



## Instructive lessons from the analysis of assistance in diabetes during the first phase of COVID-19 pandemic

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Planning specific and periodical controls in diabetes is a common activity in most countries. Early diagnosis, treatment and follow-up of the disease is a principle of preventive medicine supported by the totality of guidelines. Some previous studies have reported that not undergoing health check-ups was associated with worse quality of assistance, higher all-cause mortality, and hospital use. [1, 2].

The novel coronavirus disease 2019 (COVID-19) has represented an unprecedented new challenge worldwide, causing large-scale loss of life and a great impact on economy and society. The COVID-19 pandemic severely affected the organization of health services, and the provision to patients suffering from chronic diseases of timely and optimal care has become increasingly difficult. Healthcare systems faced a twofold challenge, as on the one hand, there was a need to address a growing demand for care of COVID-19 patients and on the other hand, there was a need to maintain continuity of care for patients with chronic diseases.

To clarify and quantify the effect of the reduced and modified care of the lockdown periods on several health outcomes, we designed a large-scale retrospective study in the population of an entire Italian Region where a developed network of diabetes units exists.

The study base included about 250,000 residents in Piedmont, with a diagnosis of type 2 diabetes, alive on 1 January

2019 (COVID-free cohort) and 1 January 2020 (COVID cohort). As described in detail elsewhere [3], patients were identified using a case-finding algorithm based on a deterministic linkage (using a unique anonymous identifier) of Electronic Health data sources.

Each patient of the two cohorts was linked with the regional databases of laboratory tests, outpatient care, accesses to the emergency room (ER), and hospitalizations and followed-up from 1 January to 31 December of each year. Several processes and outcome indicators were calculated during 2019 and 2020. Among the former, we considered diabetological examination, patient education carried out by nurses, HbA<sub>1c</sub>, Cholesterol, eye screening and ECG; furthermore, we calculated a composite indicator that can be considered as a proxy of fair adherence to screening guidelines. It is accredited by the Italian Ministry of Health (IMH) to monitor the quality of diabetes care in Italy [4] and includes at least four assessments per year among the following five: two assessments of HbA<sub>1c</sub>, lipid profile, microalbuminuria, eGFR, and eye examination. For the latter, we considered hospitalization for any cause (excluding delivery), and ER access that, based on triage classification, required immediate medical attention. To ensure comparability between the two periods, we excluded all patients who had a positive COVID-19 test.

The start of the two follow-ups was defined as January 1, 2019 and 2020, and ended at the date of the event, death, transfer out of Piedmont, or December 31, 2019 and 2020, respectively. Days of follow-up (person-time) were calculated, separately for each event, as the difference between the date of the event under study, loss to follow-up, death or December 31, and January 1. The proportions of patients with the event under study were estimated using a survival analysis based on Kaplan–Meier methods. The percentage change between the two periods was calculated as the ratio

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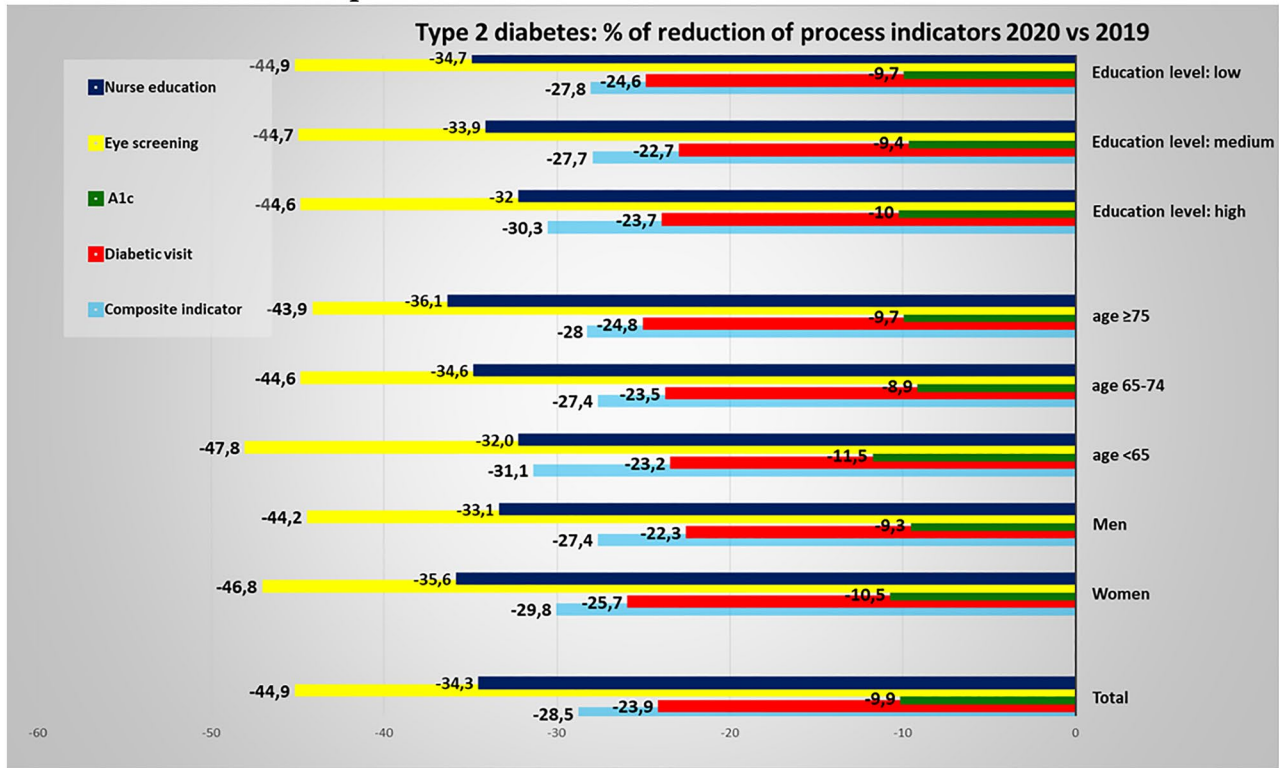
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**A. % of reduction of process indicators**



**B. % of reduction of outcome indicators**

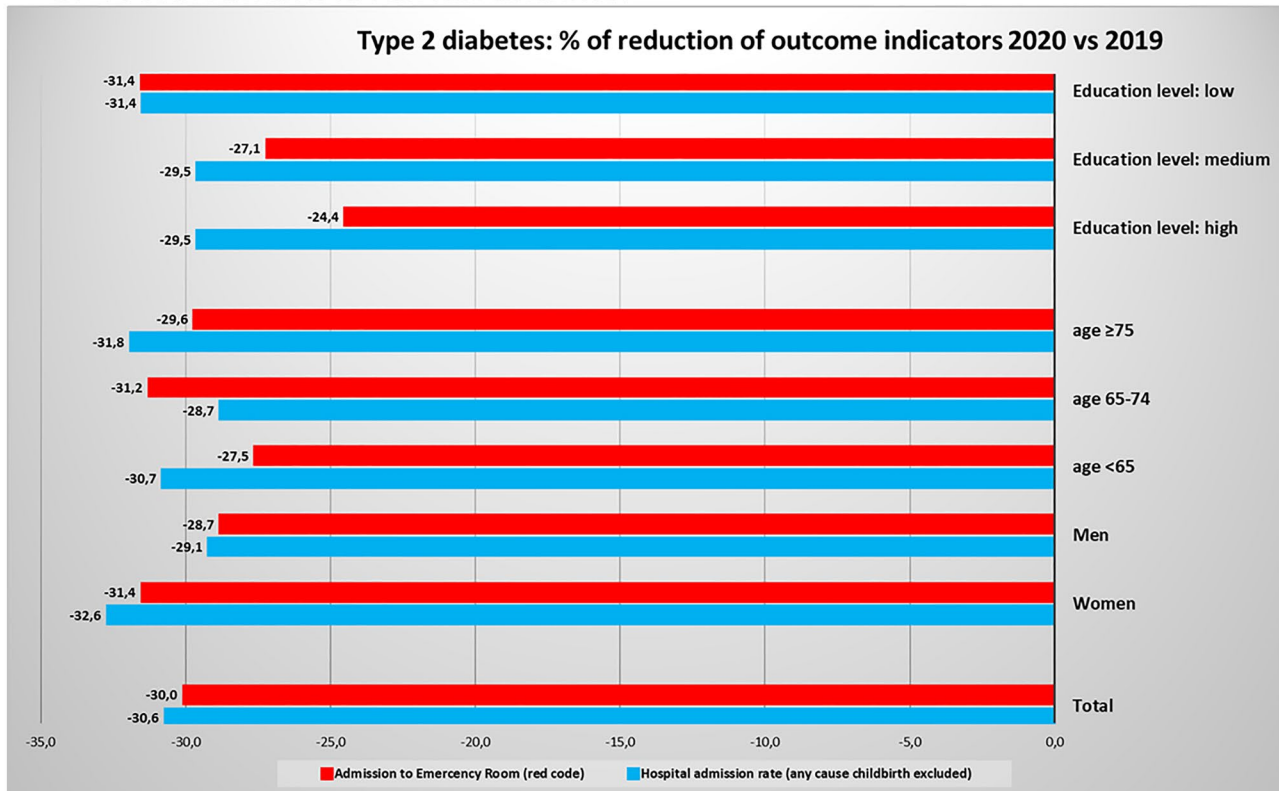


Fig. 1 Type 2 diabetes 2020 vs. 2019

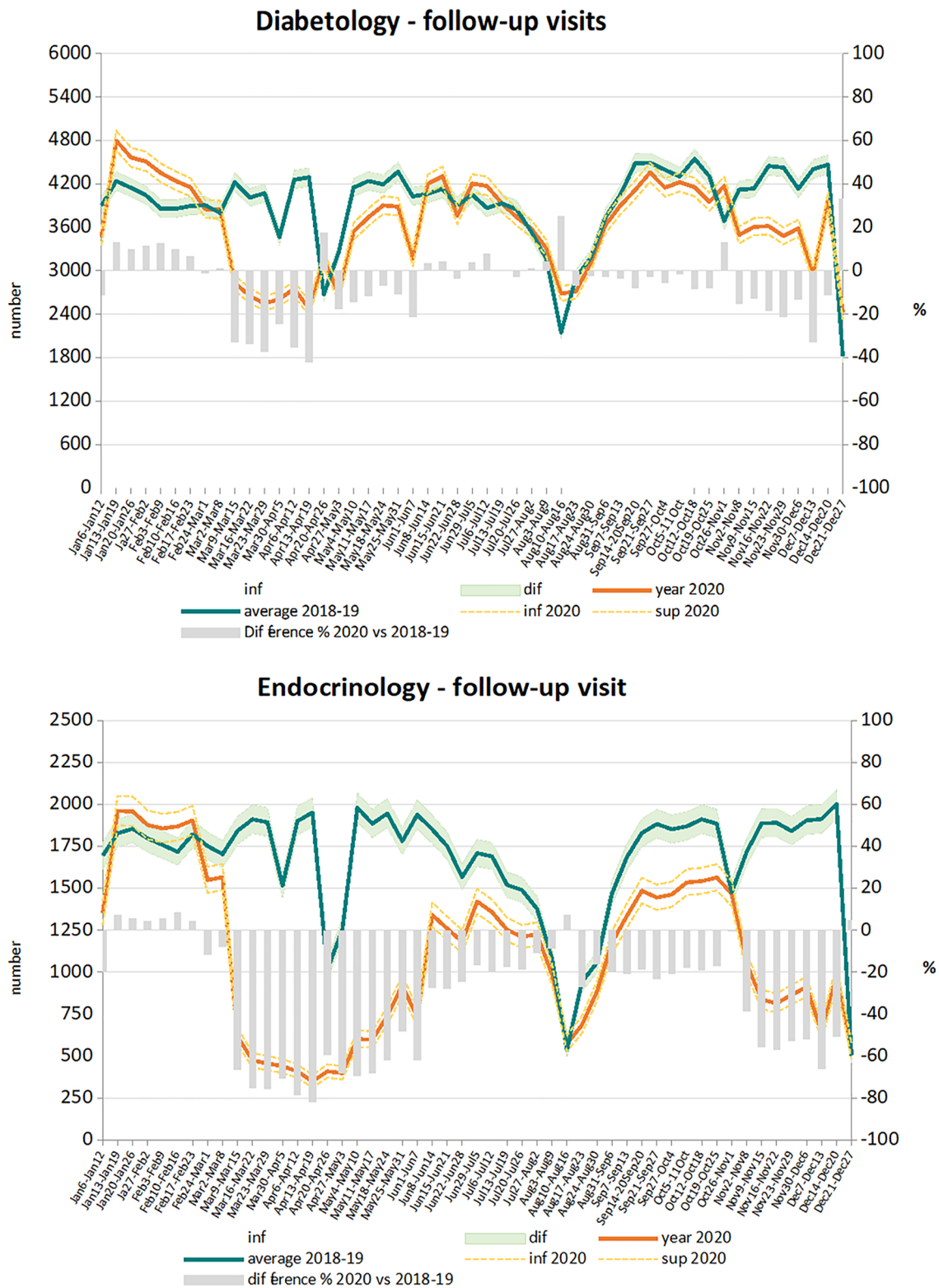


Fig. 2 Different patterns of follow-up visits diabetes vs. Endocrine one in 2020

between the absolute difference between the two periods and 2020 (100).

To compare the patterns, we also calculated the number of diabetes and endocrinology consultations performed in 2020 and in 2018–2019 (average) computed on a weekly basis, within four periods: pre-lockdown (from 1 January), lockdown (from 8 March), post lockdown (from 18 May), and the “second wave” (from 19 October). These differences were compared using the paired-simple Wilcoxon test.

As regards the results, we condensed in Fig. 1, the percent reductions between 2020 and 2019 in terms of performances and final outcomes in several areas of diabetes follow-up. All comparisons highlight a clear-cut decrease of visits, lab and instrumental tests, as well as hospital access, during the pandemic year.

There was a marked reduction in follow-up visits in type 2 diabetes patients (–24%), independent of age, sex, and educational level. The drop was maximum in March, April and November and minimum in June–October in accordance with local lockdown policy.

As regards disease monitoring, there was an almost identical reduction of lab (blood and urine) tests such as A1c, lipids and microalbuminuria, around—10%. Significantly greater was the reduction of instrumental tests, in particular, ECG and eye screening (–45%). Likewise, there was a 30%-drop in nurse activities (mainly education). The Ministry of Health indicator, based on the achievement of a cluster of tests, was markedly underperformed in 2020 as compared with 2019 (–28%).

Unfortunately, we do not have information on a possible drop of average HbA1c or other lab values attaining metabolic control. This limitation reflects the known downside of studies based on administrative sources that is lack of clinical data.

Contrary to a widespread expectation among administrators of compensative hospital overuse, there was no increase either in hospitalization or ER access for severe conditions; both decreased by 30%, in accordance with other observations in Italy for other conditions [5].

After the exclusion of positive-swab-testing patients [3], no difference in the mortality rate for non-Covid-19 causes was registered.

As a whole, this data highlights the serious blow given to assist in diabetes in Piemonte Region in 2020 mainly due to the difficulty to do on-site visits and education. However, the capacity to recover in several months and the maintenance of a fair amount of contacts even in the worst periods witness the effort carried out by the network of diabetes units to cope with the emergency and the social distancing. In this field, several initiatives of telemedicine were revealed to be very useful and allowed to keep contact with many patients.

Patients received remote consultations on health status, laboratory exams, and pharmacotherapies. However, the obliged online approach required some patients’ ability to contact the clinic and attend the visit, with a possible consequent selection of patients based on digital skills.

It is instructive to compare follow-up visits for diabetes with endocrine ones in 2020 versus 2018–2019 (Fig. 2). The pattern of reduction in diabetes is smoother than in endocrine visits in 2020. This is likely due to the model of care based on enrolment and taking in charge which favoured diabetes units in getting in touch with patients and performing some form of telemedicine.

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## Declarations

**Conflict of interest** All authors have nothing to disclose.

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

**Informed consent** According to the Italian law no approval is required for epidemiological analysis regarding anonymous data.

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