Effects of COVID-19 Lockdown on Glucose Control: Continuous Glucose Monitoring Data From People With Diabetes on Intensive Insulin Therapy

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The coronavirus disease 2019 (COVID-19) outbreak forced Italy to begin lockdown on 9 March 2020. This suddenly changed the daily routine of people with diabetes, increasing sedentary behavior, changing eating patterns, and increasing their psychological burden (1,2), all of which may result in changes in glucose control. This is especially relevant for patients on complex therapeutic regimens such as multiple daily injections (MDI) of insulin or continuous subcutaneous insulin infusion (CSII). Therefore, the COVID-19 lockdown is an unprecedented model to investigate how acute changes in lifestyle affect glucose control in diabetes.

To investigate the effects of lockdown on ambulatory glucose metrics, defined according to the international consensus on time in range (TIR) (3), we performed an analysis of continuous glucose monitoring (CGM) data of the 14 days preceding (baseline: 24 February to 8 March 2020) and following (lockdown: 10 March to 25 March 2020) the extension of lockdown to the whole of Italy in people with diabetes on MDI or CSII. After exclusion of individuals unable to upload data on online platforms or who had contact with diabetologists for therapeutic changes, 55 adults (43.6% male, median [25th, 75th percentile] age 41 [28, 49] years, disease duration 11 [5, 23] years) with diabetes (90.9% autoimmune, 5.5% type 2, 3.6% post-pancreatectomy) treated with MDI (≥4 insulin injections per day, 50.9%) or CSII (49.1%) and wearing a CGM device were included. Forty-eight people (32 office workers/cashiers, 9 students, 2 teachers, 2 housekeepers, 3 managers) activated smart-working from home or stopped working when lockdown was issued, 3 (2 cashiers, 1 driver) continued working outside home, and 4 were retired.

The study was 90% powered to detect a change in TIR ≥10% with paired *t* test (α level: 0.05).

As exploratory objectives, we evaluated the glycemic effects of lockdown in subgroups with higher hypoglycemic risk (baseline time below range [TBR] ≥4% [$n = 17$]) or poorer glycemic control (baseline TIR ≤50% [$n = 18$]).

At baseline, mean ± SD TIR was 57.1 ± 16.7, and it did not vary during lockdown (58.1 ± 20.1, $P = 0.46$), nor did other glucose metrics (Fig. 1*A–D*).

With the exception of HbA_{1c}, there were no major differences in baseline features between subgroups and their respective controls (data available upon request). The subgroup with baseline TBR ≥4% showed a significant reduction in median (25th, 75th percentile) TBR during lockdown (8% [4%, 11%] vs. 5% [2%, 8%], $P = 0.033$), which was greater than the change experienced by the subgroup with baseline TBR <4% (−2% [−5%, 0%] vs. 0% [0%, 1%], $P = 0.003$) and accompanied by a greater reduction in the mean hypoglycemia length minutes, $P = 0.029$), while the change in total number of hypoglycemic events did not differ between groups (Fig. 1*E–H*). No significant changes in glucose metrics were found between subgroups by baseline TIR or by insulin regimen (MDI or CSII).

Our analysis shows no significant changes in the ambulatory glucose profile of insulin-treated people during the first 14 days of COVID-19 lockdown. However, people at increased risk of hypoglycemia before lockdown showed a reduction of TBR afterward. The hypothesized deleterious effects of lockdown might have not worked or may have been counterbalanced by other lockdown consequences, such as improvements of eating patterns (increased consumption of homemade food), decreased workloads, and increased time to cope with the daily challenges of diabetes management. The lockdown has likely forced people to slow down their frenetic routine, possibly resulting in increased time to better control glucose trends and to provide a faster response to hypoglycemia, as suggested by the results of the exploratory subgroup analysis. Also, the type and length of physical exercise might have changed, possibly reducing hypoglycemia.

The generalizability of our findings is limited by the low sample size, but

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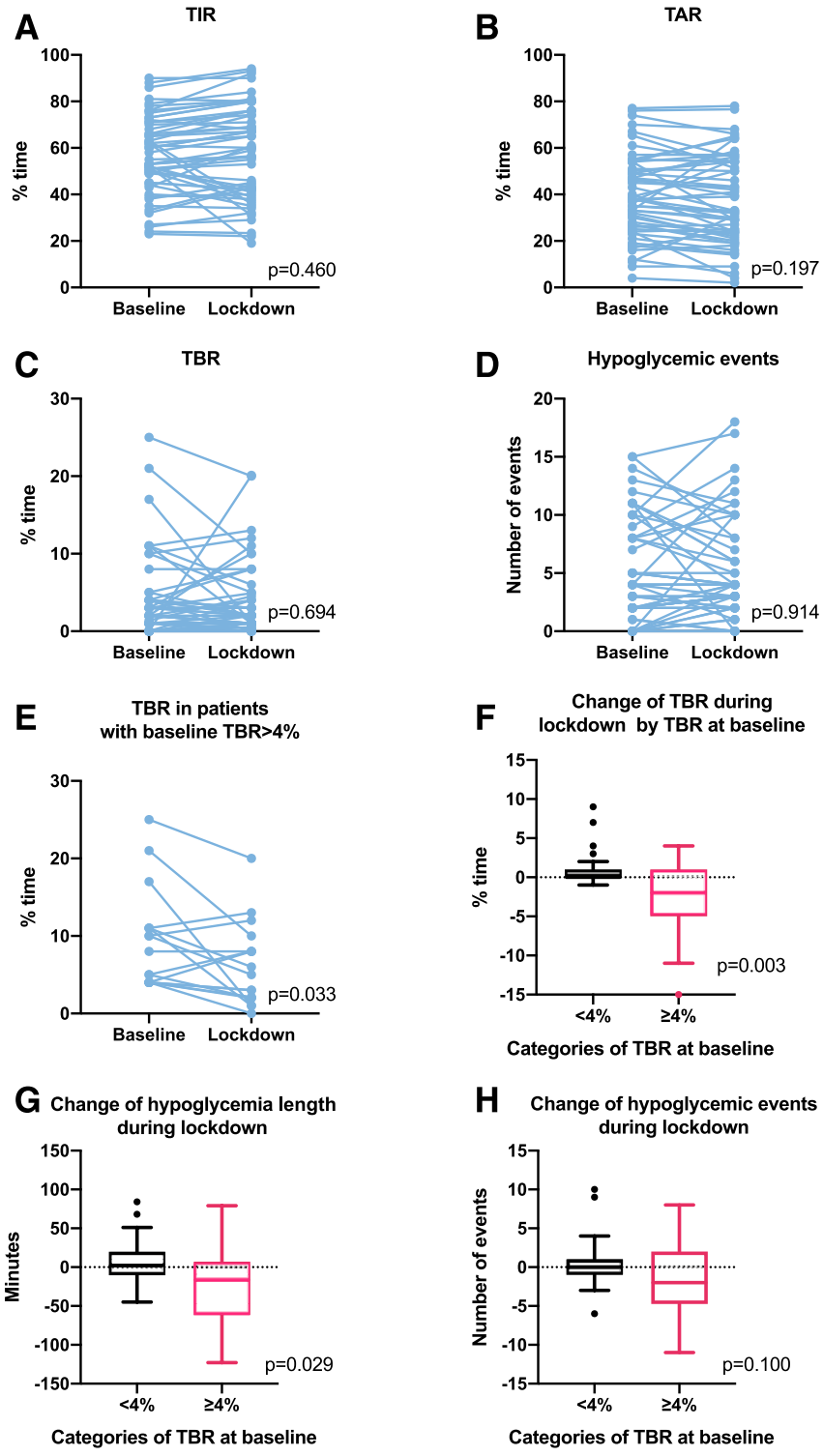

Figure 1—Effect of lockdown on ambulatory glucose profile. No significant changes in TIR (*A*), TAR (*B*), TBR (*C*), or in the total number of hypoglycemic events (*D*) occurred in the 14 days of CGM before and during lockdown in the 55 patients enrolled in this study. The 18 subjects at increased risk of hypoglycemia before lockdown (TBR ≥4%) showed a significant reduction of TBR during lockdown (*E*). The change in TBR (*F*) and in mean hypoglycemia length (*G*) but not in the overall number of hypoglycemic events (*H*) differed significantly between subjects at high vs. low hypoglycemic risk.

participants were individuated from two independent clinics in Rome (Sapienza and Campus Bio-Medico Universities), partially overcoming this issue. The results should however be confirmed in larger populations, especially those representing patients with nonautoimmune forms of diabetes who are underrepresented in this study. While limited by the selection of patients using both CGM and platforms for remote data sharing as well as by the absence of data documenting the extent of lifestyle changes and the psychological burden, this is the first study examining the short-term effects of lockdown on glucose variability in diabetes.

While unexpected, our results reassure that patients with diabetes may safely face the ongoing restrictions, which is crucial as diabetes itself may worsen COVID-19 prognosis (4,5). Our data represent a first step toward a deeper understanding of the COVID-19 outbreak impact on glucose control of non–COVID-19 patients, enabling us to comprehend their unmet needs and act on lockdown-related issues.

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