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Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019

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Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019

Marco Trabucco Aurilio^{1,2*}, Maria Ida Maiorino^{3,4*}, Simone Gazzillo⁶, Lorenzo Scappaticcio³, Miriam Longo^{3,5}, Claudia Nardone⁶, Luca Coppeta⁷, Raffaele Migliorini¹, Francesco Saverio Mennini^{6,8}, Giuseppe Bellastella^{3,5}, Dario Giugliano^{3,5}, Katherine Esposito^{3,4}

*MTA and MIM contributed equally to this paper

1. Office of Medical Forensic Coordination, Italian National Social Security Institute (INPS), Rome, Italy.
2. Department of Medicine and Health Sciences, University of Molise, Campobasso, Italy.
3. Department of Advanced Medical and Surgical Sciences, University of Campania Luigi Vanvitelli, Naples, Italy
4. Unit of Diabetes, University of Campania Luigi Vanvitelli, Naples, Italy
5. Division of Endocrinology and Metabolic Diseases, University of Campania Luigi Vanvitelli, Naples, Italy
6. CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics, University of Rome Tor Vergata, Rome, Italy
7. Department of Occupational Medicine, University of Rome Tor Vergata, Roma, Italy
8. Institute for Leadership and Management in Health, Department of Accounting and Finance, Kingston University, London, UK.

Corresponding author

Maria Ida Maiorino, Unit of Diabetes, Department of Advanced Medical and Surgical Sciences, University of Campania "Luigi Vanvitelli", Piazza Luigi Miraglia 2, 80138 Naples, Italy
Tel/fax: +39 0815665289/0815665032
Email: mariaida.maiorino@unicampania.it

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Abstract

Objectives: The aim of this study is to estimate the average number of claims for social security benefits from workers with diabetes-related disability.

Setting: The study analysed the trends and the breakdown of all claims for social security benefit with Diabetes as primary diagnosis from 2009 to 2019 in the database of the Italian Social Security Institute (INPS).

Participants: We selected all the applications with the 250.xx ICD9-CM diagnosis code from 2009 to 2019. The ratio between accepted or rejected claims for both Ordinary Incapacity Benefit (OIB) and Disability Pension (DP) and total submitted claims in the same year was computed. 40,800 requests for social security benefits having diabetes as primary diagnosis were submitted, with an annual increment of 30% per year.

Results: Throughout the study decade, there was a higher rate of rejected (67.2%) than accepted (32.8%) applications. Among the accepted requests most of them (30.7%) were recognized as OIB and the remaining 2.1% were recognized as DP. When related to the total number of claims presented per year, there was a 8.8% decrease of rejected applications, associated with a 20.6% increase of overall acceptance rate. As regards time trends, the overall rise of submitted requests from 2009 to 2019 led to an increase of both the rejected (+18%) and the accepted (+61% for OIB, +11% for DP) applications. The higher rate of accepted requests referred to workers of 51-60 years, with 52% of admitted applications.

Conclusions: Between 2009 and 2019, there was a significant increment of the applications for social security benefits due to diabetes in Italy, with a consequent increase of those accepted, mainly represented by the OIBs.

Article summary

Strengths and limitations of this study

The strengths include:

- long timeframe analyzed (11 years);
- the acquisition of data at national country level;
- the differentiation between the two types of social security benefits provided in Italy;
- the consideration of different age-groups of workers applying for social security benefits.

The main limitation refers:

- to the lack of information regarding the diabetes-related complications or risk factors which induced workers to apply for a social security benefits.

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Key question

What is already known?

- Diabetes represents an important cause of morbidity and disability during the working age, leading to lost productivity and increased economic burden.
- The supply of social security benefits due to diabetes-related disability released by the Social Security System in Italy participate in increasing the indirect cost related to diabetes.

What are the new findings?

- In the first study estimating the number of claims for any social security benefits presented by people with diabetes in Italy, in the years 2009-2019, a global increase of the number of applications submitted in the considered decade was reported.
- When related to the total number of claims presented per year, there was a 8.8% decrease of rejected applications, associated with a 20.6% increase of overall acceptance rate.
- The higher number of admitted applications was referred to people aged 51-60 years.

What do the new findings imply?

- Diabetes continues to be a relevant cause of disability in Italy, despite the availability of glucose-lowering drugs which have proved to be safe protective against major cardiovascular events in people at high risk of vascular complications.
- Efforts for an efficient secondary prevention are needed to reduce the risk of the chronic vascular complications of the growing number of persons with diabetes, reducing the economic burden related to indirect costs associated with this chronic disease.

Introduction

Between 2010 and 2015, a 25% increase in diabetes-related complications, including acute myocardial infarction, stroke, and lower extremities amputations, occurred in young adults (aged 18-44 years) and middle-aged adults (aged 45-64 years) in United States (1), confirming that diabetes is responsible for a high burden of morbidity and disability due to chronic complications particularly in the working age (1,2). Interestingly, data from the Global Burden of Diseases showed that, in Italy, from 1995 to 2017, diabetes passed from the seventh to the fourth rank for the causes of disability-adjusted life-years (DALYs), which express the number of years lost due to ill-health, disability or early death (3).

Diabetes has adverse effects on ability to work, leading to lost productivity and increased economic burden (4,5). In Italy, the Social Security System (SSS) is characterized by a dual structure that includes, on one hand, welfare and civil incapacity care benefits, and, on the other, social security benefits in a narrow sense. With regard to the latter, the SSS offers economic benefits for workers with disability and suffering from chronic physical and/or mental incapacity, largely financed by their contributions. Specifically, all work categories registered with the National Institute of Social Security are entitled, in case of an accident or illness, to benefit, following an application, for one of the two social security benefits provided: the Ordinary Incapacity Benefit (OIB), for those whose work capacity is reduced to less than a third (disability between 67% and 99%), and the Disability Pension (DP) in favor of those for whom it is ascertained the absolute and permanent impossibility to carry out any work activity (100% disability) (6). The Italian Law no. 222/84 (7) sets the requirements for access to OIB and DP (Table S1). Both OIB and DP prevent income losses for people who lose their ability to work before they become eligible for old-age pensions. However, they may be misused as an early retirement support even if the ability to work is not limited.

Little attention has been given to changes across decades in diabetes-related disability in the working-age population, despite its importance for health monitoring and social policy. The supply

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of social security benefits participate in increasing the indirect cost related to diabetes, which has been estimated of about € 10 billion in Italy (8). Moreover, acknowledging the number of requests for social security benefits over time could be useful to evaluate the impact of diabetes on working ability, providing also an indirect estimate of the effectiveness of diabetes treatment.

The aim of this study is to estimate the average number of claims for social security benefits from workers with diabetes-related disability between 2009 and 2019 in Italy. Data were gathered from the National Social Security System from each region and presented as a whole.

Methods

The data used in the study came from the database of the National Social Security Institute (INPS), that contains all the claims submitted for each benefit and the related judgments (approval or rejection) expressed by medical managers. These include the indication of the prevailing diagnosis and any secondary diagnosis, based on the international classification of diseases, ninth revision (ICD9-CM) (9). The acceptance or rejection of the claim occurs as a result of an overall assessment of physical and mental health of the applicant by the INPS’s Medical Legal Centres. The assessment is based exclusively on medical forensic criteria and does not include any examination of socio-economic or other types of factors.

In this study we took into consideration all the claims received by the INPS for the acknowledge of a social security benefit with Diabetes as primary diagnosis. In this case, all the applicants suffering from Diabetes were selected with the 250.xx ICD9-CM diagnosis code. Starting from these applications, the study analysed the trends and the breakdown of all claims from 2009 to 2019 by medical manager judgment. Further descriptive analyses were conducted using some information from the applications, for example the age of applicants, that was used to group requests by specific age groups. Specifically, through the age of diabetes patients who submitted a claim, an age grouping of the accepted applications was carried out creating a new categorical variable with 5 possible values: <30 years, 30-40 years, 41-50 years, 51-60 years and >60 years. The objective of

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3 this analysis was to investigate which age groups were most affected by diabetes. Also, this analysis
4 allowed to understand in which phase of their working life the workers, as well as diabetes patients,
5 were more likely to receive a social security benefit.
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10 Moreover, the percentage distribution of total submitted claims by judgment was calculated for
11 each study year. Specifically, we calculated the ratio between accepted claims (separately for both
12 social security benefits) and total submitted claims in the same year. Similarly, the ratio for rejected
13 applications was calculated. The aim of these ratios was to look at the trends of rejected and
14 accepted requests of social security benefits for Diabetes year by year, regardless of the trend of
15 total submitted applications, that surely influenced the trends of absolute numbers of accepted and
16 rejected claims. This analysis allowed to observe the trend over time of both acceptance and
17 rejection rates.
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28 The present study was conducted according to the The REporting of studies Conducted using
29 Observational Routinely-collected health Data (RECORD) Statement (10). The RECORD checklist
30 is reported in the Supplementary data (Table S2).
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37 **Patient and public involvement**

38 Patients or the public were not involved in the design, or conduct, or reporting, or dissemination
39 plans of our research.
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46 **Results**

47 Between the years 2009 and 2019, 40,800 requests for social security benefits having diabetes as
48 primary diagnosis were submitted, corresponding to an average number of applications per year of
49 more than 3,700, with an annual increment of 30% per year.
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56 **Figure 1**, shows the total rate of requests for social security benefits according to the final
57 judgment. Throughout the study decade, there was a higher rate of rejected than accepted
58 applications. Specifically, 67.2% of requests was rejected, corresponding to an average number of
59 applications.
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refused applications per year of about 2,500. Among the accepted requests (32.8%), most of them (30.7%) were recognized as OIB and the remaining 2.1% were recognized as DP, corresponding to a mean number of admitted applications per year of more than 1,100 for OIB and about 80 for DP. As regards time trends, the overall rise of submitted requests from 2009 to 2019 led to an increase of both the rejected (+18%) and the accepted (+61% for OIB, +11% for DP) applications (Figure 2).

The percentage distribution of applications according to the final judgment between 2009 and 2019 is depicted in Table 1. There was a 8.8% decrease of rejected applications, associated with a 20.6% increase of overall acceptance rate. With regard to the type of social security benefits, a 23% increase of accepted applications for OIB and a 14.8% reduction of accepted requests for DP were observed.

In order to classify the accepted applications per age, we considered the following specific age groups: <30 years, 30-40 years, 41-50 years, 51-60 years and >60 years (Figure 3). The higher rate of accepted requests referred to workers of 51-60 years, with 52% of admitted applications, corresponding to about 600 accepted demands per year from 2009 to 2019. The second most relevant age group was that including workers over 60 years old, with 32% of accepted applications and about 360 admitted demands per year, followed by the group of individuals aged 41-50 years, with 13% of accepted applications and about 150 admitted requests per year. No application was accepted for workers under 30 years.

Discussion

To the best of our knowledge, this is the first study estimating the number of claims for any social security benefits presented by people with diabetes in Italy, in the years 2009-2019. Data have been recorded at national level, considering the applications having “diabetes” as the principal diagnosis. We found a global increase of the number of applications submitted in the considered decade, with most of them (67.2%) being rejected. However, when related to the total number of claims presented per year, we recorded a decrease over time of the rejected applications associated with an

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3 increase of those accepted, in favor of the OIBs than DP. This is relevant, as the assessment of the
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5 state of invalidity or inability for work of people who apply for a social security benefit is on charge
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7 of the National Institute of Social Security, based solely on medico-legal criteria and not on income-
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9 related conditions. Of note, the higher number of admitted applications was referred to people aged
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11 51-60 years, suggesting that diabetes does not affect only older workers, who represented the
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13 second most relevant age group interested.
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17 The increase in the total number of applications for social security benefits submitted between
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19 2009 and 2019 suggest that diabetes continues to be felt as a relevant cause of morbidity and
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21 disability during the working age. This is also substantiated by the increase over time in the number
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23 of accepted requests, which were related primarily to the OIBs.
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27 There are different reasons which could explain these findings. First, the incidence of type 2
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29 diabetes, which accounts approximately 90% of the total cases of diabetes, is rising worldwide (11),
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31 with increasing prevalence in people younger than 45 years old, due to the global spread of
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33 unhealthy lifestyles and cardiometabolic risk factors (12), and leading to a significant and premature
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35 morbidity. Second, diabetes is associated with macrovascular and microvascular complications
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37 which are responsible for the major burden of disability and reduced quality of life in people who
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39 are affected (13-15). Macrovascular complications, which result in an increased risk of major
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41 adverse cardiovascular events (coronary heart disease, stroke, peripheral artery disease), are
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43 influenced by other cardiometabolic risk factors, including smoking, obesity, hypertension and
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45 hyperlipidemia (16). Microvascular complications, which are strictly related to hyperglycemia,
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47 affect three classical diabetes microvascular target tissues (the eye, the kidney, and the peripheral
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49 nervous system), but brain, myocardium, skin, and other tissues are also involved (17). Both
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51 macrovascular and microvascular diabetic complications can be preventable through effective
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53 glucose control and aggressive treatment of cardio-metabolic risk factors. Reaching these
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55 achievements is still challenging (18), keeping in mind that intensive glucose control is associated
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57 only with a significant 9% reduction of major cardiovascular events (MACE), leaving a certain
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“residual vascular risk,” which persists high despite the attainment of near-to-normal HbA1c targets (19). Interestingly, in different longitudinal cohort studies, diabetes was associated with a mean twofold increased risk of DP (20,21), with obesity (20) or cerebrovascular diseases (21) as major contributing factors. Third, despite the availability, of glucose-lowering drugs which have proved to be safe (DPP-4 inhibitors) or protective [GLP-1 receptor agonists (GLP-1RAs) and SGLT-2 inhibitors] against major cardiovascular events in diabetic people at high risk of vascular complications (22-24), these drugs remain underused, being still confined to less than 15% of the total number of treated diabetic people (18, 25, 26).

Studies investigating the request or the likelihood of obtaining a social security benefit for diabetes in the working age are lacking. In random samples of Finnish non-retired residents aged 18-64 years, older age increased the odds of both applying for and being awarded pension, whereas a lower socioeconomic status was associated with a greater probability of disability pension applications but also a lower probability of being awarded (27). Data of participants aged 50–65 years from three large observational studies demonstrated that both self-reported working disability and DP vary significantly among European countries or United States (28). Variables influencing the uptake of social security benefits include health and sociodemographic circumstances, and the national policy guiding the generosity of the Social Security Institution (28).

The strengths of this study include the long timeframe analyzed (11 years), the acquisition of data at national country level, the differentiation between the two types of social security benefits provided in Italy, the consideration of different age-groups of workers applying for social security benefits. The main limitation refers to the lack of information regarding the diabetes-related complications or risk factors which induced workers to apply for a social security benefits. Despite recent findings have reported conflicting evidences regarding the occupational risks for diabetic workers, policies that disqualify workers with diabetes are both unnecessary and harmful in most of occupational fields. Assessing occupational hazards and fitness for work in those subjects it is crucial to perform an individualized evaluation of the worker including consideration regarding

the risk of hypoglycemia, treating clinician, and, if needed, availability of alternative work accommodations.

Conclusions

This the first study reporting that, between 2009 and 2019, there was a substantial rise of the applications for social security benefits due to diabetes in Italy, with a consequent increase of those accepted, mainly represented by the OIBs. Since diabetes complications are preventable through stringent glycemic control and improvement of cardiovascular risk factors, major health and social gains would be made if efficient secondary prevention could improve the prognosis for the large and growing number of persons with diabetes.

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3 **Data availability statement**
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5 All data relevant to the study are included in the article.
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10 **Ethics approval**
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12 Patient consent for publication was not required considering that we only extracted data from
13 anonymous electronic chart through diseases codes and without any personal contact with patient.
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19 **Contributors**
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21 MTA, MIM, DG and KE developed the original research idea and drafted the manuscript.
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23 SG, CN and FSM carried out the analysis and contributed to revising the manuscript critically for
24 important intellectual content. LS, ML, LC, RM and GB, contributed to data analysis and writing
25 and editing the draft. All authors edited the manuscript and agreed on the final version of the
26 manuscript.
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42 **Competing interests**
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44 None declared.
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Table 1. Percentage distribution by judgment and trend of applications presented for social security benefits with diabetes as primary diagnosis.

Year	Rejected/ Submitted (%)	OIBs/ Submitted (%)	DP / Submitted (%)	Accepted/ Submitted (%)
2009	70,0%	27,6%	2,4%	30,0%
2010	71,0%	26,3%	2,7%	29,0%
2011	71,6%	26,5%	2,0%	28,4%
2012	69,2%	28,7%	2,0%	30,8%
2013	70,9%	27,4%	1,7%	29,1%
2014	69,3%	28,8%	1,8%	30,7%
2015	65,8%	32,1%	2,0%	34,2%
2016	62,3%	35,5%	2,1%	37,7%
2017	63,2%	34,6%	2,2%	36,8%
2018	66,0%	32,1%	1,9%	34,0%
2019	63,8%	34,1%	2,1%	36,2%
% variation 2009-2019	-8,8%	23,7%	-14,8%	20,6%

DP, Disability pension; OIBs, Ordinary incapacity benefits.

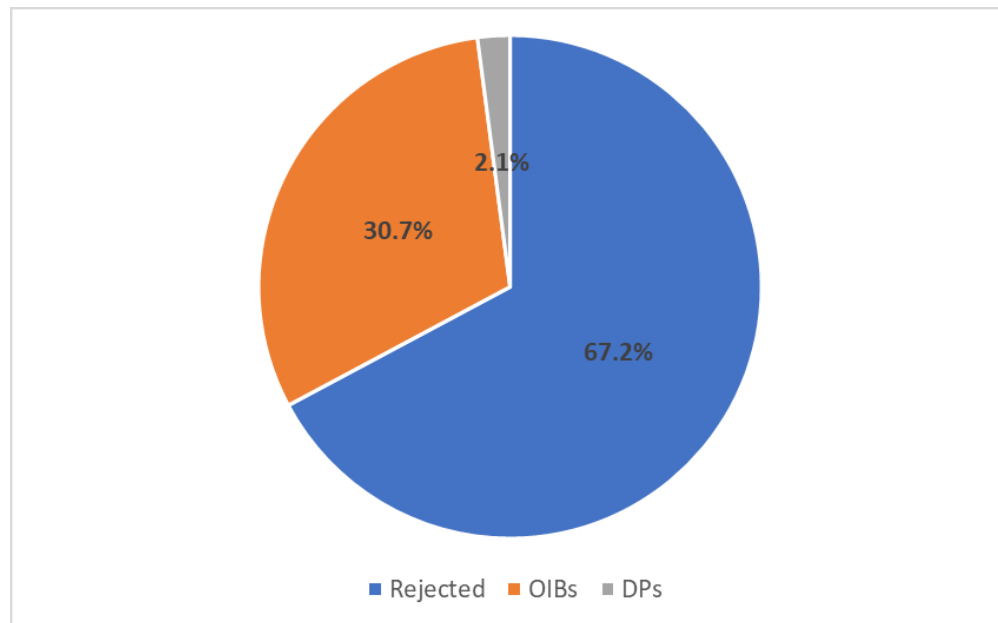
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Legend to figures

Figure 1. Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

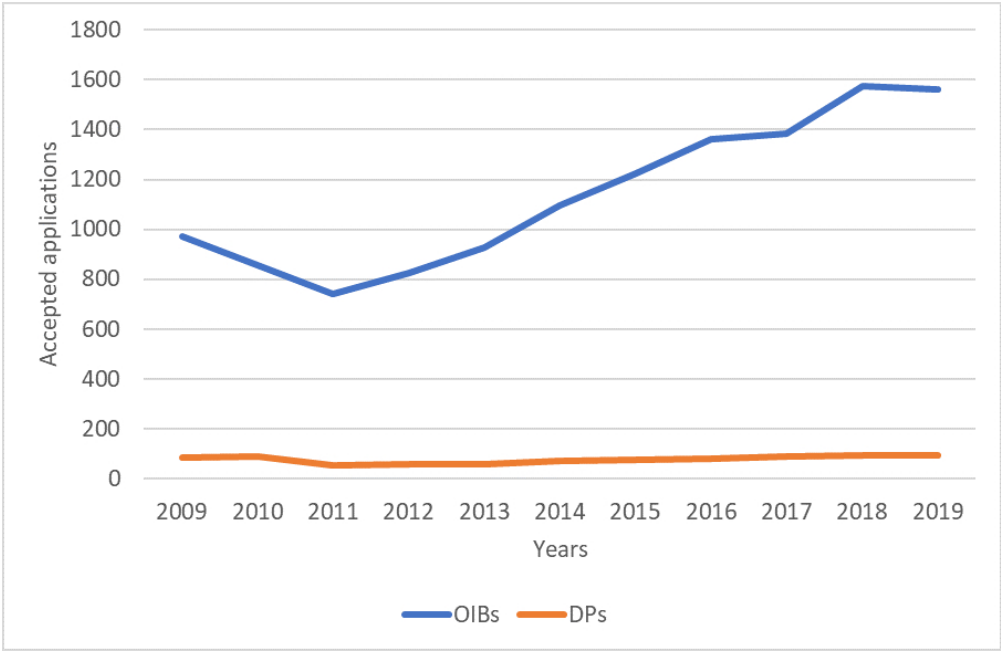
Figure 2. Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

Figure 3. Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.



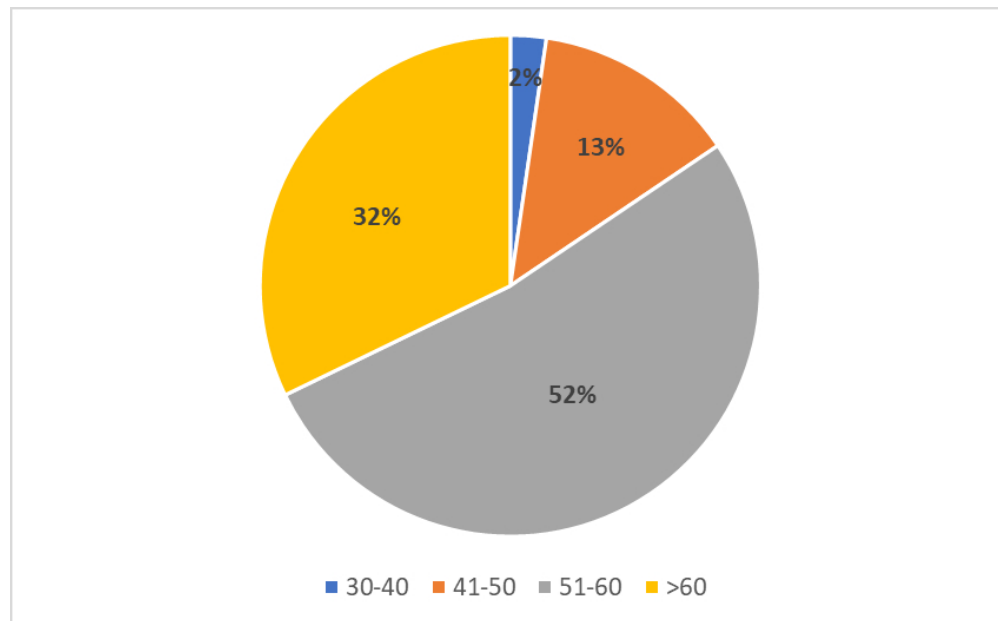
Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

71x44mm (300 x 300 DPI)



Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

76x49mm (300 x 300 DPI)



Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.

71x44mm (300 x 300 DPI)

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Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019

Supplementary file

Table S1.....2

Table S2.....3

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Table S1. Content of Italian Law no. 222/84 (7)

Both OIB and DP require at least 260 weekly contributions (5 years of contributions and insurance), of which 156 (3 years of contributions and insurance) in the 5 years prior to the date of the submitted claim. Given the partial loss of working capacity, no cessation of working activity is needed to access the OIB. The DP, instead, due to the total and permanent inability of who submit the claim, requires: cessation of any kind of working activity, removal from worker category lists, cancellation of membership of professional bodies, renouncing of payments covered by obligatory unemployment insurance and any other replacement or supplement to your salary. Following an overall assessment of the physical and mental health of the applicant, the Medical Legal Centres of the INPS approve the request, providing the benefit based on the presence of one or more disabling diseases.

Table S2. The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found		<p>RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.</p> <p>RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.</p> <p>RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.</p>	<p>1-2</p> <p>1-2</p> <p>NA</p>
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			5-6
Objectives	3	State specific objectives, including any prespecified hypotheses			6
Methods					

Study Design	4	Present key elements of study design early in the paper			6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			6-7
Participants	6	<p><i>(a) Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p><i>(b) Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching</p>		<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>6</p> <p>NA</p> <p>NA</p>

		criteria and the number of controls per case			
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	5
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group			5-6
Bias	9	Describe any efforts to address potential sources of bias			6
Study size	10	Explain how the study size was arrived at			NA
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why			5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding			5-6

		<p>(b) Describe any methods used to examine subgroups and interactions</p> <p>(c) Explain how missing data were addressed</p> <p>(d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed</p> <p><i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed</p> <p><i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy</p> <p>(e) Describe any sensitivity analyses</p>			
Data access and cleaning methods		..		<p>RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.</p> <p>RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.</p>	6
Linkage		..		<p>RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of</p>	6

				linkage quality evaluation should be provided.	
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram		RECORD 13.1: Describe in detail the selection of the persons included in the study (i.e., study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	7
Descriptive data	14	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (e.g., average and total amount)			NA
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome events or			7-8

		<p>summary measures over time</p> <p><i>Case-control study</i> - Report numbers in each exposure category, or summary measures of exposure</p> <p><i>Cross-sectional study</i> - Report numbers of outcome events or summary measures</p>			
Main results	16	<p>(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included</p> <p>(b) Report category boundaries when continuous variables were categorized</p> <p>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period</p>			7-8
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses			7-8
Discussion					

Key results	18	Summarise key results with reference to study objectives			8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	10
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			8-10
Generalisability	21	Discuss the generalisability (external validity) of the study results			10
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			NA
Accessibility of protocol, raw data,		..		RECORD 22.1: Authors should provide information on how to access any supplemental information	12

and programm ing code				such as the study protocol, raw data, or programming code.	
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BMJ Open

Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019: a nationwide retrospective study

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Complete List of Authors:	<p>Aurilio, Marco Trabucco; Italian National Social Security Institute (INPS), Office of Medical Forensic Coordination; University of Molise, Department of Medicine and Health Sciences</p> <p>Maiorino, Maria Ida; University of Campania Luigi Vanvitelli Department of Advanced Medical and Surgical Sciences</p> <p>Mennini, Francesco Saverio; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics; Kingston University, Department of Accounting and Finance</p> <p>Scappaticcio, Lorenzo; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences</p> <p>Longo, Miriam; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p> <p>Nardone, Claudia; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics</p> <p>Coppeta, Luca; University of Rome Tor Vergata, Department of Occupational Medicine</p> <p>Gazzillo, Simone; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics</p> <p>Migliorini, Raffaele; Italian National Social Security Institute (INPS), Office of Medical Forensic Coordination</p> <p>Bellastella, Giuseppe; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p> <p>Giugliano, Dario ; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences</p> <p>Esposito, K. ; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p>
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Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019: a nationwide retrospective study

Marco Trabucco Aurilio^{1,2*}, Maria Ida Maiorino^{3,4*}, Francesco Saverio Mennini^{5,6}, Lorenzo Scappaticcio³, Miriam Longo^{3,4}, Claudia Nardone⁵, Luca Coppeta⁷, Simone Gazzillo⁵, Raffaele Migliorini¹, Giuseppe Bellastella^{3,4}, Dario Giugliano³, Katherine Esposito^{3,4}

*MTA and MIM contributed equally to this paper

1. Office of Medical Forensic Coordination, Italian National Social Security Institute (INPS), Rome, Italy.
2. Department of Medicine and Health Sciences, University of Molise, Campobasso, Italy.
3. Department of Advanced Medical and Surgical Sciences, University of Campania Luigi Vanvitelli, Naples, Italy
4. Division of Endocrinology and Metabolic Diseases, University of Campania Luigi Vanvitelli, Naples, Italy
5. CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics, University of Rome Tor Vergata, Rome, Italy
6. Institute for Leadership and Management in Health, Department of Accounting and Finance, Kingston University, London, UK.
7. Department of Occupational Medicine, University of Rome Tor Vergata, Roma, Italy

Corresponding author

Maria Ida Maiorino, Unit of Diabetes, Department of Advanced Medical and Surgical Sciences, University of Campania “Luigi Vanvitelli”, Piazza Luigi Miraglia 2, 80138 Naples, Italy
Tel/fax: +39 0815665289/0815665032
Email: mariaida.maiorino@unicampania.it

Total word count: 2594

1 table, 3 figures, 1 supplementary file

Abstract

Objectives: The aim of this study is to estimate the average number of claims for social security benefits from workers with diabetes-related disability.

Design: Nationwide retrospective study.

Setting: The database of the Italian Social Security Institute (INPS) was used to analyze the trends and the breakdown of all claims for social security benefit with Diabetes as primary diagnosis from 2009 to 2019.

Participants: We selected all the applications with the 250.xx ICD9-CM diagnosis code from 2009 to 2019.

Primary and secondary outcome measures: The ratio between accepted or rejected claims for both Ordinary Incapacity Benefit (OIB) and Disability Pension (DP) and total submitted claims over a ten-year period was computed.

Results: From 2009 to 2019, 40,800 applications for social security benefits were filed with diabetes as the principal diagnosis, with an annual increase of 30% per year. Throughout the study decade, there was a higher rate of rejected (67.2%) than accepted (32.8%) applications. Among the accepted requests most of them (30.7%) were recognized as OIB and the remaining 2.1% were recognized as DP. When related to the total number of claims presented per year, there was a 8.8% decrease of rejected applications, associated with a 20.6% increase of overall acceptance rate. In terms of time trends, the overall rise of submitted requests from 2009 to 2019 resulted in an increase in both rejected (+18%) and accepted (+61% for OIB, +11% for DP) applications. The higher rate of accepted requests was for workers aged 51-60 years, with 52% of admitted applications.

Conclusions: Between 2009 and 2019, the number of applications for social security benefits due to diabetes in Italy increased significantly, and so did the number of applications approved, mainly represented by the OIBs.

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Strengths and limitations of this study

- This is the first study to provide the number of all applications for social security benefit with diabetes as primary diagnosis in Italy;
- Data were collected at national country level during a long timeframe (11 years);
- An age grouping of the accepted applications was carried out to investigate which age groups were most affected by diabetes;
- The distinction between the two types of social security benefits provided in Italy allowed to estimate the degree of disability associated with diabetes (disability between 67% and 99% for the ordinary incapacity benefit or disability equal to 100% for the disability pension)
- The main limitation of the study refers to the lack of information regarding the diabetes-related complications or risk factors that led workers to apply for a social security benefits.

review only

Introduction

Between 2010 and 2015, the number of diabetes-related complications, including acute myocardial infarctions, strokes, and lower extremity amputations, increased by 25% in young adults (aged 18 to 44 years) and middle-aged adults (aged 45 to 64 years) in the United States (1). This confirms that diabetes is responsible for a high burden of morbidity and disability due to chronic complications, particularly in working age (1, 2). Interestingly, data from the Global Burden of Diseases showed that from 1995 to 2017, diabetes in Italy rose from seventh to fourth place in causes of disability-adjusted life years (DALYs), which express the number of years lost to disease, disability, or early death (3).

Diabetes has adverse effects on ability to work, leading to lost productivity and increased economic burden (4,5). In Italy, the Social Security System (SSS) is characterized by a dual structure that includes, on one hand, welfare and civil incapacity care benefits, and, on the other, social security benefits in the strict sense. Regarding the latter, the SSS provides economic benefits to workers with disabilities and chronic physical and/or mental incapacity, largely financed by their contributions. Specifically, all categories of workers registered with the National Institute of Social Security are entitled, upon application, to one of the two social security benefits offered in the event of an accident or illness: the ordinary disability pension (OIB) for those whose ability to work is reduced to less than one-third (disability between 67% and 99%), and the Disability Pension (DP) for those who are found to be absolutely and permanently unable to perform a work activity (100% disability) (6). Italian Law No. 222/84 (7) establishes the conditions for access to OIB and DP (Table S1). Both OIB and DP prevent income loss for people who lose their ability to work before they are eligible for an old-age pension. However, they can be misused as early retirement supports even if the ability to work is not reduced.

Despite their importance for health surveillance and social policy, little attention has been paid to decades of change in diabetes-related disability in the working-age population. The provision of social security benefits contributes to the increase in indirect costs related to diabetes, estimated at

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approximately € 10 billion in Italy (8). In addition, recording the number of applications for social security benefits over time could be useful to assess the impact of diabetes on work ability, which also allows indirect estimation of the effectiveness of diabetes treatment.

The aim of this study is to estimate the average number of applications for social security benefits of workers with diabetes-related work disability between 2009 and 2019 in Italy. Data were collected from the National Social Security System from each region and presented as a whole.

Methods

Study design and data source

This is a retrospective study with data from the database of the National Social Security Institute (Istituto Nazionale della Previdenza Sociale, INPS) database, which includes all claims submitted for each benefit and the related judgments (approval or rejection) by medical officers. This includes the indication of the prevailing diagnosis and any secondary diagnosis, based on the international classification of diseases, ninth revision (ICD9-CM) (9). The acceptance or rejection of the application is made as a result of an overall assessment of the applicant's physical and mental health by the INPS Medical Legal Centres. The assessment is based solely on medical forensic criteria and does not include consideration of socioeconomic or other factors.

Case definition

In this study, we considered all applications received by INPS for recognition of a social benefit with diabetes as the principal diagnosis. In this case, all claimants suffering from Diabetes with diagnosis code 250.xx ICD9- CM were selected.

Analyses by socio-demographic characteristics

Based on these claims, the study analysed trends and breakdowns of all claims from 2009 to 2019 by medical director judgement. Further descriptive analyses were conducted using some information from the claims, such as the age of the claimants, which was used to group the claims by specific age groups, their gender, and their work class. Specifically, the age of diabetes

applicants was used to group the accepted applications by age and to create a new categorical variable with 5 possible values: < 30 years, 30-40 years, 41-50 years, 51-60 years, and > 60 years. The aim of this analysis was to investigate which age groups are most affected by diabetes. In addition, this analysis allowed us to understand at what stage of their working lives workers and diabetes patients are most likely to receive a social security benefit.

A breakdown of accepted claims by occupational group was made based on the main groups protected by the INPS, namely: 1) legislators, entrepreneurs and top managers, 2) intellectual, scientific and highly specialized professions, 3) technical professions, 4) executive desk job professions, 5) commercial activities and services professions, 6) artisans, specialized workers and farmers, 7) plant operators, stationary and moveable machinery staff and drivers of vehicles, 8) unskilled professions.

Descriptive statistics

The descriptive analyses aimed to provide a framework for a better understanding of the characteristics of individuals with diabetes and of applicants for social security benefit by the INPS. The percentage distribution of total claims filed by judgement was calculated for each study year. Specifically, we calculated the ratio of applications accepted (separately for both social security benefits) to total applications filed in the same year. Similarly, the ratio for denied applications was calculated. The objective of these ratios was to examine the evolution of rejected and accepted requests of social security benefits in diabetes year by year, independently of the evolution of total applications filed, which certainly influenced the evolution of the absolute numbers of accepted and rejected applications. This analysis allowed us to observe the evolution over time of both acceptance and rejection rates.

The present study was conducted according to the The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement (10). The RECORD checklist is reported in the Supplementary data (Table S2).

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5 Patients or the public were not involved in the design, or conduct, or reporting, or dissemination
6 plans of our research.
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12 **Results**
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14 Between the years 2009 and 2019, 40,800 applications for social security benefits having diabetes
15 as primary diagnosis were submitted, corresponding to an average number of applications per year
16 of more than 3,700, with an annual increase of 30% per year.
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21 **Figure 1**, shows the overall rate of requests for social security benefits according to the final
22 judgment. Throughout the study decade, there was a higher rate of rejected than accepted
23 applications. Specifically, 67.2% of requests was rejected, corresponding to an average number of
24 refused applications per year of approximately 2,500. Of the accepted requests (32.8%), most of
25 them (30.7%) were approved as OIB and the remaining 2.1% were approved as DP, corresponding
26 to a mean number of admitted applications per year of more than 1,100 for OIB and about 80 for
27 DP. As regards time trends, the overall rise of submitted requests from 2009 to 2019 led to an
28 increase of both the rejected (+18%) and the accepted (+61% for OIB, +11% for DP) applications
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42 The percentage distribution of applications by final judgment between 2009 and 2019 is depicted
43 in **Table 1**. There was a 8.8% decrease of rejected applications, associated with a 20.6% increase of
44 overall acceptance rate. In terms of the type of social security benefits, there was a 23% increase in
45 accepted applications for OIB and a 14.8% decrease in accepted applications for DP.
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51 To classify accepted applications by age, we looked at the following specific age groups: < 30
52 years, 30-40 years, 41-50 years, 51-60 years, and > 60 years (Figure 3). The highest percentage of
53 accepted applications was for workers aged 51-60, with 52% of applications accepted, representing
54 about 600 accepted applications per year from 2009 to 2019. The second most relevant age group
55 was that including workers over 60 years old, with 32% of accepted applications and about 360
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admitted demands per year, followed by the group of individuals aged 41-50 years, with 13% of accepted applications and about 150 admitted requests per year. No application was accepted for workers under 30 years.

The number of accepted applications was higher for men (971 per year) than for women (245 per year; however, between 2009 and 2019, we recorded a 58% increase in the number of accepted applications for men, and a 51% increase in the number of accepted applications for women (Table S3).

When analyzed by labor class (Table S3), "unskilled occupations" (29% of total accepted claims) were the most important groups in terms of accepted claims, followed by "artisans, skilled workers, and farmers" (27% of total accepted claims). Both "plant operators, stationary and moveable machinery staff and drivers of vehicles" and "commercial activities and services professions" had a weight of 15% among the overall accepted applications. Finally, the working classes with the lowest weight in terms of accepted applications were "executive desk job professions", "technical professions", "legislators, entrepreneurs and top managers" and "intellectual, scientific and highly specialized professions" (7%, 4%, 2% and 1% respectively of the total accepted claims).

Discussion

To the best of our knowledge, this is the first study estimating the number of claims for any social security benefits presented by people with diabetes in Italy, in the years 2009-2019. Data were collected at the national level, taking into account applications with the principal diagnosis of diabetes. We found that the number of claims submitted increased overall during the decade considered, with most claims (67.2%) being rejected. However, in terms of the total number of applications submitted per year, we observed a decrease in rejected applications over time in conjunction with an increase in accepted applications, in favor of OIBs as DP. This is relevant, as the assessment of the state of invalidity or inability for work of people who apply for a social security benefit is on charge of the National Institute of Social Security, and is based exclusively on

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medico-legal criteria and not on income-related conditions. It is noteworthy that most applications were made by persons aged 51-60, suggesting that diabetes does not only affect older workers, who are the second most interested age group. In addition, most claimants were male, suggesting that women with diabetes-related disabilities are more likely than men to have irregular work schedules or not be gainfully employed. Finally, the most relevant worker classes with accepted applications were “unskilled professions” and “artisans, specialized workers and farmers”, which often require physical strength or coordination.

The increase in the total number of applications for social security benefits submitted between 2009 and 2019 indicates that diabetes continues to be considered a relevant cause of working-age morbidity and disability. This is also supported by the increase in the number of claims approved over time, primarily for OIBs, which also reflects improved knowledge in diagnosing diabetes-related complications.

There are different reasons which could explain these findings. First, the incidence of type 2 diabetes, which accounts approximately 90% of the total cases of diabetes, is rising worldwide (11), with increasing prevalence in people younger than 45 years old, due to the global spread of unhealthy lifestyles and cardiometabolic risk factors (12), and leading to a significant and premature morbidity. Second, diabetes is associated with macrovascular and microvascular complications which are responsible for the major burden of disability and reduced quality of life in people who are affected (13-15). Macrovascular complications, which result in an increased risk of major adverse cardiovascular events (coronary heart disease, stroke, peripheral artery disease), are influenced by other cardiometabolic risk factors, including smoking, obesity, hypertension and hyperlipidemia (16). Microvascular complications, which are strictly related to hyperglycemia, affect three classical diabetes microvascular target tissues (the eye, the kidney, and the peripheral nervous system), but brain, myocardium, skin, and other tissues are also involved (17). Both macrovascular and microvascular diabetic complications can be preventable through effective glucose control and aggressive treatment of cardio-metabolic risk factors. Reaching these

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3 achievements is still challenging (18), keeping in mind that intensive glucose control is associated
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5 only with a significant 9% reduction of major cardiovascular events (MACE), leaving a certain
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7 “residual vascular risk,” which persists high despite the attainment of near-to-normal HbA1c targets
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9 (19). Interestingly, in different longitudinal cohort studies, diabetes was associated with a mean
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11 twofold increased risk of DP (20, 21), with obesity (20) or cerebrovascular diseases (21) as major
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13 contributing factors. Third, despite the availability, of glucose-lowering drugs which have proved to
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15 be safe (DPP-4 inhibitors) or protective [GLP-1 receptor agonists (GLP-1RAs) and SGLT-2
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17 inhibitors] against major cardiovascular events in diabetic people at high risk of vascular
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19 complications (22-24), these drugs remain underused, being still confined to less than 15% of the
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21 total number of treated diabetic people (18, 25, 26).

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26 Studies investigating the request or the likelihood of obtaining a social security benefit for
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28 diabetes in the working age are lacking. In random samples of Finnish non-retired residents aged
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30 18-64 years, older age increased the odds of both applying for and being awarded pension, whereas
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32 a lower socioeconomic status was associated with a greater probability of disability pension
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34 applications but also a lower probability of being awarded (27). Data of participants aged 50–65
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36 years from three large observational studies demonstrated that both self-reported working disability
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38 and DP vary significantly among European countries or United States (28). Variables influencing
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40 the uptake of social security benefits include health and sociodemographic circumstances, and the
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42 national policy guiding the generosity of the Social Security Institution (28).

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47 The strengths of this study include the long timeframe analyzed (11 years), the acquisition of data
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49 at national country level, the differentiation between the two types of social security benefits
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51 provided in Italy, the consideration of different age-groups of workers applying for social security
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53 benefits. The main limitation refers to the lack of information regarding the diabetes-related
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55 complications or risk factors which induced workers to apply for a social security benefits.
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58 The economic burden related to the accepted applications for social security benefits provided by
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60 the INPS was not analyzed. Two studies estimated the costs related to the accepted applications in

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the setting of schizophrenia (29) and breast cancer (30) in Italy, suggesting that the monthly rate assigned to patients depends only on the type of social security benefit (OIB or DP) conferred on the basis of the level of disability, regardless of the disease. However, a recent study estimating the economic burden associated with social security benefits for diabetes in Italy reported an expenditure of € 715.3 million (about € 120 million per year) from 2014 to 2019 (31).

Despite recent findings have reported conflicting evidence regarding the occupational risks for diabetic workers, policies that disqualify workers with diabetes are both unnecessary and harmful in most of occupational fields. Because people with diabetes are at high risk of developing disease-related disabilities, occupational risk assessment is crucial to identify potentially critical conditions in the workplace (e.g., risk of hypoglycemia, effectiveness of therapy, etc.); for these reasons, efforts should be made to improve and prolong the work ability of people with diabetes, including, if necessary, the availability of alternative work opportunities.

Conclusions

This the first study reporting that, between 2009 and 2019, there was a substantial rise of the applications for social security benefits due to diabetes in Italy, with a consequent increase of those accepted, mainly represented by the OIBs. Since diabetes complications are preventable through stringent glycemic control and improvement of cardiovascular risk factors, major health and social gains would be made if efficient secondary prevention could improve the prognosis for the large and growing number of persons with diabetes.

Data availability statement

All data relevant to the study are included in the article.

Ethics approval

Patient consent for publication was not required considering that we only extracted data from anonymous electronic chart through diseases codes and without any personal contact with patient.

Contributors

MTA, MIM, DG and KE developed the original research idea and drafted the manuscript. SG, CN and FSM carried out the analysis and contributed to revising the manuscript critically for important intellectual content. LS, ML, LC, RM and GB, contributed to data analysis and writing and editing the draft. All authors edited the manuscript and agreed on the final version of the manuscript.

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Competing interests

None declared.

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Table 1. Percentage distribution by judgment and trend of applications presented for social security benefits with diabetes as primary diagnosis.

Year	Rejected/ Submitted (%)	OIBs/ Submitted (%)	DP / Submitted (%)	Accepted/ Submitted (%)
2009	70,0%	27,6%	2,4%	30,0%
2010	71,0%	26,3%	2,7%	29,0%
2011	71,6%	26,5%	2,0%	28,4%
2012	69,2%	28,7%	2,0%	30,8%
2013	70,9%	27,4%	1,7%	29,1%
2014	69,3%	28,8%	1,8%	30,7%
2015	65,8%	32,1%	2,0%	34,2%
2016	62,3%	35,5%	2,1%	37,7%
2017	63,2%	34,6%	2,2%	36,8%
2018	66,0%	32,1%	1,9%	34,0%
2019	63,8%	34,1%	2,1%	36,2%
% variation 2009-2019	-8,8%	23,7%	-14,8%	20,6%

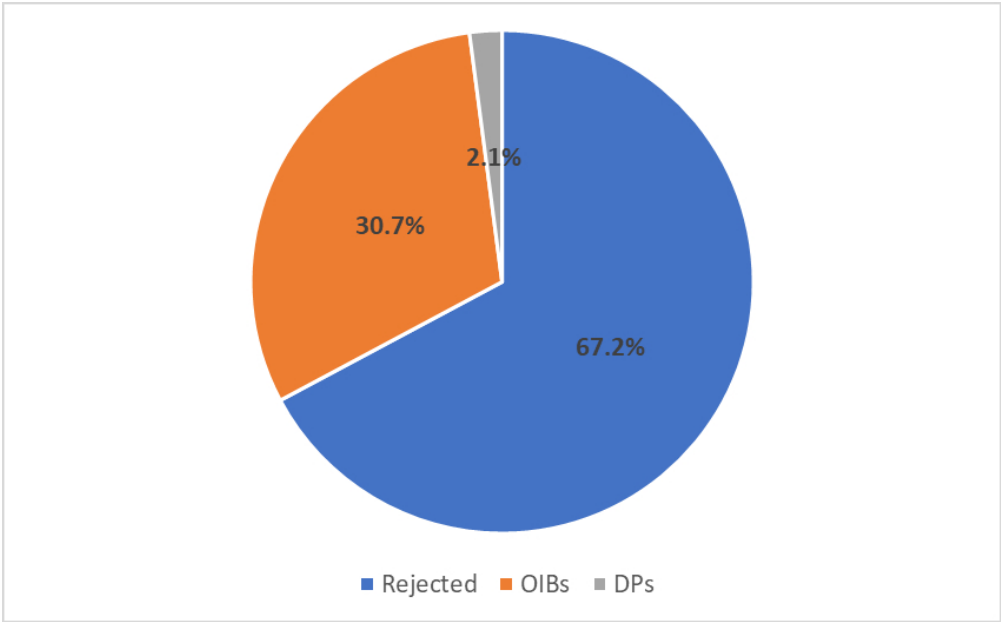
DP, Disability pension; OIBs, Ordinary incapacity benefits.

Legend to figures

Figure 1. Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

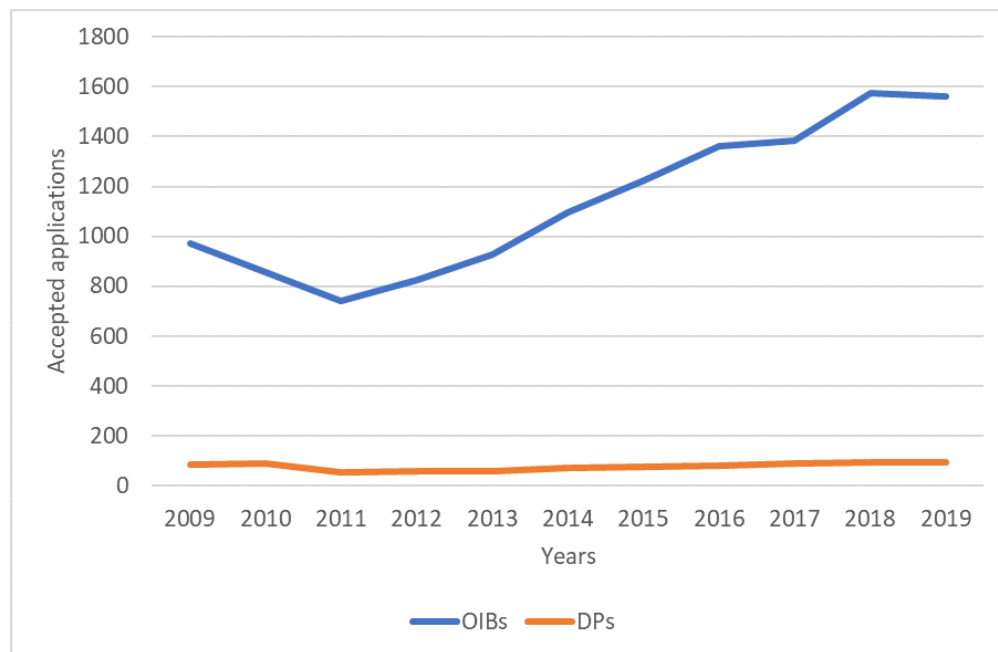
Figure 2. Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

Figure 3. Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.



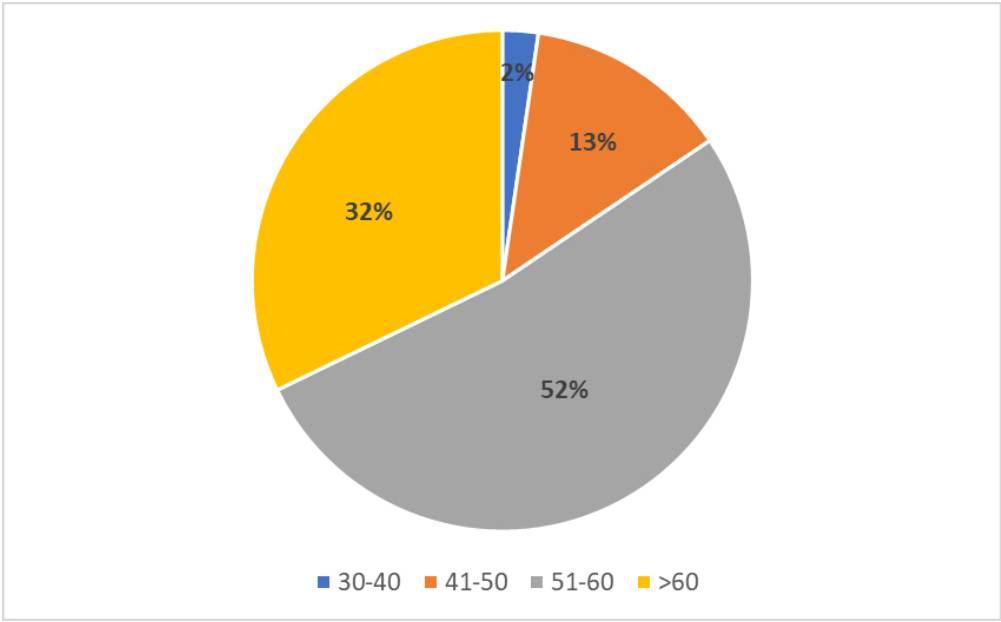
Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

71x44mm (300 x 300 DPI)



Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

76x49mm (300 x 300 DPI)



Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.

71x44mm (300 x 300 DPI)

**Applications for social security benefits related to diabetes in the working age in Italy between
2009 and 2019: a nationwide retrospective study**

Supplementary file

Table S1.....	2
Table S2.....	3
Table S3.....	11
Table S4.....	12

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Table S1. Content of Italian Law no. 222/84 (7)

Both OIB and DP require at least 260 weekly contributions (5 years of contributions and insurance), of which 156 (3 years of contributions and insurance) in the 5 years prior to the date of the submitted claim. Given the partial loss of working capacity, no cessation of working activity is needed to access the OIB. The DP, instead, due to the total and permanent inability of who submit the claim, requires: cessation of any kind of working activity, removal from worker category lists, cancellation of membership of professional bodies, renouncing of payments covered by obligatory unemployment insurance and any other replacement or supplement to your salary. Following an overall assessment of the physical and mental health of the applicant, the Medical Legal Centres of the INPS approve the request, providing the benefit based on the presence of one or more disabling diseases.

For peer review only

Table S2. The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found		<p>RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.</p> <p>RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.</p> <p>RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.</p>	<p>1-2</p> <p>1-2</p> <p>NA</p>
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			4-5
Objectives	3	State specific objectives, including any prespecified hypotheses			5
Methods					

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Study Design	4	Present key elements of study design early in the paper			5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			5-6
Participants	6	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p>(b) <i>Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching</p>		<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>5-6</p> <p>NA</p> <p>NA</p>

		criteria and the number of controls per case			
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	5
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group			5-6
Bias	9	Describe any efforts to address potential sources of bias			6
Study size	10	Explain how the study size was arrived at			6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why			5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding			5-6

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		(b) Describe any methods used to examine subgroups and interactions			5-6
		(c) Explain how missing data were addressed			5-6
		(d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed			7
		<i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed			NA
		<i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy			NA
		(e) Describe any sensitivity analyses			7-8
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	5-6
				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	5-6
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of	6

				linkage quality evaluation should be provided.	
Results					
Participants	13	<p>(a) Report the numbers of individuals at each stage of the study (<i>e.g.</i>, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed)</p> <p>(b) Give reasons for non-participation at each stage.</p> <p>(c) Consider use of a flow diagram</p>		RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	7
Descriptive data	14	<p>(a) Give characteristics of study participants (<i>e.g.</i>, demographic, clinical, social) and information on exposures and potential confounders</p> <p>(b) Indicate the number of participants with missing data for each variable of interest</p> <p>(c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i>, average and total amount)</p>			<p>8</p> <p>7-8</p> <p>7</p>
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome events or			7-8

Discussion

Key results	18	Summarise key results with reference to study objectives			8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			8-11
Generalisability	21	Discuss the generalisability (external validity) of the study results			10
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			NA
Accessibility of protocol, raw data,		..		RECORD 22.1: Authors should provide information on how to access any supplemental information	12

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and programm ing code				such as the study protocol, raw data, or programming code.	
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Table S2. Number of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019 according to gender.

	Total number of claims	Average number claims per year	Percentage of variation between 2009-2010
Female	2697	245	51%
Male	10677	971	58%
Total	13374	1216	57%

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Table S3. Number and percentage weight of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019 according to gender.

	Total claims	Average number of claims per year	% weight
Legislators, entrepreneurs and top managers	157	14	2%
Intellectual, scientific and highly specialized professions	61	6	1%
Technical professions	281	26	4%
Executive desk job professions	497	45	7%
Commercial activities and services professions	1035	94	15%
Artisans, specialized workers and farmers	1848	168	27%
Plant operators, stationary and moveable machinery staff and drivers of vehicles	1026	93	15%
Unskilled professions	2002	182	29%
Total	6907	628	100%

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Applications for social security benefits related to diabetes in the working age in Italy between 2009 and 2019: a nationwide retrospective cohort study

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Complete List of Authors:	<p>Aurilio, Marco Trabucco; Italian National Social Security Institute (INPS), Office of Medical Forensic Coordination; University of Molise, Department of Medicine and Health Sciences</p> <p>Maiorino, Maria Ida; University of Campania Luigi Vanvitelli Department of Advanced Medical and Surgical Sciences</p> <p>Mennini, Francesco Saverio; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics; Kingston University, Department of Accounting and Finance</p> <p>Scappaticcio, Lorenzo; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences</p> <p>Longo, Miriam; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p> <p>Nardone, Claudia; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics</p> <p>Coppeta, Luca; University of Rome Tor Vergata, Department of Occupational Medicine</p> <p>Gazzillo, Simone; University of Rome Tor Vergata, CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics</p> <p>Migliorini, Raffaele; Italian National Social Security Institute (INPS), Office of Medical Forensic Coordination</p> <p>Bellastella, Giuseppe; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p> <p>Giugliano, Dario ; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences</p> <p>Esposito, K. ; University of Campania Luigi Vanvitelli, Department of Advanced Medical and Surgical Sciences, Division of Endocrinology and Metabolic Diseases</p>
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**Applications for social security benefits related to diabetes in the working age in Italy between
2009 and 2019: a nationwide retrospective cohort study**

Marco Trabucco Aurilio^{1,2*}, Maria Ida Maiorino^{3,4*}, Francesco Saverio Mennini^{5,6}, Lorenzo Scappaticcio³,
Miriam Longo^{3,4}, Claudia Nardone⁵, Luca Coppeta⁷, Simone Gazzillo⁵, Raffaele Migliorini¹, Giuseppe
Bellastella^{3,4}, Dario Giugliano³, Katherine Esposito^{3,4}

*MTA and MIM contributed equally to this paper

1. Office of Medical Forensic Coordination, Italian National Social Security Institute (INPS), Rome, Italy.
2. Department of Medicine and Health Sciences, University of Molise, Campobasso, Italy.
3. Department of Advanced Medical and Surgical Sciences, University of Campania Luigi Vanvitelli, Naples, Italy
4. Division of Endocrinology and Metabolic Diseases, University of Campania Luigi Vanvitelli, Naples, Italy
5. CEIS - Economic Evaluation and HTA (EEHTA), Faculty of Economics, University of Rome Tor Vergata, Rome, Italy
6. Institute for Leadership and Management in Health, Department of Accounting and Finance, Kingston University, London, UK.
7. Department of Occupational Medicine, University of Rome Tor Vergata, Roma, Italy

Corresponding author

Maria Ida Maiorino, Unit of Diabetes, Department of Advanced Medical and Surgical Sciences, University of Campania “Luigi Vanvitelli”, Piazza Luigi Miraglia 2, 80138 Naples, Italy
Tel/fax: +39 0815665289/0815665032
Email: mariaida.maiorino@unicampania.it

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1 table, 3 figures, 1 supplementary file

Abstract

Objectives: The aim of this study is to estimate the average number of claims for social security benefits from workers with diabetes-related disability.

Design: Nationwide retrospective study.

Setting: The database of the Italian Social Security Institute (INPS) was used to analyze the trends and the breakdown of all claims for social security benefit with Diabetes as primary diagnosis from 2009 to 2019.

Participants: We selected all the applications with the 250.xx ICD9-CM diagnosis code from 2009 to 2019.

Primary and secondary outcome measures: The ratio between accepted or rejected claims for both Ordinary Incapacity Benefit (OIB) and Disability Pension (DP) and total submitted claims over a ten-year period was computed.

Results: From 2009 to 2019, 40,800 applications for social security benefits were filed with diabetes as the principal diagnosis, with an annual increase of 30% per year. Throughout the study decade, there was a higher rate of rejected (67.2%) than accepted (32.8%) applications. Among the accepted requests most of them (30.7%) were recognized as OIB and the remaining 2.1% were recognized as DP. When related to the total number of claims presented per year, there was a 8.8% decrease of rejected applications, associated with a 20.6% increase of overall acceptance rate. In terms of time trends, the overall rise of submitted requests from 2009 to 2019 resulted in an increase in both rejected (+18%) and accepted (+61% for OIB, +11% for DP) applications. The higher rate of accepted requests was for workers aged 51-60 years, with 52% of admitted applications.

Conclusions: Between 2009 and 2019, the number of applications for social security benefits due to diabetes in Italy increased significantly, and so did the number of applications approved, mainly represented by the OIBs.

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Strengths and limitations of this study

- This is the first study that evaluates the number of social security claims with diabetes as the main diagnosis in Italy;
- A long period was used for data collection at national level (11 years);
- Diabetic people who applied for a social security benefits were divided according to age and work class to determine which age or working class group is most affected by diabetes;
- The distinction between the two types of social security benefits provided in Italy allowed to estimate the degree of disability associated with diabetes (disability between 67% and 99% for the ordinary incapacity benefit or disability equal to 100% for the disability pension);
- An important limitation of this study is the lack of information on diabetes-related complications or risk factors that lead workers to apply for social security benefits.

review only

Introduction

Diabetes-related complications, including acute myocardial infarctions, strokes, and lower extremity amputations, increased by 25% between 2010 and 2015 among young adults (aged 18 to 44 years) and middle-aged adults (aged 45 to 64 years) in the United States (1). Accordingly, diabetes is associated with high rates of morbidity and disability due to chronic complications, particularly in the working-age population (1, 2). Between 1995 and 2017, Global Burden of Diseases data showed that diabetes moved from seventh to fourth place in Italy in terms of disability-adjusted life years (DALYs), which represent the number of years lost to disease, disability, and premature death (3).

Diabetes negatively affects productivity and economic costs through reduced work capacity (4,5). The Italian social security system (SSS) is characterized by a dual structure that provides social assistance and civil disability benefits as well as social security benefits in the strict sense. Regarding the latter, the SSS provides economic benefits to workers with disabilities and chronic physical and/or mental disabilities, financed primarily by their contributions. In particular, all workers registered with the National Institute of Social Security are entitled, upon application, to one of the following two social security benefits (SSB): the normal disability pension (OIB) is granted to persons whose ability to work is reduced to less than one-third (disability between 67% and 99%), and the disability pension (DP) is granted to persons who are permanently and absolutely unable to work (100%) (6). Italian Law No. 222/84 (7) specifies the conditions for access to OIB and DP (Table S1). Both OIB and DP provide income protection for persons who become unable to work before they are entitled to an old-age pension.

Diabetes has received relatively little attention as a reason for claiming SSB in the working-age population, despite its importance for both health surveillance and social policy. Indeed, there are very few studies examining the rate of SSB provided by the National SSS due to diabetes. This is relevant for several reasons. First, the provision of SSB contribute to the increase in indirect costs related to diabetes, estimated at about 10 billion euros in Italy (8). In addition, it might be useful to

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track the number of applications for SSB over time to evaluate the impact of diabetes on a person's ability to work; this would also allow an indirect evaluation of the effectiveness of diabetes treatment. Finally, evaluating the number of applications for SSB filed by people with diabetes over time could be used to improve the Social Security assessment process.

The aim of this study is to estimate the number of applications for SSS filed by Italian workers with diabetes-related work disability from 2009 to 2019. Data from the SSS of each region were collected and presented as a whole.

Methods

Study design and data source

This is a retrospective cohort study using data from the National Institute of Social Security (Istituto Nazionale della Previdenza Sociale, INPS) database. The database contains all claims submitted for each benefit and the associated judgments (approval or rejection) by medical officers. It contains the indication of the principal diagnosis and all secondary diagnoses using the International Classification of Diseases, Ninth Revision (ICD9- CM) (9). In order for an application to be accepted or denied, INPS medical legal centres make an overall assessment of the applicant's physical and mental health. The assessment is based solely on medical forensic criteria and does not consider other socioeconomic factors.

Case definition

In this study, we examined all applications received by the INPS for recognition of a social benefit with diabetes as the principal diagnosis. In this case, all claimants suffering from Diabetes with diagnosis code 250.xx ICD9- CM were selected.

Analyses by socio-demographic characteristics

Based on these claims, the study analysed trends and breakdowns of all claims from 2009 to 2019. Further descriptive analyses were performed using additional data from the claims, such as claimant age, which was used to categorize claims by different age groups, gender, and occupational class.

Specifically, diabetes claimant age was used to categorize accepted claims into five age groups: < 30 years, 30-40 years, 41-50 years, 51-60 years, and > 60 years. The purpose of this analysis was to determine which age groups are most affected by diabetes. As a result of this analysis, we were able to determine at what stage of their working lives workers and diabetes patients are most likely to receive a SSB.

Based on the main groups protected by the INPS, a breakdown of the accepted claims by occupational category was generated. These include: 1) legislators, entrepreneurs and top managers, 2) intellectual, scientific, highly specialized occupations, 3) technical professions, 4) executive desk job occupations, 5) commercial activities and services occupations, 6) artisans, special workers and farmers, 7) plant operators, stationary and moveable machinery staff and drivers of vehicles, 8) unskilled occupations.

Descriptive statistics

Descriptive analyses were conducted to provide a framework for better understanding the characteristics of diabetics and those seeking SSB. Based on the total number of claims filed by judgement for each study year, the percentage distribution was calculated. Specifically, we calculated the ratio of approved applications (separately for both SSB) to total applications filed in the same year. We also calculated the ratio of denied applications. The purpose of these ratios was to examine the evolution of rejected and approved applications for SSB in diabetes over time, after taking into account the evolution of total applications, which certainly influenced the evolution of the absolute number of approved and rejected applications. In this analysis, we were able to observe the evolution of both the approval and denial rates over time.

This study was conducted in accordance with the REporting of Studies Conducted Using Observationally Collected Health Data (RECORD) statement (10). The checklist RECORD is provided in the supplemental data (Table S2).

Patient and public involvement

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We did not involve patients or the public in the planning, conduct, reporting, or dissemination of our research.

Results

Between 2009 and 2019, a total of 40,800 claims for SSB were filed with diabetes as the principal diagnosis. This represents an average of more than 3,700 claims per year and an annual increase of 30%.

Figure 1 illustrates the overall rate of Social Security claims based on the final judgment. During the study decade, more applications were denied than granted. Specifically, 67.2% of applications were denied, or an average of about 2,500 denied applications per year. The majority (32.8%) of accepted applications (30.7%) were approved as OIB, while only 2.1% were approved as DP. This results in an average number of approved applications per year of more than 1,100 for OIB and about 80 for DP. Looking over time, the overall increase in applications submitted from 2009 to 2019 resulted in both an increase in applications denied (+18%) and applications accepted (+61%) (**Figure 2**).

Table 1 shows the percentage distribution of applications by final judgment from 2009 to 2019. An 8.8% decrease in denied applications was accompanied by a 20.6% increase in approval rates. In terms of the type of SSB, there was a 23% increase in accepted applications for OIB and a 14.8% decrease in accepted applications for DP.

We looked at the following specific age groups to determine application acceptance: < 30 years, 30-40 years, 41-50 years, 51-60 years, and > 60 years (**Figure 3**). Workers aged 51-60 accounted for the largest percentage of accepted applications, with 52% of accepted applications, or approximately 600 accepted applications per year between 2009 and 2019. Workers over the age of 60 were the second largest age group, accounting for 32% of accepted applications and approximately 360 accepted applications per year, followed by workers aged 41-50, accounting for

13% of accepted applications and approximately 150 accepted applications per year. Applications from workers younger than 30 were not accepted.

The number of accepted applications was higher for men (971 per year) than for women (245 per year); however, between 2009 and 2019, the number of accepted applications increased by 58% for men and 51% for women (Table S3).

When analysed by working class (Table S3), "unskilled occupations" (29% of total accepted claims) were the most important groups in terms of accepted claims, followed by "artisans, skilled workers, and farmers" (27% of total accepted claims). Both "plant operators, stationary and moveable machinery staff and drivers of vehicles" and "commercial activities and services professions" had a weight of 15% among the overall accepted applications. Finally, the working classes with the lowest weight in terms of accepted applications were "executive desk job professions", "technical professions", "legislators, entrepreneurs and top managers" and "intellectual, scientific and highly specialized professions" (7%, 4%, 2% and 1% respectively of the total accepted claims).

Discussion

To the best of our knowledge, this is the first study to estimate the number of people with diabetes who applied for SSB in Italy from 2009 to 2019. Data were collected at national level, taking into account claims in which diabetes was the main diagnosis. The overall number of claims submitted increased during the decade considered, with the majority of claims (67.2%) being rejected. However, the number of rejected claims submitted per year has decreased, and the number of accepted claims has increased in favor of OIBs rather than DP.

The National Institute of Social Security is responsible for assessing the incapacity for work of persons applying for social security benefits, relying exclusively on medical and legal criteria and not on income-related conditions. It is noteworthy that most of the applications were made by persons aged 51-60, suggesting that diabetes is not unique to older workers, the second most

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prevalent group. In addition, the majority of claimants were male, suggesting that women with diabetes-related disabilities are more likely than men to have irregular work schedules or to be inactive. In addition, the most appropriate categories of workers with accepted claims were classified as "unskilled professions" and "craftsmen, skilled workers, and farmers," all of which require physical strength and coordination.

Diabetes continues to be considered a relevant cause of morbidity and disability in workers, as shown by the increase in total applications for social security benefits between 2009 and 2019. This is also confirmed by the increase in the number of claims approved over time, especially in the area of OIB, which also reflects an improved knowledge of the diagnosis of diabetes-related complications.

These results could be explained by a number of factors. First, the incidence of type 2 diabetes, which accounts for approximately 90 percent of all diabetes cases, is increasing worldwide (11), with a rising prevalence in those under 45 years of age due to the global spread of unhealthy lifestyles and cardiometabolic risk factors (12), leading to significant and premature morbidity. Second, diabetes is associated with macrovascular and microvascular complications that lead to disability and poor quality of life in affected individuals (13-15). The risk of macrovascular complications (coronary heart disease, stroke, peripheral artery disease) is largely influenced by other cardiometabolic risk factors such as smoking, obesity, hypertension, and hyperlipidemia (16). The microvascular complications of diabetes are closely related to hyperglycemia and affect three of the classic target tissues (eye, kidney, and peripheral nervous system). However, the brain, myocardium, skin, and other tissues are also affected (17). Effective glycemic control and aggressive treatment of cardiometabolic risk factors can prevent both macrovascular and microvascular diabetic complications. Achieving these goals remains a challenge (18), considering that intensive glycemic control is associated with only a significant 9% reduction in major cardiovascular events (MACE), implying that there remains some "residual vascular risk" that persists despite achieving near-normal HbA1c targets (19). Interestingly, a number of longitudinal

cohort studies have shown that diabetes is associated with twice the risk of developing DP (20, 21), with obesity (20) and cerebrovascular disease (21) being the largest contributors. Third, despite the availability of glucose-lowering drugs which have been shown to be safe (DPP-4 inhibitors) or protective [GLP-1 receptor agonists (GLP-1RAs) and SGLT-2 inhibitors] against major cardiovascular events in diabetic people at high risk for vascular complications (22-24), these drugs remain underused in less than 15% of total diabetics treated (18,25,26).

There is a lack of studies examining whether a person with diabetes may be able to receive a SSB in their working years. An analysis of a random sample of Finnish nonretired persons aged 18 to 64 years found that older age increased the likelihood of both applying for and receiving a pension, whereas lower socioeconomic status was associated with a greater likelihood of applying for a disability pension but also a lower likelihood of receiving it (27). Participants aged 50 to 65 years from three large observational studies indicated that both self-reported disability and the prevalence of disability varied considerably across countries in Europe or the United States (28). There are a number of factors that influence the use of SSB, including health and sociodemographic factors as well as national policies that determine the generosity of the Social Security Institution.

The strengths of this study include the extended timeframe analyzed (11 years), the collection of data at the national level, the differentiation of benefits between the two types of social security schemes in Italy, and the consideration of different age groups or occupational class of workers claiming social security benefits. The main limitation concerns the lack of information on diabetes-related complications or risk factors that led workers to apply for social security benefits. In addition, we could not compare the total number of SSB claims for diabetes with claims for noncommunicable chronic diseases during the same period. Compared with data from a study describing the economic and social costs of breast cancer in Italy (29), the average number of benefits granted annually for diabetes was lower than that for breast cancer. In both cases, the majority of approved claims refer to OIB rather than DP. For diabetes, the percentage of approved claims is 61%, and for breast cancer, the percentage is 14%. Finally, the economic burden

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associated with accepted applications for SSB provided by the INPS has not been analysed. Two studies calculated the costs associated with the evaluation of the acceptance of applications related to schizophrenia (30) and breast cancer (29) in Italy. They concluded that the monthly rate assigned to patients depends only on the type of social security benefit (OIB or DP), which is based on the patient's degree of disability, regardless of the disease. Nevertheless, a study estimating the economic burden of social security benefits for diabetes in Italy identified an expenditure of 715.3 million euros (about 120 million euros per year) between 2014 and 2019 (31).

Although recent evidence on the occupational risk of people with diabetes is conflicting, policies that exclude diabetic workers are both unnecessary and harmful in most occupations. Because people with diabetes are at high risk of developing disease-related disabilities, assessing occupational risk is crucial to identify potentially critical conditions in the workplace (e.g., risk of hypoglycemia, effectiveness of treatment, etc.); for these reasons, efforts should be made to improve and prolong the work ability of people with diabetes, including, if necessary, providing alternative employment opportunities.

Conclusions

This is the first study to document that the number of applications for SSB due to diabetes in Italy increased significantly from 2009 to 2019, with an increase in the number of applications granted, mainly under the OIB. Because diabetes complications can be prevented by strict glycemic control and improvement of cardiovascular risk factors, there would be substantial health and social benefits if effective secondary prevention could improve the prognosis for the many people with diabetes. Although some population-based cohort studies suggest that cardiorenal protection by new antihyperglycemic agents may act in addition to that of optimal glycemic control, randomized controlled trials are needed to clarify this issue.

Data availability statement

All data relevant to the study are included in the article.

Ethics approval

Patient consent for publication was not required considering that we only extracted data from anonymous electronic chart through diseases codes and without any personal contact with patient.

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Contributors

MTA, MIM, DG and KE developed the original research idea and drafted the manuscript. SG, CN and FSM carried out the analysis and contributed to revising the manuscript critically for important intellectual content. LS, ML, LC, RM and GB, contributed to data analysis and writing and editing the draft. All authors edited the manuscript and agreed on the final version of the manuscript.

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None declared.

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Table 1. Percentage distribution by judgment and trend of applications presented for social security benefits with diabetes as primary diagnosis

Year	Rejected/ Submitted (%)	OIBs/ Submitted (%)	DP / Submitted (%)	Accepted/ Submitted (%)
2009	70,0%	27,6%	2,4%	30,0%
2010	71,0%	26,3%	2,7%	29,0%
2011	71,6%	26,5%	2,0%	28,4%
2012	69,2%	28,7%	2,0%	30,8%
2013	70,9%	27,4%	1,7%	29,1%
2014	69,3%	28,8%	1,8%	30,7%
2015	65,8%	32,1%	2,0%	34,2%
2016	62,3%	35,5%	2,1%	37,7%
2017	63,2%	34,6%	2,2%	36,8%
2018	66,0%	32,1%	1,9%	34,0%
2019	63,8%	34,1%	2,1%	36,2%
% variation 2009-2019	-8,8%	23,7%	-14,8%	20,6%

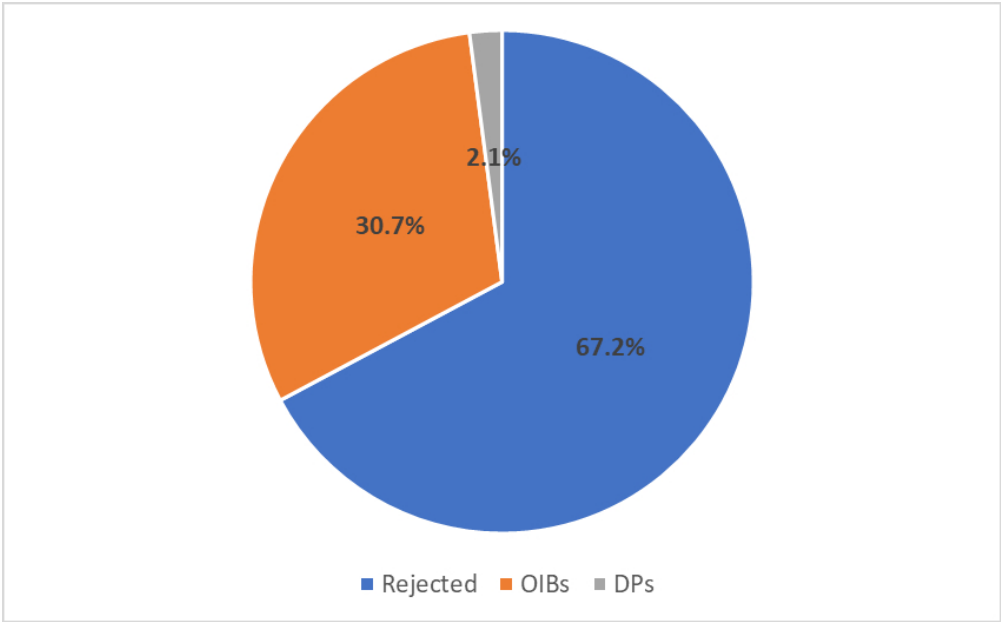
DP, Disability pension; OIBs, Ordinary incapacity benefits.

Legend to figures

Figure 1. Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

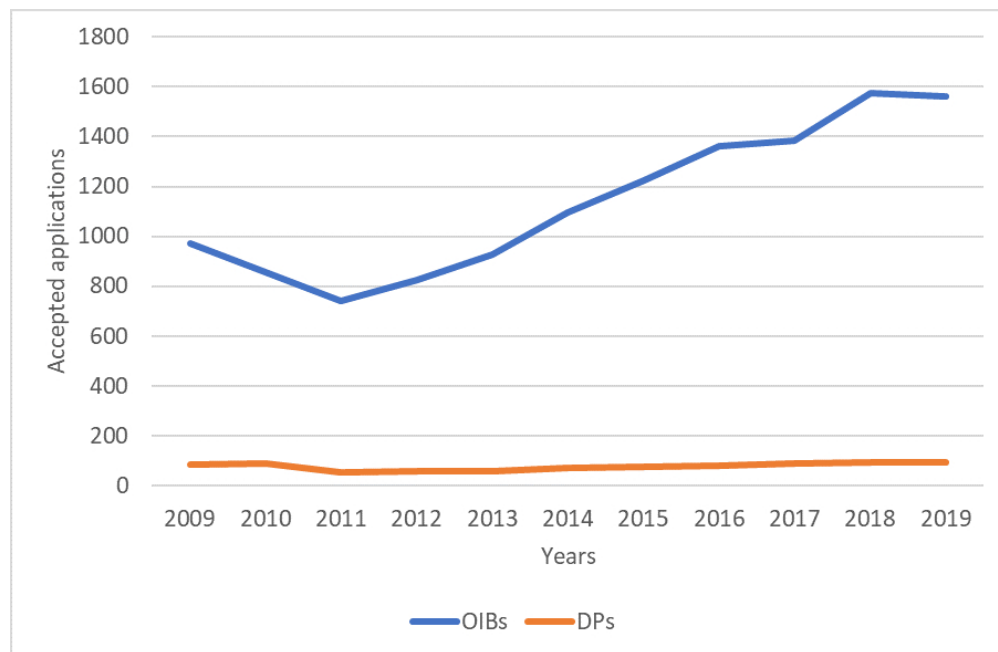
Figure 2. Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

Figure 3. Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.



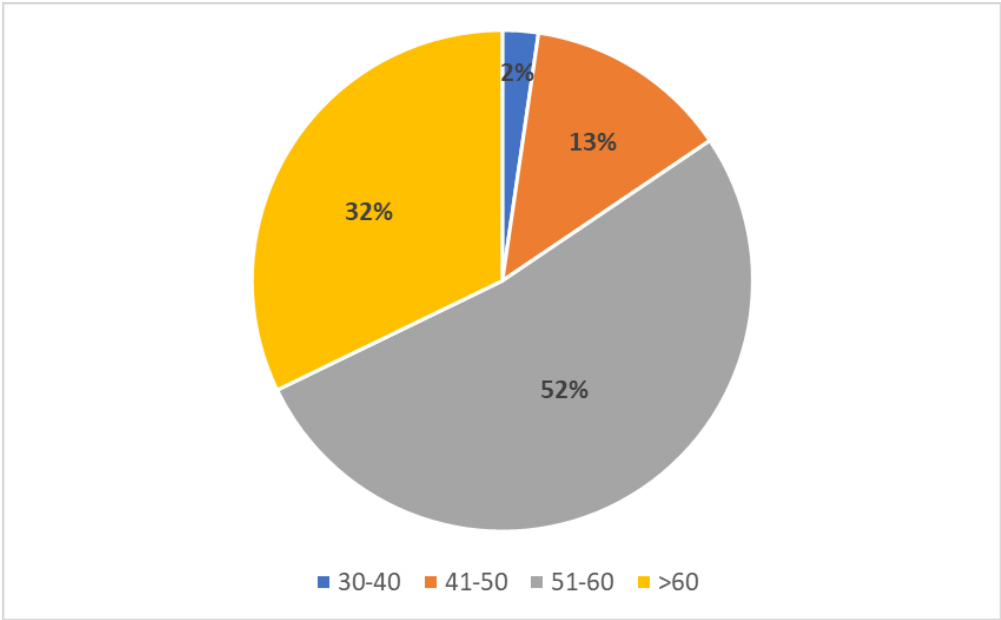
Percentage distribution of claims for social security benefits per final judgment with diabetes as primary diagnosis in Italy between 2009-2019.

71x44mm (300 x 300 DPI)



Time trend of accepted applications for social security benefits (OIB and DP) with diabetes as primary diagnosis in Italy between 2009-2019. On the vertical axis, number of accepted applications; on the horizontal axis, years.

76x49mm (300 x 300 DPI)



Percentage weight of age groups in terms of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019.

71x44mm (300 x 300 DPI)

**Applications for social security benefits related to diabetes in the working age in Italy between
2009 and 2019: a nationwide retrospective study**

Supplementary file

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Table S1. Content of Italian Law no. 222/84 (7)

Both OIB and DP require at least 260 weekly contributions (5 years of contributions and insurance), of which 156 (3 years of contributions and insurance) in the 5 years prior to the date of the submitted claim. Given the partial loss of working capacity, no cessation of working activity is needed to access the OIB. The DP, instead, due to the total and permanent inability of who submit the claim, requires: cessation of any kind of working activity, removal from worker category lists, cancellation of membership of professional bodies, renouncing of payments covered by obligatory unemployment insurance and any other replacement or supplement to your salary. Following an overall assessment of the physical and mental health of the applicant, the Medical Legal Centres of the INPS approve the request, providing the benefit based on the presence of one or more disabling diseases.

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Table S2. The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found		<p>RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included.</p> <p>RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract.</p> <p>RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.</p>	<p>1-2</p> <p>1-2</p> <p>NA</p>
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			4-5
Objectives	3	State specific objectives, including any prespecified hypotheses			5
Methods					

Study Design	4	Present key elements of study design early in the paper			5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			5-6
Participants	6	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p>(b) <i>Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching</p>		<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>5-6</p> <p>NA</p> <p>NA</p>

		criteria and the number of controls per case			
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.		RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	5
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group			5-6
Bias	9	Describe any efforts to address potential sources of bias			6
Study size	10	Explain how the study size was arrived at			6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why			5-6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding			5-6

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		(b) Describe any methods used to examine subgroups and interactions			5-6
		(c) Explain how missing data were addressed			5-6
		(d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed			7
		<i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed			NA
		<i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy			NA
		(e) Describe any sensitivity analyses			7-8
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	5-6
				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	5-6
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of	6

				linkage quality evaluation should be provided.	
Results					
Participants	13	<p>(a) Report the numbers of individuals at each stage of the study (<i>e.g.</i>, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed)</p> <p>(b) Give reasons for non-participation at each stage.</p> <p>(c) Consider use of a flow diagram</p>		RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	7
Descriptive data	14	<p>(a) Give characteristics of study participants (<i>e.g.</i>, demographic, clinical, social) and information on exposures and potential confounders</p> <p>(b) Indicate the number of participants with missing data for each variable of interest</p> <p>(c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i>, average and total amount)</p>			<p>8</p> <p>7-8</p> <p>7</p>
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome events or			7-8

Discussion

Key results	18	Summarise key results with reference to study objectives			8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			8-11
Generalisability	21	Discuss the generalisability (external validity) of the study results			10
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			NA
Accessibility of protocol, raw data,		..		RECORD 22.1: Authors should provide information on how to access any supplemental information	12

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and programm ing code				such as the study protocol, raw data, or programming code.	
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Table S2. Number of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019 according to gender.

	Total number of claims	Average number claims per year	Percentage of variation between 2009-2010
Female	2697	245	51%
Male	10677	971	58%
Total	13374	1216	57%

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Table S3. Number and percentage weight of applications accepted for social security benefits with diabetes as primary diagnosis in Italy in the period 2009-2019 according to gender.

	Total claims	Average number of claims per year	% weight
Legislators, entrepreneurs and top managers	157	14	2%
Intellectual, scientific and highly specialized professions	61	6	1%
Technical professions	281	26	4%
Executive desk job professions	497	45	7%
Commercial activities and services professions	1035	94	15%
Artisans, specialized workers and farmers	1848	168	27%
Plant operators, stationary and moveable machinery staff and drivers of vehicles	1026	93	15%
Unskilled professions	2002	182	29%
Total	6907	628	100%