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Glycemic control in type 1 diabetes mellitus and COVID-19 lockdown: What comes after a "quarantine"?

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Highlights

- A stable or even improved glycemic control was found in adolescents with T1DM using hybrid closed loop system not only during COVID-19 lockdown but also in the weeks after, when daily activities slowly resumed.
- Although the slowing down of routine daily activities might still have an influence, we believe that the continuation of the health care professional assistance through telemedicine during lockdown might have led to a "dragging effect" in these patients also after its suspension.

To the Editor,

Despite the potential deleterious effect of the extreme and prolonged situation of coronavirus disease 2019 (COVID-19) lockdown on glycemic control in individuals with type 1 diabetes mellitus (T1DM), a few studies conducted on adults in Italy and Spain showed instead a stable or even improved glycemic control during lockdown.[1-3] Maddaloni et al verified data of 55 individuals (most of whom stayed at home during lockdown), evaluated through continuous glucose monitoring (CGM) after 14 days of lockdown, and found a stable time in range (TIR) (from 57% to 58%) and a significant reduction in time below range (TBR) (from 8% to 5%).[1] Bonora et al showed an increase in TIR from 54 to 65% in another cohort of 20 individuals who stayed at home during lockdown and were evaluated through flash glucose monitoring (FGM) after 21 days.[2] Capaldo et al studied the largest cohort with 207 individuals for 2 weeks, evaluated through CGM or FGM, finding an improvement in TIR (from 56 to 58%), a decrease in glycemic variability (coefficient of variation, CV%) (from 36 to 35%), and a reduction of time spent below 54 mg/dL (from 1.4% to 0.6%).[3]

We reported that also in adolescents with T1DM using an hybrid closed loop (HCL) system in auto mode, there was an increase in TIR, evaluated through CGM after 28 days, from 68 to 72%, with a meaningful variance between individuals who performed physical activity at home (mean TIR 75%, mean increase in TIR +5%) or not (mean TIR 65%, mean increase in TIR +2%) ($P < 0.01$).[4]

All the authors of studies on adult population concluded that the reason for these beneficial effects on T1DM management was the slowing down of routine daily activities (more regular lifestyle, improvements of eating patterns and reproducible mealtimes, decreased workloads, more time for self-care, and increased time to cope with the daily challenges of diabetes management).[1-3] We speculated that, apart from a more regular timetable during the day and the continual presence of adolescents' parents at home, the continuation of the health care professional assistance through telemedicine could have been the reason for this improvement.[4]

1 | METHODS

To understand what to expect after lockdown period, when daily activities slowly resume, we further evaluated glycemic control in the previously described cohort of 13 adolescents when lockdown was over. We recruited all adolescents with T1DM followed at the Diabetes Pediatric Unit of the Institute for Maternal and Child Health "Burlo Garofolo" (a tertiary hospital and research institute that serves as a pediatric referral center for the province of Trieste, Italy) who were using an HCL system

TABLE 1 Data relating to glycemic control of the 13 adolescents using hybrid closed loop system in the four time intervals

	Before lockdown	Complete lockdown	Partial lockdown	End of lockdown
Mean CGM glucose (mg/dl)	155 (152-168)	153 (149-159)	156 (149-163)	157 (146-162)
Coefficient of variation (%)	34.2 (32.7-37.2)	35.1 (29.0-36.9)	33.1 (27.9-35.3)*,**	30.5 (28.9-35.2)*,**
GMI (%)	7.0 (6.9-7.5)	7.0 (6.8-7.2)	7.1 (6.8-7.3)	7.1 (6.7-7.3)
Sensor wear (%)	93 (87-96)	93 (89-97)	91 (74-96)	94 (68-95)
TIR (70-180 mg/dL) (%)	68 (60-71)	72 (68-76)*	72 (61-74)	72 (68-75)
TAR (>180 mg/dL)	28 (24-39)	28 (24-33)	26 (23-36)	28 (22-32)
TBR (<70 mg/dL)	2.0 (1.0-3.0)	1.0 (0.0-2.5)*	0.5 (0.0-1.8)*	0.0 (0.0-1.0)*
Auto mode (%)	81 (56-94)	93 (80-96)	84 (74-97)	96 (88-97)*
Total daily dose (U/kg/day)	0.9 (0.8-1.1)	0.8 (0.7-1.1)	1.0 (0.8-1.4)	1.0 (0.7-1.2)
Bolus amount (%)	57 (49-63)	54 (52-60)	49 (44-57)	55 (41-63)
Meals per day	4.9 (4.1-6.6)	5.1 (3.9-6.6)	4.0 (3.1-5.9)	5.7 (2.3-6.5)
CHO intake (grams/kg/day)	4.1 (2.9-4.7)	3.8 (2.8-5.2)	3.2 (2.5-4.6)	3.5 (2.5-4.6)

CHO, carbohydrates; CGM, continuous glucose monitoring; GMI, glucose management indicator; TIR, time in range; TAR, time above range; TBR, time below range.
*$P < 0.05$ compared to period before lockdown.
**$P < 0.05$ compared to period during complete lockdown).
Note: Data are presented as median and interquartile ranges (IQRs).

(Medtronic MiniMed 670G) in auto mode and have made telemedicine visits every 2 weeks.[5] Their mean age was 14.2 ± 3 years, 62% were female, mean body mass index was 21.9 ± 3.8 kg/m^2 (0.5 ± 0.8 standard deviation score according to Italian growth reference charts), mean HbA1c before lockdown 7.2 ± 0.4%.

Data on glycemic control were extracted during the televisits from CareLink Personal reports in the first 2 weeks after the first reduction of restrictions (including outdoor physical activities) (4-17 May, *partial lockdown*) and the following 2 weeks when the majority of restrictions were abolished (18-31 May, *end of lockdown*). These data were compared to the period before the severe acute respiratory syndrome coronavirus 2 outbreak in Italy (10-23 February 2020 - *before lockdown*) and the first 2 weeks of complete lockdown (9-22 March, 2020 - *complete lockdown*) (Table 1).

Ethical committee approval was not requested because the General Authorization to Process Personal Data for Scientific Research Purposes (Authorization no. 9/2014) declared that retrospective archive studies that use ID codes, preventing the data from being traced back directly to the data subject, do not need ethics approval.[6] Because of the retrospective nature of the study, the existing generic ethic approval and informed consent signed by parents at the disease onset, in which they agree that *"clinical data may be used for clinical research purposes*, *epidemiology*, *study of pathologies and training*, *with the objective of improving knowledge*, *care and prevention"* was used. Additionally, all parents were requested to give a specific informed consent for the collection of the data.

2 | RESULTS

Reference data at the beginning of lockdown showed already a good glycemic control in these individuals.[4] The TIR after lockdown remained stable at 72%, and CV % decreased significantly both compared to the period before and during complete lockdown (from 34.2 to 30.5%). We also found a reduction in TBR from lockdown onwards compared to the period before restrictions (from a 2% to 0%) and an increase in time spent in auto mode at the end of lockdown compared to the period before lockdown (from 81 to 96%)

3 | COMMENT

Although the absence of school and many after-school activities might still have an influence (reducing stress levels and irregularity of overlapped activities), at least in adolescents, we believe that the continuation of the health care professional assistance through telemedicine during lockdown might have led to a "dragging effect" in these patients also after the suspension of lockdown.[7,8] Although there is still insufficient evidence to support telemedicine use for glycemic control and other clinically relevant outcomes among patients with T1DM,[9] and the

routine download of data, which were conducted every 2 weeks in our cohort, could be seen as a "performance bias," because individuals were constantly in physician's sight, we believe that this routine and proximity, giving a direct objective method for adherence assessment and allowing positive reinforcement, should be considered in further research if they allow a better glycemic control both in adolescents and adults with T1DM. To confirm this hypothesis more data are needed, especially comparing these results to those of individuals with T1DM who were not able to continue diabetes care through telemedicine and had to skip their consultations during lockdown.

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DISCLOSURE

None declared.

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