FEATURE ARTICLE

Effect of COVID-19 on Type 2 Diabetes Self-Care Behaviors: A Rapid Review

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OBJECTIVE | The aim of this review was to describe how the coronavirus disease 2019 (COVID-19) lockdown affected the self-care behaviors of people living with type 2 diabetes.

METHODS | A systematic rapid review was conducted using four electronic databases. Studies reporting on the lockdown's impact on at least one of the self-care behaviors that were published from January 2020 through October 2021 were included. Findings were synthesized narratively, using the Association of Diabetes Care & Education Specialists ADCES7 Self-Care Behaviors as a framework. The methodological level of evidence and quality ratings of the articles were assessed using the Joanna Briggs Institute Appraisal Checklist.

RESULTS | Fifteen articles were included. Most studies reported on at least five of the self-care behaviors. There were reported increases in diabetes-related stress, as well as in increases in dietary intake and changes in the timing of meals. Physical activity was reported to decrease. Overall, taking medications and glycemic self-monitoring of blood glucose (SMBG) were unaffected by the lockdown. Of the studies reporting glycemic outcomes, the lockdown appeared to have little negative effect. None of the articles assessed all the self-care behaviors. The self-care behavior of SMBG was the least assessed. Most articles had a medium level of evidence and a medium to high quality rating (scores >60%).

CONCLUSION | The findings from this review found the COVID-19 lockdown had a variable impact on diabetes self-care behaviors. Because the potential for future COVID-19 surges and/or other virulent transmissible diseases remains a concern, health care providers should continue to address the importance of self-care behaviors to mitigate the risk of poor health outcomes in people with diabetes.

In 2019, a new virus known as SARS CoV-2 (severe acute respiratory syndrome coronavirus 2) appeared in China's Wuhan, Hubei province. The virus caused a new disease called coronavirus disease 2019 (COVID-19), which spread globally, infecting and killing millions of people (1). Over time, it became apparent that not all patient populations were equally vulnerable to the virus. Cardiometabolic comorbidities such as diabetes increased the risk of severe infection and mortality from COVID-19 (2,3).

Numerous infection control measures were imposed to slow the spread of COVID-19. Worldwide, lockdowns were initiated mandating that people stay inside and limit contact with others except for essential activities. Access to diabetes management resources such as outpatient office visits, routine screenings, medications, and self-monitoring supplies decreased or rapidly came to a halt. Previous research indicated that pandemics could negatively affect glycemia (4), and thus it was predicted that the COVID-19 pandemic and subsequent lockdown would have a negative effect on the health outcomes of people with diabetes (5).

Several research studies have explored how glycemic control changed during the pandemic. A recent systematic review reported improved glycemic control among people with type 1 diabetes during the COVID-19 lockdown; however, among people with type 2 diabetes, there was a worsening in glycemic parameters (6). In contrast, Silverii et al. (7) reported that the lockdown did not result in a significant difference in A1C in people with type 1 or type 2 diabetes.

Glycemic management is largely dependent on the behaviors of people with the condition (8). According to the Association of Diabetes Care & Education Specialists (ADCES), there are seven self-care behaviors believed to promote health and prevent complications of diabetes. These include healthy coping, healthy eating, being active, taking medication, self-monitoring, reducing risks, and problem-solving (9).

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The purpose of this rapid review was to describe the self-care behaviors and glycemic management of people living with type 2 diabetes during the COVID-19 lockdown period. This knowledge will help researchers and health care providers (HCPs) better understand supports needed for people with type 2 diabetes when health care and community resources are reduced. For this rapid review, only people with type 2 diabetes were included to reduce heterogeneity and discern specific patterns in self-care behaviors within this population.

Research Design and Methods

Search Strategy

A rapid review was conducted following the Cochrane rapid review guidelines (10). The study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO registration no. CRD42021296465). The review question was, "In people with type 2 diabetes, did the COVID-19 lockdown affect self-care behaviors?" Studies were identified by searching the Embase, CINAHL, and Web of Science databases using the following search terms: COVID-19, type 2 diabetes, lockdown, and self-care behavior. Articles published from January 2020 through October 2021 were included. Observational and experimental studies were included. Reviews, meta-analyses, theses, position papers, protocol papers, and studies published in languages other than English were excluded. Also excluded were studies that focused exclusively on type 1 diabetes, inpatient mortality rates, and/or gestational diabetes.

Screening

A total of 199 studies were found using the criteria above. These studies were imported to Covidence review software (11), which facilitated screening, tracking, and documentation efforts between geographically distant investigators. Two reviewers (J.M.O. and V.J.B.) screened 20% of the abstracts, with conflicts resolved to ensure interrater reliability. One reviewer (J.M.O.) screened the remaining abstracts, and the second reviewer (V.J.B.) screened all excluded abstracts to ensure concordance. The remaining full-text articles were independently screened, and disagreements regarding the eligibility of studies were resolved by consensus. Reference lists of included studies were manually screened.

Level of Evidence and Quality Appraisal

All reviewers (J.M.O., V.J.B., and S.S.) assigned levels of evidence and quality ratings to the studies using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists (12). Levels of evidence ranged from 1 (experimental design) to 5 (expert opinion). Quality ratings were assigned based on the number of "yes" responses on the review checklist. Studies scoring ≥80% were considered to have strong quality, those scoring from 60 to <80% were of moderate quality, and those scoring <60% were of weak quality (Table 1).

Data Extraction, Synthesis, and Analysis

The following information was extracted from the articles: year of publication, study region, study design, sample size, sample selection, data collection dates, lockdown definition and length, measurement of self-care behaviors, and findings. Findings were synthesized narratively using the ADCES7 Self-Care Behaviors (9) as a framework.

Results

Characteristics of Included Studies

Fifteen articles were included in this review. The Preferred Reporting for Systematic Reviews and Meta-Analysis (PRISMA) (13) flow diagram is presented in Figure 1. Table 2 summarizes the characteristics of the studies that met the inclusion criteria, including 13 cross-sectional studies (14–26), 1 cohort study (27), and 1 mixed-methods study (28). The levels of evidence (29) assigned to the articles included in this review were between 3 and 4 (observation-analytic and observational-descriptive) except for one mixed-methods study with an evidence level of 2B (28). The quality of most studies was moderate to strong (Table 1). Of the 15 studies, six were conducted in India (15,17,18,20,24,26). About half of the studies collected data via telephone surveys (14,15, 17,20,22,23,25).

Self-Care Behaviors

Table 3 provides a visual representation of the self-care behaviors addressed in each study, based on the ADCES7 Self-Care Behaviors (9) framework. All studies evaluated reported on at least one component of the self-care behaviors. Fifty-three percent of the studies (8 of 15) reported on at least five of the self-care behaviors. None of the articles assessed all the self-care behaviors. The self-care behavior of self-monitoring of blood glucose (SMBG) was the least assessed. Table 4 provides a detailed summary of the findings on self-care behaviors in each study.

Healthy Coping

Healthy coping was measured by self-report of negative emotions and quality of life.

TABLE 1 Quality Assessment Using JBI Institute Critical Appraisal Tools (12)

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Total Score,%*†	JBI LOE (29)
High-quality cohort study													
Rowlands et al. (27)	NA	NA	1	1	1	NA	1	UC	1	NA	1	100	3.e/B
High-quality cross-sectional studies													
Khare and Jindal (18)	NA	NA	1	1	1	NA	1	1	UC	UC	1	100	3.e/B
Regeer et al. (21)	1	1	1	1	1	1	1	1	NA	NA	NA	1.00	4.b/B
Önmez et al. (19)	1	1	1	1	1	0	1	1	NA	NA	NA	87	3.c/A
Sankar et al. (24)	1	1	0	1	1	1	1	1	NA	NA	NA	87	3.e/A
Anjana et al. (15)	1	1	UC	1	0	1	1	1	NA	NA	NA	85	4.b/B
Sacre et al. (23)	NA	NA	1	1	1	0	1	1	UC	UC	1	85	3.e/B
Medium-quality cross-sectional studies													
Rastogi et al. (20)	1	1	1	1	0	0	1	1	NA	NA	NA	75	4.b/B
Ruiz-Roso et al. (22)	1	1	1	1	0	0	1	1	NA	NA	NA	75	4.b/B
Silva-Tinoco et al. (25)	1	1	1	1	0	0	1	1	NA	NA	NA	75	4.b/B
Low-quality cross-sectional studies													
Alshareef et al. (14)	1	0	UC	UC	1	0	UC	UC	NA	NA	NA	50	4.b/B
Ghosh et al. (17)	1	1	0	0	0	0	1	1	NA	NA	NA	50	3.e/B
Fisher et al. (16)	1	1	1	0	0	0	0	1	NA	NA	NA	50	3.e/B
Tiwari et al. (26)	1	1	0	UC	0	0	0	UC	NA	NA	NA	50	4.b/B
Low-quality mixed-methods study													
Sauchelli et al. (28)	1	1	0	0	1	0	0	1	NA	NA	NA	50	2/B

1 = yes; 0 = no. loe, level of evidence; NA, not applicable; UC, unclear. *For calculation of total score, NA and UC were not included in numerator or denominator. †Total scores ≥80% are indicative of high quality, those 60–80% indicate medium quality, and those ≤60% suggest low quality.

Negative Emotions

Eight studies assessed participants' perception of stress or anxiety during the lockdown (14,16,17,19,21,23,24,26) using a variety of validated and study-specific patient-reported outcomes (Table 2). The percentage of study participants reporting ranged from 12 to 87% (15,17,19,25,26). In contrast, a decrease in stress was noted in ≤12% of participants in three studies (15,19,25). Two studies found the lockdown did not affect distress, anxiety, or depression ratings (16,28).

Diabetes-Related Stress

Three studies looked at stress specific to the management of type 2 diabetes (16,23,24). Fisher et al. (16) found that just over half of the participants reported concerns about obtaining food and diabetes supplies, having access to the health care team, and having laboratory tests canceled. Sankar et al. (24) noted that participate concerns were related to medication access (20%) and missing doctor appointments (36.4%). Sauchelli et al. (28) found that confidence in the ability to take care of mental well-being decreased in one-third of participants.

COVID-19–Related Stress

Three studies explored concerns specific to COVID-19 and its spread (16,18,23). The proportion of participants who expressed concerns related to the spread of COVID-19 ranged from 33 to 66% (18,23,24). The effect of COVID-19 on employment/financial concerns was also noted in two studies (16,18). Social isolation caused by the lockdown was a concern for many participants in two studies (16,18).

Quality of Life

Önmez et al. (19) noted lower scores on social functioning and role limitations, indicating decreased quality of life for people with type 2 diabetes during the lockdown. Sacre et al. (23) found that 29–73% of participants reported negative impacts on quality-of-life dimensions related to leisure activities, feelings about the future, and emotional well-being.

Overall, most participants studied reported that the pandemic caused an increase in stress and anxiety. Diabetes-related stress and pandemic-related stress negatively affected overall participants' well-being and coping ability.

Healthy Eating

Eleven studies explored the effect of the pandemic on eating behaviors (14–20,23–26). Alshareef et al. (14) noted that 1.3% of participants indicated a decrease in healthy eating after the lockdown. However, Silva-Tinoco et al. (25) reported that less than half of participants had difficulty with their diet during the lockdown. Other researchers found that participants reported no change in the quantity

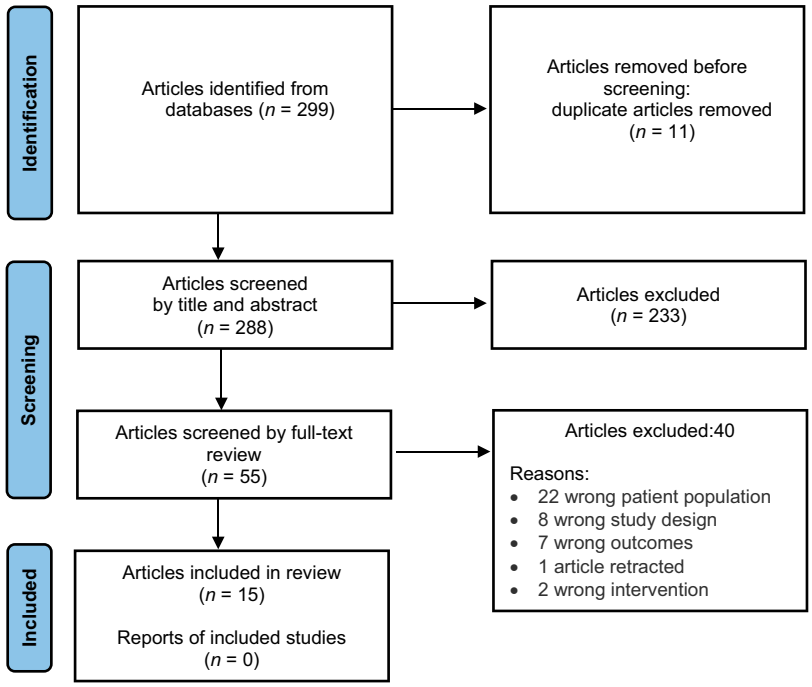

FIGURE 1 PRISMA flow diagram (13).

of food they consumed (17). Similarly, no changes in eating behaviors (dietary patterns or maintaining a healthy diet) during the pandemic were noted in other studies (15,24). Fisher et al. (16) and Khare and Jindal (18) found that the quantity of food consumed was greater after the lockdown.

Dietary Components

No change in fruit and vegetable consumption was reported in two studies (15,17). Additionally, Ruiz-Roso et al. (22) reported no significant change in vegetable intake. However, an increase in fruit and vegetable intake was reported by one study (24). Two studies found an increase in snacking (22,24). Consumption of sugary foods reportedly decreased in one study (17) but increased in another (22). Önmez et al. (19) reported on healthy eating in terms of dieting, finding that only a small percentage of the study participants reported dieting regularly. Although a 38% increase in carbohydrate intake was noted in their study, Ghosh et al. (17) also reported that 97% of participants ate home-cooked fresh meals (17). Fisher et al. (16) reported that nearly equal percentages of participants in their study increased, decreased, or had no change in eating patterns.

Eating Behaviors

Some studies reported improvements in eating behaviors. Dietary adherence increased by 6.4% among participants in the study by Sankar et al. (24). An overall decrease in food intake was noted in 25% of participants in the study by Ghosh et al. (17). In another study, 22% of participants reported an increase in adherence to healthy eating guidelines, and approximately half indicated that they did not experience a change in their confidence to adhere to such guidelines (28).

Lockdown was found to have a negative impact on eating habits/patterns in 60% of the studies (9 of 15). The most common changes in dietary intake were increased quantity (14,16), changes in the timing of meals (17,18), increased snacking (22,24) and difficulty with dieting or food choices (25,26,28).

Being Active

Fourteen of the 15 studies reported results on physical activity during the COVID-19 lockdown (14–18,20–28), making activity the most addressed self-care behavior.

Decreased Activity

Seven of the studies reported varying degrees of decrease in physical activity during the lockdown (14–17,21,23,24). Rowlands et al. (27) noted that participants reported taking fewer steps per day and increasing levels of inactivity, whereas other participants reported increased moderate to vigorous activity. In contrast, participants in one study reported decreased moderate activity and walking and increased time sitting (22). Sacre et al. (23) reported no change in time spent sitting. Önmez et al. (19) measured the frequency

TABLE 2 Characteristics of Included Studies

Study, Location	Design	Sample Size, *n*	Methods	Length of Lockdown at the Time of Study and Description of Lockdown Measures	Self-Care Measures
Alshareef et al. (14), Saudi Arabia	Cross-sectional	394	Telephone interviews with current primary care center patients who had been seen in May 2019 and May 2020; data collection period not provided	NR	Kessler Psychological Distress Scale* to assess distress Study-specific survey to assess diet, physical activity, and medication compliance
Anjana et al. (15), India	Cross-sectional	2,510	Telephone interviews with 10% of patients at one of 48 diabetes centers across eight states of India; data collection period from 30 April to 5 May 2020	Initial 21-day lockdown started 25 March 2020 and extended twice until 31 May 2020; all activities except essential services halted	Study-specific survey at assess diet, physical activity, sleep pattern, use of telehealth, self-monitoring, online support, access to care, and access to food
Fisher et al. (16), United States	Cross-sectional	619	Convenience sampling: online survey sent to participants of a prior online diabetes education event; data collection in early April 2020	Study took place a few weeks after the pandemic began; selective social restrictions in place	Study-specific survey to assess stress/distress, diabetes management, access to care, and access to diabetes supplies
Ghosh et al. (17), India	Cross-sectional	150	Convenience sampling; telephone interviews of regular patients; data collection 10–17 May 2020	Study took place during fourth phase of lockdown; people told to stay inside homes except for carrying out essential activities	Study-specific survey to assess stress, diet, physical activity, behavioral factors, basic knowledge about telemedicine, and general questions
Khare and Jindal (18), India	Cross sectional	307	Convenience sampling of outpatients with good glycemic control and without chronic complications; telehealth used for surveys and reporting of blood glucose values; data collection for 3 weeks during the first-phase lockdown period	Lockdown measures were not specifically described. Study conducted during the first phase of lockdown.	Glycemic control assessed by review of home glucose self-monitoring data Study-specific survey to assess self-management behaviors
Önmez et al. (19), Turkey	Cross-sectional	101	Individuals who missed type 2 diabetes care follow-up appointments because of the lockdown and then were seen when pandemic restrictions lifted: data collection in July and August 2020	Various restrictions imposed in March 2022 and gradually lifted in June 2020	Short Form-36* to assess general health Study-specific survey to assess diet and physical activity

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TABLE 2 Characteristics of Included Studies

Study, Location	Design	Sample Size, *n*	Methods	Length of Lockdown at the Time of Study and Description of Lockdown Measures	Self-Care Measures
Rastogi et al. (20), India	Cross-sectional	422	Telephone interviews with regular clinic patients who had a blood glucose meter at home; data collection at the last clinic visit prior to lockdown and 3 months after lockdown	Complete lockdown 25 March to 4 May 2020, with partial lockdown restrictions thereafter	Global Physical Activity Questionnaire* and study-specific survey to assess physical activity
Regeer et al. (21), Netherlands	Cross-sectional	536	Convenience sampling of previous participants in an exercise program; online survey; data collection in the first week of May 2020	Lockdown started 9 March 2020 and included social distancing (no gatherings of >3 people and only then a distance of ≥1.5 meters); closure of schools, daycare centers, and sporting facilities; work from home if possible; and restrictions on public transportation; outdoor activities, exercise, and shopping for groceries were allowed	Short Questionnaire to Assess Health-Enhancing Physical Activity* to assess physical activity Perceived Stress Scale* to assess anxiety World Health Organization Well-Being Index* to assess well-bring Study-specific survey to assess stress, anxiety, and emotional changes related to COVID-19
Rowlands et al. (27), United Kingdom	Prospective cohort	165	Convenience study of participants in a prior stud; accelerated mail to participants; data collection for the first point between 2017 and 2020 and for the second point: from 17 May to 12 June 2020	Lockdown started 23 March 23, 2020, with easing of restrictions on 10 May 2020 and relaxing of restrictions on 4 July 2020; outdoor exercise permitted	Accelerometer data to assess physical activity; log notations to assess sleep
Ruiz-Roso et al. (22), Spain	Cross-sectional	72	Telephone interviews of hospital-based population; data collection from 8 April to 20 May 2020	Strict lockdown began 14 March 2020, initially including social distancing and complete confinement at home	Food Frequency Questionnaire (FFQ)* to assess nutrition-related behavior Food Craving Questionnaire–State* and Food Craving Questionnaire–Trait* to assess food cravings Physical Activity Questionnaire* to assess physical activity

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TABLE 2 Characteristics of Included Studies

Study, Location	Design	Sample Size, *n*	Methods	Length of Lockdown at the Time of Study and Description of Lockdown Measures	Self-Care Measures
Sacre et al. (23), Australia	Cross-sectional	470	Convenience sampling: telephone interviews of participants enrolled in a previous study; data collection for baseline between 2018 and 2020 and for second time point estimated from 30 March to 30 April 2020 during restriction easing	Restriction of unreported length included no leaving home except for medical care/caregiving, shopping for necessary food/supplies, essential work/education, or exercise; face-to-face clinical services limited and replaced with telehealth	General Anxiety Disorder-7* to assess anxiety Patient Health Questionnaire-8* to assess depression Problem Areas in Diabetes scale* to assess diabetes distress CRISIS questionnaire* to assess COVID-19 infection risk DAWN2 Impact of Diabetes Profile* to assess effect of COVID-19 on quality of life Confidence in Diabetes Self-Care* to assess confidence in self-care ability Diabetes Support Scale* to assess perceived support Study-specific survey to assess physical activity, sitting time, alcohol consumption, medication taking, glucose self-monitoring, and attendance at general practitioner visits
Sankar et al. (24), India	Cross-sectional	110	In-person questionnaire given to regular patients at an outpatient diabetes clinic; data collection for baseline from medical record review (unknown time period) and for second time point from third week of May to third week of June 2020	First lockdown for 1 month starting 16 March 2020, followed by second and third lockdowns	Hospital Anxiety and Depression Score* to assess COVID-19–related anxiety Study-specific survey to assess psychosocial stress, dietary adherence, physical activity, sleep quality, glucose self-monitoring, and use of digital media Medical record review to collect anthropometric and laboratory data

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TABLE 2 Characteristics of Included Studies

Study, Location	Design	Sample Size, *n*	Methods	Length of Lockdown at the Time of Study and Description of Lockdown Measures	Self-Care Measures
Sauchelli et al. (28), United Kingdom	Mixed methods	220	Convenience sample from local hospital and university; online survey; data collection from 24 April to 31 August 2020	National lockdown-imposed 23 March 2020; patients with COVID-19 prioritized across the National Health System; from 1 June 2020, a range of physical distancing measures were imposed to varying degrees across time	Study-specific survey to assess confidence in diabetes self-management, access to information and support, resources used for guidance on COVID-19 physical distancing measures, and support from personal network Medical record review to collect demographic, A1C, and body weight data
Silva-Tinoco et al. (25), Mexico	Cross-sectional	212	Convenience sample of patients previously enrolled in a diabetes education program; telephone survey; data collection from 20 April to 29 May 2020	NR	Summary of Diabetes Self-Care Activities* to assess diet, physical activity, glucose self-monitoring, accessing medications, and adherence to medications
Tiwari et al. (26), India	Cross-sectional	1,346	Face-to-face interviews with all patients visiting various clinical centers during the first month after lockdown; data collection June 2020	NR	Study-specific survey to assess physician accessibility, dietary patterns, exercise, glucose self-monitoring, sleep patterns, psychological factors, medication availability, and awareness of the pandemic

All study samples were people with type 2 diabetes. *Validated instrument. NR, not reported.

TABLE 3 ADCES7 Self-Care Behaviors (9) Addressed in Each Study

Study	Healthy Coping	Healthy Eating	Being Active	Taking Medications	Self-Monitoring	Reducing Risks	Problem-Solving
Alshareef et al. (14)	X	X	X	X	X	X	X
Anjana et al. (15)	X	X	X	NA	X	X	X
Fisher et al. (16)	X	X	X	X	X	NA	X
Ghosh et al. (17)	X	X	X	X	X	X	X
Khare and Jindal (18)	X	X	X	X	X	NA	NA
Önmez et al. (19)	NA	X	NA	NA	X	X	NA
Rastogi et al. (20)	NA	NA	X	NA	NA	X	NA
Regeer et al. (21)	X	NA	X	NA	NA	X	NA
Rowlands et al. (27)	X	NA	X	NA	NA	X	NA
Ruiz-Roso et al. (22)	NA	X	X	NA	NA	NA	NA
Sacre et al. (23)	X	NA	X	X	X	X	X
Sankar et al. (24)	X	X	X	X	X	X	X
Sauchelli et al. (28)	X	X	X	NA	X	X	X
Silva-Tinoco et al. (25)	NA	X	X	X	X	NA	NA
Tiwari et al. (26)	X	X	X	X	X	X	X
Total of 15	11	11	14	8	11	11	7

of exercise; most respondents indicated that they never (34.6%) or rarely (34.6%) exercised during the lockdown period, but the authors did specify the amount or type of physical activity, nor did they compare this finding to pre-pandemic levels. Ruiz-Roso et al. (22), noted participants reported more time sitting and less walking or moderate activity. Khare and Jindal (18), found decreases in they type, timing and duration of exercise among participants.

Increased Activity

An increase in activity by some participants was reported in seven of the studies (47%) (15–17,19,21,24,28). Increased activity among study participants ranged from reported frequency of 2.7% to 27% (17,19,21,24) The study by Ghosh et al. (17) was the only one that identified specific types of physical activity. They found that, among participants who exercised, aerobic exercise was the most common form. Tiwari et al. (26) found that the majority of participants reported regularly exercising during the lockdown but did not quantify the amount of time spent, the type of activity, or how this finding compared with pre-pandemic levels. In one study, researchers measured physical activity telephonically using the Global Physical Activity Questionnaire and found an increase in physical activity scores during the lockdown (20).

No Change in Activity

The authors of five studies reported no change in physical activity (15–17,21,24). Silva-Tinoco et al. (25) compared reported global self-care behavior scores before and after the onset of the pandemic. Physical activity/exercise was one of the scored behaviors. Participants reported difficulty with physical activity and exercise recommendations (25). Duration of exercise was examined in two studies (17,18). Ghosh et al. (17) reported that most participants indicated that they decreased their duration of exercise during the lockdown period. Khare and Jindal (18) noted changes in the type, timing, and duration of exercise among study participants. However, these authors did not clearly indicate whether the changes they noted involved an increase or decrease in activity. In the study by Sauchelli et al. (28), most participants indicated that their confidence in their ability to perform physical activity remained the same.

Overall, these studies demonstrate that activity decreased during the lockdown period. However, in most of the studies, activity measures were not assessed before the pandemic, making it difficult to ascertain the extent to which activity levels decreased.

Taking Medications

Eight studies explored the impact of COVID-19 on medication-taking behaviors (14,16–18,23–26). Two studies reported that medication-taking behaviors were largely unchanged (14,23). In studies by Ghosh et al. (17) and Sankar et al. (24) more than 90% of the participants continued to have access to medications. Other studies found that patients reported difficulty obtaining medications (18,24–26). Participants self-reported difficulty taking medications stemming from an inability to consult a doctor, decreased availability of medications, and access to medications (18,25,26). Other studies found that their participants had a high level of ability to continue taking medications during lockdown (16,26), and Fisher et al. (16) noted a 9.5% increase in taking medication. Overall, lockdown did not appear to have a marked negative effect on medication-taking.

TABLE 4 Findings Regarding Changes in Self-Care Behaviors

Study	Healthy Coping	Healthy Eating	Being Active	Taking Medications	Self-Monitoring	Reducing Risks	Problem-Solving
Alshareef et al. (14)	NA	NA	NA	Take medications on time: 89.6 okay before lockdown, 88.3 after lockdown	SMBG: 45.9 before lockdown, 46.2 after lockdown	Compliance with medical treatment and lifestyle habits: ↓ 18.5 before lockdown, 17.4 during lockdown*	NA
Anjana et al. (15)	Screen time: ∼ 73.1, ↑ 15.9, ↓ 9.0 Sleep patterns: nighttime ∼ 73.1, ↑ 15.9, ↓ 9.0, daytime ∼ 81.6, ↑ 15.5, ↓ 2.9	Dietary patterns: eating out ∼ 87.9, ↑ 0.1, ↓ 11.9%; quantity ∼ 35.7, ↑ 38.1, ↓ 26.2; quality—fruits and vegetables ∼ 89, ↑ 5.6, ↓ 4.8, junk foods ∼ 88.2, ↑ 4.1, ↓ 7.7	Physical activity: ∼ 62.7, ↑ 13.5, ↓ 23.9	NA	SMBG: overall ↑	Smoking: ∼ 36.2, ↑ 5.2, ↓ 58.6 Alcohol use: ∼ 44.8, ↑ 2.1, ↓ 53.1 Weight: ↓	Doctor visit: in person 34.3, telehealth 30.6, unable to attend 35.1 Telehealth for online support: 11.4
Fisher et al. (16)	General stress: ∼ 14.6, ↑ 78.4, ↓ 7 Diabetes-related distress: ∼ 44.3, ↑ 51.2, ↓ 4.5 COVID-19–related distress: employment/finances yes 52, social isolation yes 79.3	Quantity: ∼ 35.7, ↑ 38.1, ↓ 26.2	Exercise: ∼ 24.1, ↑ 18.7, ↓ 57.2	Adherence to taking medications: ∼ 83.2, ↑ 9.5, ↓ 7.3	Frequency of SMBG: ∼ 76, ↑ 9.2, ↓ 14.9 Frequency of reviewing SMBG results: ∼ 76, ↑ 9.2, ↓ 14.9	NA	Appointments postponed or canceled: 42.5 Changed to telehealth: 37.6
Ghosh et al. (17)	Mental stress: yes 87 Sleep: ∼ 57, ↑ 16, ↓ 27 Coping activities: TV watching 53, spending time with family 19, office work 16, new hobbies 9, reading books 3	Dietary patterns: appetite ∼ 67, ↑ 20, ↓ 13: meal-timing ∼ 45, early 13, delayed 42, eating out ∼ 97 Change in quantity: ∼ 56, ↑ 19, ↓ 25 Change in quality: ∼ 62, ↑ 38	Duration of exercise: ∼ 33, ↑ 25, ↓ 42	Able to access medication: yes 91, no 3	SMBG: ∼ 77, ↑ 0, ↓ 23	Weight: ∼ 48, ↑ 19 with gain of 5–10%, ↓ 30 with loss of <5% and 3 with loss of ≥5% Alcohol: ∼ 89, ↑ 3, ↓ 8 Tobacco: ∼ 95, ↑ 3, ↓ 2	Aware of telemedicine: yes 69
Khare and Jindal (18)	Stress type: financial yes 81.8, COVID-19–related yes 69.2, no social network yes 49 Change in sleep: timing yes 74.1, duration yes 58.0, frequency 70.6	Change in dietary patterns: timing yes 60.1, frequency yes 60.1, quantity yes 68.5, type yes 39.9	↓ in type, timing and duration of exercise during the lockdown period 8	Change in medication: timing yes 58.0, availability yes 32.2, missed medication doses yes 35	Prescribed by research protocol	NA	NA

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TABLE 4 Findings Regarding Changes in Self-Care Behaviors

Study	Healthy Coping	Healthy Eating	Being Active	Taking Medications	Self-Monitoring	Reducing Risks	Problem-Solving
Önmez et al. (19)	NA	NA	NA	NA	NA	Weight change: ∼ 21.7, ↑ 39.6, ↓ 38.6	NA
Rastogi et al. (20)	NA	NA	Physical activity: ↑ Global Physical Activity Questionnaire score*	NA	NA	Weight: ↓ 1.0 kg from pre-lockdown to during lockdown	NA
Regeer et al. (21)	Stress: ∼ 58.9, ↑ 29.1, ↓ 12	NA	Activity: ∼ 47, ↑ 27, ↓ 26	NA	NA	Weight: ∼ 46, ↑ 37	NA
Rowlands et al. (27)	Sleep: ∼	NA	Activity: ↓ overall physical activity,* ↑ 21.9 inactive time,* ↑ moderate-vigorous activity	NA	NA	Adherence to COVID-19 recommendations: self-isolating 76, advised to self-isolate 31	NA
Ruiz-Roso et al. (22)	NA	Change in quantity or quality: ↑ sugary foods, snacks, dairy, and vegetables;* ∼ soda, nuts, cereal, legumes, fruit, and meat	Physical activity:* ↑ time sitting, ↓ walking, ↓ moderate activity	NA	NA	NA	NA
Sacre et al. (23)	Stress: ∼ anxiety, ∼ depression ↓ QoL:* 29–73 reported negative impacts on quality-of-life dimensions (greatest for leisure activities, feelings about the future, and emotional well-being) Diabetes-related distress: ↓ in diabetes distress overall COVID-related distress: moderate COVID-19 infection worry 31	NA	Physical activity: ∼ sitting time Physical activity reduced by 10% overall	Medication taking: ∼ (95% pre-COVID and 95% during COVID)	SMBG: ∼ (26 checks per month pre-COVID and 25 checks per month during COVID)	Alcohol consumption: ∼ (similar at baseline and follow-up) ↑ Doctor visits (0.6 visits per month pre-COVID to 1.1 visits per month during COVID)	Used telehealth 73, canceled appointment 43, no new appointment 39, proceeded with one or more appointments after changed to telehealth 73

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TABLE 4 Findings Regarding Changes in Self-Care Behaviors

Study	Healthy Coping	Healthy Eating	Being Active	Taking Medications	Self-Monitoring	Reducing Risks	Problem-Solving
Sankar et al. (24)	Stress: ∼ 73.6, ↑ 15.5, ↓ 10.9 Sleep: ∼ 52.8, ↑ 23.6, ↓ 23.6 COVID-19–related distress: COVID-19 spread yes 27.3 Diabetes-related distress: medication access yes 20, missing doctor appointments yes 36.4 Use of time during lockdown: TV watching–COVID-19 updates 99.1, movies/sports 60; spending time with family 73.6; household chores 70; social media 10; hobbies 10; working from home 17.3	Dietary adherence: ∼ 86.4, ↑ 6.4, ↓ 7.3 Change in quantity or quality: ↑ fruit 80.9, ↑ vegetables 42.7, ↑ snacking/fried or processed foods 63	Physical activity: ∼ 82.7, ↑ 2.7, ↓ 14.5	Medication adherence: missed due to lack of availability 10	NA	Weight: ∼ 65.5, ↑ 22.7, ↓ 11.8	Use of digital media to communicate: ∼ 65.5, ↑ 30, ↓ 4.5 Telemedicine use: 7.3
Sauchelli et al. (28)	Change in confidence: mental well-being ∼ 51, ↑ 18, ↓ 31	Change in confidence: healthy eating ∼ 42, ↑ 25, ↓ 33; choosing correct foods ∼ 47, ↑ 22, ↓ 33	Change in confidence: physical activity ∼ 45, ↑ 22, ↓ 33	NA	NA	Adhering to COVID-19 restrictions: 99 Change in confidence: maintaining a healthy weight ∼ 45, ↑ 31, ↓ 25	Appointment cancellation: yes 46.4 Social support: ↓ support from health care teams rated as poor by 43.2%
Silva-Tinoco et al. (25)	NA	Difficulty with diet: yes 41.5	Difficulty with exercise: yes 40	Difficulty with treatment adherence: yes 18.8 Difficulty getting pharmacological treatment: yes 22.6	NA	NA	NA

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‹ CONTINUED FROM P. 12

TABLE 4 Findings Regarding Changes in Self-Care Behaviors

Study	Healthy Coping	Healthy Eating	Being Active	Taking Medications	Self-Monitoring	Reducing Risks	Problem-Solving
Tiwari et al. (26)	Changes in sleep: yes 30.8 Stress: yes 27.0 How time was spent time during lockdown: sleep 7, hobby 3, excess TV watching 24	Change in diet: yes 14.7	Regular exercise: yes 54.8	Taking medications: adherence–stopped taking medications 13, took medications as prescribed 82; difficulty getting meds yes 18.8, no 81.22	NA	Adhering to COVID-19 restrictions: full adherence 88, partial adherence 11	Able to consult doctor: yes 16.7

All reported numerical values are %. ↓ = decrease; ↑ = increase; ~ = no change. *Statistically significant. NA, not applicable; QoL, quality of life.

SMBG

The ADCES7 recommendations include SMBG. The impact of the COVID-19 lockdown on this behavior was described in 73% of the articles (11 of 15) (14–19,23–26,28).

No Change in Self-Monitoring

The authors of four of these 11 articles (36%) noted that participants reported no change in the frequency of SMBG activities during the lockdown period (16,17,23,24). Fisher et al. (16) reported no change from the pre-pandemic period in the frequency of SMBG or in the frequency of review of glucose results from before the lockdown. Ghosh et al. (17), Sacre et al. (23), and Sankar et al. (24) assessed SMBG at one time point during the COVID-19 lockdown and found that people with diabetes reported that their SMBG behaviors remained unchanged. Khare and Jindal (18) advised participants in their study to conduct SMBG at least twice daily (at least one fasting and one postprandial measurement). However, the authors did not report whether participants' SMBG behaviors had changed, so we were unable to determine whether there was a difference from before the lockdown period. Önmez et al. (19) found that only 25.7% of the participants reported regularly checking their SMBG during the lockdown. Most participants reported the frequency of SMBG during the lockdown as occasionally (23.7%) or rarely (36.6%) (19). Because the study was conducted only during the pandemic, no baseline (pre-pandemic) data were available to ascertain whether this finding represented a change over time. Tiwari et al. (26) noted that 69.7% of participants monitored their SMBG, with 65% reporting that they performed one to five SMBG checks. However, the authors did not state whether this degree of SMBG occurred daily or weekly or whether it represented an increase or decrease. For the 30.3% of participants in the study who reported not doing SMBG, the reasons they gave included unavailability of glucose strips, no access to a glucose meter, and no perceived need to monitor.

Increased SMBG

Two of the studies reported an increase in SMBG (14,15). Alshareef et al. (14) noted that 45.9% of participants reported regularly SMBG before the lockdown, with 46.2% indicating regular SMBG after the lockdown. However, the regularity with which these participants monitored their blood glucose was not elucidated in either of the two studies (14,15). In a study by Anjana et al. (15) SMBG once weekly or more often was reported by 11.9% of participants before the lockdown and increased to 38.8% of participants during the lockdown. One study found that people with diabetes reported increased confidence in SMBG during the lockdown (28).

A paucity of the studies in this review examined change in SMBG during the lockdown period. The studies that reported

these findings did not compare them to pre-pandemic SMBG and relied on self-reports about this self-care behavior from people with type 2 diabetes.

Reducing Risk

Eleven of the fifteen studies explored the effect of lockdown on risk-reducing behaviors (14,15,17,19–21,23,24,26–28). Some of the behaviors reported in the articles included maintaining a healthy weight, not using tobacco, and adhering to lockdown recommendations. Weight gain was reported in four of the studies (17,19,21,24). Sauchelli et al. (28) reported that participants' confidence in maintaining a healthy weight had increased and decreased in similar percentages.

Alshareef et al. (14), Anjana et al. (15), and Ghosh et al. (17) reported on tobacco use. Two of the studies noted very few changes in smoking behaviors (14,17), whereas the third (15) noted a decrease in >50% of the participants in their study. Three studies (15,17,23) reported on alcohol consumption patterns. Anjana et al. (15) noted that >50% of participants decreased alcohol consumption. Although not many participants in the study by Ghosh et al. (17) consumed alcohol, those who did decreased their consumption.

People with type 2 diabetes have an increased risk of severe COVID-19 and experience worse health outcomes from it. Adhering to infection control measures was one way of reducing risk. The degree to which participants adhered to COVID-19 restrictions was examined in three studies and found to be high (26–28).

Overall, risks of diabetes complications were reduced by decreased tobacco and alcohol consumption and adherence to infection control measures. However, there was an overall increase in weight, which could increase risks.

Problem-Solving

A large percentage of people with type 2 diabetes were either unable to consult with their HCPs or had their appointments canceled and/or rescheduled (15,16,23,26,28). The use of telehealth was widely adopted as a strategy to manage the reduction of office visits (15,17,23). In contrast, only 11.4% of participants in one study used technology for diabetes management support (15). Anjana et al. (15) also reported that few people had access to home blood collection or home delivery of medications.

Overall Diabetes Management

A few studies did not categorize self-care behaviors, but rather reported on overall diabetes management. Sankar et al. (24) reported that the pandemic negatively affected diabetes self-management in 10% of the patients. However, 7% of patients in the study by Fisher et al. (16) reported that the pandemic made diabetes management easier; however, almost half of those in this study indicated that managing diabetes was more difficult. Sacre et al. (23) reported that participants experienced no significant change in their confidence regarding diabetes self-management. Global self-care behaviors decreased in the study by Silva-Tinoco et al. (25). Sauchelli et al. (28) reported that most patients reported no change in degree of confidence in their ability to self-manage, and 18% reported an increase in their confidence level.

Discussion

The COVID-19 pandemic and subsequent lockdown measures presented a unique opportunity to observe how people with type 2 diabetes self-manage their condition when their normal patterns of care and lifestyle are disrupted. The purpose of this review was to explore whether and what changes in self-care behaviors of people with type 2 diabetes occurred secondary to lockdown measures at the start of the pandemic.

Self-Care Behaviors Changed by Lockdown

Lack of access to HCPs and resources can affect a person's coping abilities and negatively affect diabetes self-care behaviors (9). COVID-19 disrupted many aspects of society and daily living, leading to an increase in diabetes-related stress above the high levels (40%) already associated with individuals with type 2 diabetes during "normal" conditions (30). Participants reported concerns about obtaining food, medications, and diabetes supplies, as well as accessing HCPs and laboratory testing (16,23,24). Additionally, participants were concerned about the spread of the virus and changes in social functioning (16,18,23). Given the potential impact of diabetes-related stress on self-care behaviors, HCPs need to implement systems to assist people with type 2 diabetes in accessing necessary tools and services to maintain self-care behaviors.

Negative changes in dietary intake such as increased consumption of sugary foods, carbohydrates, junk foods, snacks, and fats, as well as changes in meal timing and increases in the amount of food consumed were reported (17,18,22,24,28). This deviation from healthy eating may have been reflective of so-called "stress eating," which has been shown to negatively affect glycemia (31,32).

Both increases and decreases in exercise were reported; however, decreases occurred more often. Lack of time is often a barrier to regular physical activity; yet, it would seem that more time would have been available for physical activity during the lockdown. Infection prevention measures

that closed exercise facilities may have contributed to the decrease in physical activity seen in these studies. It is plausible that people with type 2 diabetes remained isolated and chose to remain in the safety of their homes because of concerns about the potential transmission of the virus. These findings suggest an opportunity for diabetes care and education specialists to provide people with type 2 diabetes with tools and tips for exercising in their homes and may also present an opportunity to use various forms of technology (e.g., digital apps, exercise videos, and home treadmills) to increase engagement in physical activity in such instances.

Self-Care Behaviors Unchanged by Lockdown

Taking and accessing medications were largely unaffected by the lockdown (16–18,24–26), and most of the studies that explored glucose self-monitoring behaviors found no change for most participants (16–18). The ability to continue taking medications as prescribed may be related to methods of obtaining medications. Although the scope of this review did not include evaluating medication access, the fact that medications in the United States are often available via various routes such as mail-order, drive-up pharmacy windows, and local pharmacy delivery services may explain why medication access was relatively unaffected. Also, participants may have had more time during lockdown to engage in medication-taking and SMBG behaviors. However, most of the studies in this review relied on self-reports from people with type 2 diabetes, and individuals may over- or under-report their SMBG.

Problem-solving allowed many people to continue accessing their HCPs by using telehealth. This may have been why some expected negative effects of lockdown were not seen. The use of telehealth has been shown to be an invaluable tool for reaching people with type 2 diabetes in a variety of settings and provides a means of connecting with patients during times of social isolation (33).

Of the participants in studies reporting on glycemia, 60–70% reported that the lockdown did not negatively affect their glycemic management (21,26). This finding differs from that in a systematic review by Eberle and Stichling (6), which showed a worsening of glycemic values among people with type 2 diabetes, which was attributed to changes in food choices and snacking habits, decreased physical activity, increased screen time, and weight gain. Our findings suggest that the participants in the reviewed studies were engaged in their care and attentive to glycemic outcomes.

Overall, major disruptions in self-care behaviors were not reported. This finding may be because of the increased time people with type 2 diabetes had to focus on their health. It may also be indicative of their increased awareness of their inclusion in a high-risk population vulnerable to severe COVID-19 and subsequent poor outcomes. It is plausible that increased risks associated with COVID-19 may have been the impetus for some people with type 2 diabetes to be more diligent in their efforts to maintain, and in some instances increase, their self-care behaviors. This possibility aligns with findings of other diabetes researchers who noted that beliefs about severe illness and its consequences influence engagement with diabetes self-care recommendations (34,35).

Our rapid review was prompted by the need to inform decision-making in the event of future COVID-19 variant surges and a return to lockdown measures. Findings from this review have several important implications. First, knowing how isolation measures affect people with type 2 diabetes can inform public health policy during future pandemics. The effectiveness of lockdown measures has been controversial (36). However, this rapid review demonstrated that, although the lockdown did not adversely affect some self-care behaviors (e.g., taking medications), it did adversely affect others (e.g., healthy coping). Additional examination of the impact of lockdown measures on self-care behavior is needed. Second, the results from this review can inform HCPs who care for people with type 2 diabetes and prompt them to assess these patients for lingering post-pandemic stress and prepare to support patients' needs during potential variant surges and future lockdowns. Finally, additional procedures may be needed to help people with type 2 diabetes access health care. Technology, whether in the form of tools to remotely access SMBG data, electronic messaging systems, or the provision of telehealth visits across all HCP levels, offers a way to guide people with diabetes without exposing them to additional health risks. Technology-based diabetes support has been shown to improve outcomes (9).

Strengths and Limitations

Previous reviews calculated glycemic end points as a proxy for examining diabetes management during the COVID-19 pandemic lockdown. To our knowledge, this is the first rapid review that teases out the individual behavioral components crucial to diabetes self-management. Using the ADCES7 Self-Care Behaviors (9) framework in the context the COVID-19 lockdown will allow future investigations to be conducted and generalized. One of the benefits of the rapid review approach is its ability to identify gaps and key evidence that can facilitate clinical responses for future standards of care and public health crises. This review elucidates the importance of HCPs' early prioritization and ongoing assessment of self-care behaviors in patients with type 2 diabetes during

normal daily life as well as during personal or global crises. The use of the ADCSE7 Self-Care Behaviors (9) to guide the analysis of this review is a strength, given that it offered a structured framework for reviewing and synthesizing the included articles. Finally, use of the JBI Critical Appraisal Checklists (12) provided an objective and standardized tool for reviewers to assess the rigor and quality of studies.

A limitation of the literature in this review is the lack of empirical studies investigating this topic in the type 2 diabetes population, which is not surprising given the rapid emergence of COVID-19 and resultant precipitously changing events in health care. Several methodological issues were noted among the articles, which made it difficult to assess and generalize the overall impact of the COVID-19 lockdown on the self-care behaviors of people with type 2 diabetes. First, most of the articles included in the review had cross-sectional study designs, which limits their ability to establish causation between the lockdown and self-care behaviors. However, because of the scope of the pandemic, using this study design was practical and feasible. Second, the definitions of various self-care behaviors differed among the studies from broad to more specific descriptions. For example, the concept of "activity" encompassed a wide range of definitions, which made it difficult to assess the overall impact of the pandemic on physical activity in people with type 2 diabetes. Third, there was heterogeneity among the measurement tools used in the studies, with some using author-developed tools, whereas others used validated measures of self-care behaviors, potentially influencing the overall findings. The self-care behaviors of problem-solving and self-monitoring were not assessed by most of the studies, which limited information about any effects lockdown may have had on these behaviors. Finally, the studies were conducted in different countries that had various levels of stringency and durations of restrictions during the lockdown, which may have influenced the self-care behaviors of participants.

Conclusion

This rapid review identified and elucidated the impact of COVID-19 lockdown restrictions on the self-care behaviors of people with type 2 diabetes The evidence presented from the included studies indicates that, overall, people with type 2 diabetes did not experience major disruptions in their self-care behaviors during the COVID-19 pandemic lockdown. Because the potential for future COVID-19 surges and the threat of other virulent transmissible diseases remain, HCPs should continue to address with their patients with type 2 diabetes the importance of self-care behaviors to mitigate risk.

DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

J.M.O. crafted the concept for the study. All authors contributed to writing and editing the manuscript. J.M.O. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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