/j.rec.2013.09.029

Vandenbroucke, J. P., Von Elm, E., Altman, D. G., Gøtzsche, P. C., Mulrow, C. D., Pocock, S. J., Poole, C., Schlesselman, J. J., Egger, M., & Initiative, S. (2014). Strengthening the reporting of observational studies in epidemiology (STROBE): Explanation and elaboration *. *International Journal of Surgery*, *12*(12), 1500–1524. https://doi.org/10.1016/j.ijsu.2014.07.014

Viigimaa, M., Sachinidis, A., Toumpourleka, M., Koutsampasopoulos, K., Alliksoo, S., & Titma, T. (2020). Macrovascular complications of type 2 diabetes mellitus. *Current Vascular Pharmacology*, *18*(2), 110–116. https://doi.org/10.2174/1570161117666190405165151

Voigt, M., Schmidt, S., Lehmann, T., Köhler, B., Kloos, C., Voigt, U. A., Meller, D., Wolf, G., Müller, U. A., & Müller, N. (2018). Prevalence and progression rate of diabetic retinopathy in type 2 diabetes patients in correlation with the duration of diabetes. *Experimental and clinical endocrinology and diabetes: Official journal, German Society of Endocrinology [and] German Diabetes Association*, *126*(9), 570–576. https://doi.org/10.1055/s-0043-120570

Walker, R. J., Smalls, B. L., Campbell, J. A., Strom Williams, J. L., & Egede, L. E. (2014). Impact of social determinants of health on outcomes for type 2 diabetes: A systematic review. *Endocrine*, *47*(1), 29–48. https://doi.org/10.1007/s12020-014-0195-0

Wu, S. F. V., Young, L. S., Yeh, F. C., Jian, Y. M., Cheng, K. C., & Lee, M. C. (2013). Correlations among social support, depression, and anxiety in patients with type-2 diabetes. *Journal of Nursing Research*, *21*(2), 129–138. https://doi.org/10.1097/jnr.0b013e3182921fe1

How to cite this article: Barrios Quinta, A. M., Morilla Romero de la Osa, R. & Bueno Ferrán, M. (2022). Reducing health inequalities among most disadvantaged type 2 diabetes patients: A cross-sectional exploratory pilot study. *Journal of Nursing Scholarship*, *54*, 668–677. https://doi.org/10.1111/jnu.12781