Article

Disrupted Self-Management and Adaption to New Diabetes Routines: A Qualitative Study of How People with Diabetes Managed Their Illness during the COVID-19 Lockdown

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Abstract: When societies went into the COVID-19 lockdown, the conditions under which people with diabetes managed their illness dramatically changed. The present study explores experiences of everyday life during the COVID-19 lockdown among people with diabetes, and how diabetes self-management routines were affected. The data consist of 20 interviews with adults with diabetes, focusing on experiences during the COVID-19 lockdown. The analysis showed that experiences of self-management during lockdown were diverse and that participants handled daily life changes in very different ways. The main changes in self-management related to physical activity and food intake, which decreased and increased, respectively, for many participants during lockdown. We found two main and significantly different overall experiences of everyday life while on lockdown: (1) A daily life significantly changed by the lockdown, causing disruption of diabetes self-management routines, and (2) a largely unaffected everyday life, enabling continuance of diabetes routines. Our findings showed that people with diabetes lacked information about strategies to self-manage diabetes during lockdown and would have benefited from guidance and support throughout the pandemic, or any other crisis, to maintain their diabetes self-management routines.

Keywords: COVID-19; diabetes; self-management; psychosocial effects; qualitative research

1. Introduction

Coronavirus disease 2019 (COVID-19) has emerged as a global pandemic. Although most people infected with COVID-19 only develop asymptomatic or mild illness [1], people with comorbidities are at higher risk of poor COVID-19 outcomes and more frequently develop severe illness [2,3]. Studies have shown that comorbid diabetes mellitus is associated with more severe illness and increased mortality [3–7]. Globally, the prevalence of diabetes (all types) among COVID-19 patients is estimated to be around 10% [8,9], making diabetes a common comorbidity in patients with COVID-19.

Maintaining good glycemic control of type 1 diabetes (T1D) and type 2 diabetes (T2D) is fundamental to diabetes management and an important requirement for lowering the risk of diabetes-related complications [10]. The importance is even greater during the COVID-19 pandemic, as proper glycemic control might reduce the risk of COVID-19 infection and severity of illness [11–13]. Self-monitoring of blood glucose along with daily physical activity, healthy diet, and adherence to medication are integral components of diabetes self-management and key to achieving glycemic targets [14,15]. These self-management behaviors have been challenged during the pandemic and the nationwide lockdowns imposed in numerous countries [16].

Current evidence on diabetes management during the COVID-19 pandemic recommends that people with diabetes monitor and maintain glycemic control, keep a balanced and healthy diet, exercise for 1 h/day at home, and adhere to medication and social distancing requirements [17]. However, while living under lockdown, people with diabetes

may experience barriers to self-management due to limitations on free space to exercise, difficulties in obtaining diabetes supplies, limited resources for maintaining a healthy diet, and limited interaction with health care professionals, all of which pose a challenge to adequate diabetes management [16,18].

People with diabetes may be further challenged by worries related to diabetes management during the COVID-19 pandemic, which may put additional strains on their everyday life while on lockdown. Under normal circumstances (i.e., not during a pandemic), people with diabetes experience daily worries about diabetes management, are concerned about glycemic control, and fear diabetes complications as well as hypo- and hyperglycemia [19–21]. These worries may be exacerbated during this time of crisis and coupled with fear of infection and COVID-19-induced distress, which may have a negative impact on the ability of people with diabetes to self-manage [22].

During quarantine, people have been found to experience stressors: fear of infection, boredom, frustration, confusion, and inadequate basic and medical supplies [23]. Joensen et al. [24] studied 1369 people with diabetes in Denmark and found that worries related to the COVID-19 pandemic were highly prevalent. More specifically, regarding a possible COVID-19 infection, half of survey respondents were worried about being overly affected due to diabetes, 39% were worried about being characterized as a risk group, and 28% worried about not being able to manage diabetes if infected. The study also showed that women and people with type 1 diabetes were more likely to be worried than were men and people with type 2 diabetes, respectively. Yan et al. [25] studied a sample of people with and without diabetes and found that people with diabetes were more worried about being infected with COVID-19 and had a higher self-perceived risk of infection than did people without diabetes. Anxiousness about COVID-19 among people with diabetes has also been found in other studies [26,27].

On 13 March 2020, a national lockdown was imposed by the Danish Government [28]. The lockdown in Denmark did not include "mass quarantine", but encompassed suspension of all non-essential services and ordinances to "shelter in place". A complete lockdown of the country lasted until 9 April, when the first phase of the gradual and controlled reopening of society was announced [29]. Thus, people with diabetes in Denmark lived under lockdown for a considerable period of time, with potentially changed self-management routines and intensified worries about the sufficiency of their self-management. In a previous study, also part of the current research project, we explored how the COVID-19 lockdown affected psychosocial life with diabetes in a Danish population, highlighting how people with diabetes experienced a changed view of themselves during the lockdown, new complexity regarding social relationships, and confusion about their level of risk if they were to contract COVID-19 [30]. While the previous study clearly showed that the psychosocial life of people with diabetes changed during lockdown, knowledge about how people with diabetes were able to perform everyday diabetes tasks, how they worried about these tasks, and how these practice-related worries, in turn, affected their daily diabetes management is sparse. These topics have only been investigated quantitatively [24] or with a broader and more theoretical focus [30]. Hence, in the present exploratory qualitative study, we address and investigate the impact of lockdown on aspects of daily life related to diabetes self-management. The aim of the study is to explore: (1) how diabetes tasks and routines were carried out in daily life during the COVID-19 lockdown in Denmark and (2) everyday worries related to changes in daily diabetes management.

2. Methods

2.1. Data Collection

We conducted 20 interviews with people with diabetes during lockdown to gain an in-depth understanding of how their daily lives had played out regarding their experience of diabetes-related tasks, routines, and worries.

The study population comprised members of two user panels at Steno Diabetes Center Copenhagen and the Danish Diabetes Association, respectively. Members of the panels

were people with T1D, T2D, and other types of diabetes who had agreed to provide information and share experiences about living with diabetes [24]. Email newsletters were sent out inviting all members (n = 2430) to participate in individual interviews. Members interested in an interview were then contacted by the research team. We contacted the first 20 people who responded. The remaining interested members were sent an email thanking them for their willingness to participate.

We decided to include people with T1D, T2D, or LADA to a broad insight into the experience of managing diabetes during lockdown, but also to study potential differences between people with T1D and T2D. Characteristics of the interviewees are presented in Table 1, stratified by diabetes type.

Table 1. Study population.

	Gender	Age	Type
1	Female	70	Type 2
2	Female	26	Type 1
3	Male	58	Type 2
4	Female	71	Type 2
5	Male	69	LADA
6	Female	27	Type 1
7	Male	20	Type 1
8	Male	73	Type 2
9	Female	50	Type 1
10	Male	69	Type 2
11	Female	71	Type 2
12	Male	60	Type 2
13	Male	75	Type 2
14	Female	24	Type 1
15	Female	23	Type 1
16	Male	68	Type 2
17	Male	22	Type 1
18	Female	44	Type 1
19	Male	54	Type 2
20	Female	70	Type 2

The main objective of the semi-structured interviews was to gain insight into experiences of living with diabetes during the COVID-19 pandemic. More specifically, the interviews addressed four main themes: (1) diabetes management (questions about daily diabetes tasks such as medication, exercise, and diet), (2) quality of life (questions about general well-being), (3) perception of risk (questions about health and risk communication in relation to COVID-19 and diabetes), and (4) relationships and support (questions about social life and interactions with family, friends, and health care professionals).

After each interview, the research team discussed and systematically wrote down the overall topics and themes emerging in each interview. First, 15 interviews were conducted, and based on a discussion of these interviews, the research team agreed that especially the interviews with people with T2D lacked information power, as they did not contain sufficiently rich details or comprehensive insights into the research topic [31]. Subsequently, five additional individuals from the user panels were recruited through the same procedure and interviewed using the same interview guide. Three of these additional interviewees had T2D and two had T1D. When a total of 20 interviews had been conducted, the research team agreed that the interviews contained a sufficient level of information power, as the interviews provided in-depth, nuanced, and diverse insights into the interviewees' lives with diabetes. Moreover, the team concluded that data saturation had been reached [32].

All interviews went without problems and no interviews were stopped prematurely by interviewer or interviewee. The interviewer did not experience any dilemmas where interviewees disclosed health issues or health behavior that needed to be addressed by a healthcare professional.

The interviews were conducted between 2 April and 15 April 2020. Due to the lockdown in Denmark, interviews were conducted and recorded using a secure online communication platform with the video function disabled. The average duration of the interviews was 40 min; they were audio-recorded and transcribed verbatim. All interviews were done in Danish and only the selected quotes have been translated for the purpose of this article.

2.2. Qualitative Analysis

The transcribed interviews were analyzed using systematic text condensation, which is a descriptive and explorative method for thematic analysis of qualitative data [33]. For the purpose of the present study, we exclusively extracted excerpts from the interviews concerning diabetes self-management and worries about self-management. The excerpts were read through and coded into meaning units. The meaning units were grouped into code groups regarding self-management practices and everyday life while on lockdown. The code groups were analyzed, split, and reassembled as analytic main themes and subthemes. Lastly, the themes were reviewed, compared, and transversely interpreted to ensure distinctiveness and analytical transparency.

The study was approved by the Danish Data Protection Agency (P-2020-271) and carried out in accordance with the Declaration of Helsinki. According to Danish legislation, interview studies require no approval from an ethics committee. All participants gave their informed consent based on thorough explanations of the study's purpose. All participants were told they had the right to not answer any given question and that they could stop the interview at any time if they were not comfortable with the situation. Furthermore, they were given details regarding whom to contact for answers to questions about the research and the research subject's rights.

3. Results

3.1. The Changes in and Challenges of Self-Management Caused by the Lockdown

Analysis showed that the interviewees' diabetes practices had been affected by the lockdown in different ways and to varying degrees. The number of changes and ensuing challenges in diabetes routines were closely related to the interviewees' everyday life pre-lockdown, in that interviewees with an active and outgoing daily life (mainly interviewees with T1D) struggled to manage diabetes during lockdown, whereas interviewees with a more sedentary and home-based everyday life (mainly interviewees with T2D) were able to continue their usual diabetes routines.

3.1.1. Disruption of Self-Management Practices

The interviewees described how the lockdown in Denmark had disrupted their everyday life and changed their day-to-day activities. Consequently, the interviewees' daily diabetes management routines were often not sustained in their usual form, forcing the interviewees to adapt to a new kind of daily life. For some interviewees, however, adaptation had been difficult. For example, interviewees with T1D described how their blood glucose levels had fluctuated more than normal due to higher levels of stress and frustrations induced by the ongoing pandemic. One interviewee described her blood glucose control during lockdown:

> "I have many ups and downs during a day, and not one day passes without having either too high or too low blood glucose."

> (Female, 27 years, T1D)

Furthermore, interviewees treated with insulin were frustrated with how their changed daily life and activities had affected their diabetes and challenged them to find the right insulin dose, as another interviewee expressed:

> "We're in a situation now where we barely move, like when you're working from home like I am. Then you need much more insulin, and that just happened from

one day to another … but you don't know how much [insulin you need], it's not something you can calculate, so you just have to guess"

(female, 26 years, T1D)

Thus, when facing a changed daily life, some interviewees' diabetes routines had been disrupted, leading to severe challenges to their diabetes tasks. The self-management challenges arising from disruption of everyday life were centered around physical activity, food intake, and, for interviewees with T1D, adjustment of insulin. Especially physical activity was impaired while on lockdown, as most interviewees had decreased their usual amount of exercise. Despite efforts to stay physically active, several interviewees reported finding it difficult to sustain their usual level of activity, as this interviewee explained:

"I became aware, that even though I biked five kilometers or did something else to work out, then I was still short on my daily exercise. Normally, I would go grocery shopping, go for more walks with my dog, or do something else that I don't consider exercise, but that matters for my diabetes—physical activity throughout the day that isn't there now."

(Female, 27 years, T1D)

Achieving a balance between exercise, food, and insulin was particularly challenging in a disrupted everyday life, as all three factors were interdependent and altered in the state of lockdown, as one interviewee explained:

"When COVID-19 came into our lives, I've had difficulties managing it [diabetes], because of my very reduced activity level. I think insulin-to-carb ratio, how much to eat, and how many units [of insulin] to take is a bit more difficult now."

(Male, 20 years, T1D)

The lockdown had not only disrupted the structural context of the interviewees' lives, it had also changed their social context due to the social distancing requirements. The interviewees frequently described how they were eating less healthy food and eating more snacks than usual because of the consequent limitation of social activities. Some interviewees called their new snacking habits "emotional eating," like this interviewee did:

"I'm comfort eating a bit. I drink a glass of wine on weekdays and that sort of stuff, that I normally don't do."

(Male, 60 years, T2D)

The increase in food intake was typically due to either boredom, laziness, or loneliness, as one interviewee explained:

"You could say that I snack more [during lockdown], because I'm just walking around the house being bored and that affects my diabetes."

(Female, 24 years, T1D)

Taken together, a changed social and everyday life had entailed a disruption of diabetes management routines, often leading to practices and behaviors that compromised adequate management of diabetes.

3.1.2. Unaffected Diabetes Routines

Whereas some interviewees found themselves living a completely changed and disrupted everyday life, others remained largely unaffected by the lockdown and proceeded with their usual day-to-day lives despite the ongoing pandemic. Thus, for these interviewees:

"the [diabetes management] routines are continuing on the same path as they did before the Corona crisis"

(male, 54 years, T2D)

and they were able to:

> "take the pills I normally take, eat what I normally eat—exactly like I'm used to"
>
> (male, 69 years, T2D)

These interviewees' normal daily lives resembled life while on lockdown, and their diabetes management had been largely unaffected during the lockdown. Common denominators for these interviewees were that they had type 2 diabetes and were relatively old (see Table 1). Several interviewees with T2D were retired and had reached an age where they were engaging in a more relaxed way of life, therefore spending most of their time at home—regardless of the lockdown. For this reason, the lockdown did not represent a disruption of diabetes self-management for all interviewees—some had managed to more or less continue their usual diabetes routines.

3.2. Different Ways of Adapting Diabetes Routines to Life During Lockdown

As demonstrated, the interviewees' daily lives and diabetes routines had been impacted by the lockdown in different ways. Moreover, it was evident that the interviewees had reacted and adapted differently to everyday life during lockdown in relation to their diabetes management. Some interviewees reported taking concrete and active actions to adapt their self-management to the new daily context, whereas others had not implemented health-promoting modifications in their new daily lives and perceived the time on lockdown as an occasion to relax their rather strict lifestyle.

3.2.1. Modifications and Adaptions in Everyday Life

The interviewees who experienced disruption in their daily routines had often taken active actions in response to their changed everyday life. They were trying to prevent deterioration of their metabolic control prompted by the period on lockdown, which encompassed inventing (and adapting to) new daily routines that were beneficial for diabetes.

All interviewees had made some kind of effort to compensate for the physical activities they were no longer able to do. To adjust to life during lockdown, the interviewees had identified alternative activities that were feasible when sheltering in place, e.g., taking daily walks, bike rides, gardening, and working out to online fitness or yoga classes. One interviewee explained her strategy for ensuring an adequate level of physical activity:

> "Then I think to myself: Okay, I have to reach 10,000 steps a day. I'll do it [go for a walk] one time, then I get it all over with at once! (. . .) Then I can stay at home the rest of the day, because I have walked the steps I need."
>
> (Female, 24 years, T1D)

It was important for the interviewees to minimize their exposure to the COVID-19 virus, so they had made efforts to find ways to exercise that minimized the risk of infection. For instance, several interviewees reported going grocery shopping or for a run very early or late in the evening to avoid crowds to the extent possible, while still getting exercise. Another example was an interviewee who had re-located himself from an apartment in a large city to a summer house in a rural and less populated area during the lockdown, allowing him to get more exercise without fearing COVID-19:

> "I was running up there [in the summer house], so that way I increased my activity level by staying at the summer house, because I had more free space and wasn't so nervous about meeting other people."
>
> (Male, 20 years, T1D)

Despite limited possibilities to physically interact with their diabetes social networks, some interviewees, primarily young women with T1D, had made use of social media platforms to maintain contact with their peers, where they received support and advice on how to manage diabetes in this unfamiliar situation. These interviewees mirrored themselves and their daily diabetes management tasks in other users' experiences and

feelings. One interviewee described the interaction in a Facebook group for people with diabetes who use a Do It Yourself closed-loop artificial pancreas system [34]:

> "We have this chat conversation where you can get guidance on different topics. I've asked how they are handling it, and they've answered in different ways and we've had some discussions about how to act in relation to Corona."
>
> (Female, 26 years, T1D)

By engaging in peer interactions, these interviewees had received valuable tips, inputs, and suggestions on how to manage diabetes during lockdown.

3.2.2. Corona Holiday

Not all interviewees had adapted and modified their lifestyle to fit life while on lockdown. One group of interviewees with T2D reported having a significantly different and more relaxed approach to daily life and self-management during lockdown. These interviewees had allowed themselves a less strict lifestyle during lockdown, intending to return to their usual lifestyle when normalcy returned, like this interviewee said:

> "I have a somewhat more liberated approach to everything [now]. If things are going the wrong way for a while, then you must pull yourself together in the next period, and so on. The most important thing at the moment is to survive this period."
>
> (Female, 71 years, T2D)

Because of the difficult and uncertain situation, the interviewees had allowed themselves to indulge in more sweets, alcohol, and less healthy food for the duration of the lockdown. One interviewee gave an example of this approach:

> "This morning I went to the bakery, and they had this pastry that I thought we [himself and his wife] should share. Something that I would not normally do."
>
> (Male, 60 years, T2D)

Illustratively, another interviewee called the period of lockdown a "Corona holiday" (male, 58 years, T2D), underlining the special situation that permitted new habits. However, the interviewees were aware that these practices were only appropriate for a limited period and acknowledged that they had to deal with the consequences of their newfound unhealthy habits, as the same interviewee as above stated that "once all this is normalized, I have to go to 'rehab'" (Male, 58 years, T2D).

In contrast to the interviewees who had actively adjusted their self-management practices so as to prevent a worsening of their metabolic control, these interviewees had accepted potential deterioration of their metabolic control for the duration of the COVID-19 constraints.

3.2.3. Positive Side Effects of Changed Conditions for Everyday Life

Besides the concrete ways in which the interviewees had handled diabetes management during lockdown, a considerable share of them had also focused on their mindset and how they mentally approached this challenging time. Hence, some interviewees underlined several advantages of the lockdown for both their diabetes and general wellbeing. For example, one interviewee stressed how the quiet and stress-free life during lockdown had allowed her to focus on her diabetes:

> "Currently, my diabetes, diet, and physical activity have my full and absolute attention! I don't have anything else to do, I'm not going anywhere, I'm not talking to anyone, so I have plenty of time to care for my diabetes! It's my top priority right now, because I struggle to lose weight and change my HbA1c [indicator of glycemic control], so it's really getting more focus that it usually does."
>
> (Female, 44 years, T1D)

Getting more familiar with their diabetes and achieving a new awareness of their bodily symptoms were other positive side effects of lockdown highlighted by the interviewees. One interviewee described perceiving the lockdown as an opportunity to try out and get familiar with a new insulin pump, which would have taken up too much of her time and energy under normal circumstances. Other interviewees saw the lockdown as a chance to reconnect with themselves by spending quality time with themselves, as one interviewee expressed:

> "It [lockdown] has been a sort of gift for me—it's SO wonderful to putter around with myself (. . .) Wow, have I had a good time!"
>
> (Female, 70 years, T2D)

The interviewees reported that trying to make the best of the situation and identifying opportunities rather than obstacles had helped them cope with this uncertain and worrisome time.

3.3. Worries Related to Self-Management during Lockdown

Because of the serious and uncertain time of crisis, worries were inevitable elements of the interviewees' lives. In addition to more general worries about the pandemic, the interviewees said they were worried about their everyday diabetes management during lockdown.

3.3.1. Fear of Infection with COVID-19

One common and overarching worry was the fear of getting infected with COVID-19. The interviewees were especially concerned about their glycemic control and worried that suboptimal diabetes control would make them more susceptible to COVID-19. Several interviewees had struggled with their glycemic control during lockdown, causing worries about the consequent risk of COVID-19. One interviewee expressed such a worry:

> "I've had difficulties managing my blood glucose levels. I have the feeling, that the more unstable you are, the worse your immune system is. So that way I think that the virus may more easily gain a foothold in people [with diabetes] who have poor or suboptimal diabetes control."
>
> (Male, 20 years, T1D)

Further, the interviewees were concerned about their diabetes control in case of infection and worried about how an infection would impact their diabetes self-management. If infected, the interviewees worried about their possibilities to properly self-manage their diabetes as well as the effect of COVID-19 on diabetes control, as one interviewee said:

> "I know from other times I've been sick that diabetes is a hell to manage. I think that's why I'm a bit frightened of it [COVID-19], because I know it's going to be really unpleasant [if I get infected]. It's one thing to be sick, but then there's also the damn diabetes that you have to care for, right?"
>
> (Female, 23 years, T1D)

3.3.2. Worrying How Lockdown Lifestyle Affects Diabetes Management

Other worries related more specifically to management of diabetes during lockdown. As described, many interviewees had altered their lifestyle during lockdown to comprise more unhealthy food and less exercise. They were aware of the adverse effects of this new lifestyle on diabetes and worried about the impact on their diabetes control, as one interviewee said:

> "What worries me is this, I wouldn't call it laziness, but the lack of exercise and too much bad food and that sort of stuff."
>
> (Male, 60 years, T2D)

However, when the interviewees had tried to increase their physical activity, worrying impeded their efforts to exercise. These worries included fear of infection, which kept interviewees from, e.g., going for a run in their neighborhood or grocery shopping. Instead, they were "not taking any chances" (male, 20 years, T1D) and self-quarantining "because I'm SO terrified of getting infected with this virus" (male, 75 years, T2D). In this way, worries had challenged self-management during lockdown. One interviewee explained his thoughts and concerns about going for a run outside:

> "I wouldn't do it [go for a run] in the middle of the day because I don't feel like going outside and exercising when there're people in the streets. (. . .) I see myself as being in the risk group, so if I cross a lot of people on the street while running, then I definitely feel like I'm more exposed than if I didn't do it. I have that worry about being physically active."
>
> (Male, 20 years, T1D)

3.3.3. Can We Still Get Our Insulin?

Another COVID-19-related worry that had impacted the interviewees' everyday life and diabetes management was related to adequacy of diabetes supplies. Because of the uncertainty characterizing the pandemic, one common worry among the interviewees was whether they would have access to the diabetes supplies they needed for the duration of the lockdown. One interviewee asked the following question:

> "Can we still get our insulin and our cannulas and the stuff we need?"
>
> (female, 71 years, T1D)

Others were also concerned about availability:

> "Some people say that as a diabetic you should make sure you have enough supplies and Libre systems [continuous glucose monitor] for a month, but no one says why. Are there suddenly no more Libre systems left in the world?"
>
> (Female, 27 years, T1D)

As a reaction to these worries, some interviewees had increased their stock of diabetes supplies, reducing the need to worry about being short of vital supplies:

> "I've bought more insulin because I didn't know which direction it [the pandemic] would go, so I've felt a bit insecure about what would happen."
>
> (Male, 20 years, T1D)

4. Discussion

Our study offers a broad insight into the everyday management of diabetes during lockdown among a diverse group of people with diabetes in Denmark. It demonstrates the variety of approaches the interviewees had taken to self-management while in lockdown, and provides nuances concerning the impact of COVID-19-related worries on self-management. The results revealed significant differences between the ways in which the interviewees' self-management routines had been affected by the COVID-19 pandemic and the ensuing lockdown. Important findings were: (1) that some interviewees had experienced significant disruption in their everyday life and self-management routines due to the lockdown, while the daily life of others had remained largely unchanged, and (2) that the strategies the interviewees had developed to deal with sudden barriers to their daily diabetes self-management were substantially different in nature.

The interviewees who reported experiencing a disruption in their usual everyday life had faced the challenge of adapting to a changed daily life and having to adjust to new diabetes management routines. Due to the constraints of the lockdown, most interviewees had adopted a rather sedentary lifestyle, which especially challenged maintenance of an adequate level of physical activity. Consequently, a decreased level of physical activity was frequently reported. To account for the lack of physical activity, the interviewees

identified and implemented new ways of exercising that complied with social distancing requirements. Another self-management practice affected by the lockdown was food intake, which increased for some participants. Especially intake of unhealthy food increased during lockdown, as some interviewees reported allowing themselves a break from their usual healthy lifestyle during the challenges of the lockdown.

Several other studies have investigated the impact of the COVID-19 lockdown on various diabetes parameters [26,27,35–38]. However, to the best of our knowledge, the present study is the first to undertake a qualitative exploration of how daily life and diabetes management tasks played out during the lockdown among people with diabetes. As mentioned, one main finding of the present study was the substantial difference in the impact of lockdown on self-management among the interviewees. Thus, our findings suggested that lockdown can have both positive, negative, and no effect on self-management practices. One possible explanation for why we found these differences is that we included a broad and heterogeneous study population (i.e., people with different types of diabetes and a large age range). Other studies on diabetes management during lockdown, with a narrower and more specific study population, have found both positive and negative consequences of lockdown on self-management practices, thus confirming our findings in this respect.

Khader et al. [27] found that almost half of participants (the large majority with T2D) increased their food intake during the lockdown in India. A less healthy diet during lockdown was reported by participants with T2D in other studies, and especially an increase in intake of sugary foods and snacks was a general finding [35,38]. This result is in line with our finding of an increase in snacking and intake of unhealthy foods, which the participants in the present study often explained as being caused by boredom during confinement in their homes. Boredom may be a possible cause of an increase in unhealthy food, as the relation between boredom and increased desire for and intake of snacks and less healthy food has been well-established [39].

Reduced levels of physical activity have been a frequent finding in studies investigating lifestyle changes among people with diabetes prompted by the lockdown. A study on young adults with T1D found that 90% experienced a reduction in physical activity during the lockdown [37], and a study on people with T2D found that 69% of respondents reported a decrease in physical activity [27]. Similar declines in physical activity have been seen in other studies of people with T2D [35,38].

On the other hand, several studies have shown that the majority of participants with both T1D and T2D reported continuing their diabetes management routines during lockdown, such as following their routine diet and exercising regularly [26,36,37,40]. These findings, along with our results, suggest that even though some people with diabetes experience a negative effect of lockdown on self-management, the majority of individuals with diabetes are able to either continue or modify their dietary and physical activity routines fit life during lockdown.

Glycemic control in diabetes is likely to be affected by changes in self-management behaviors. Although not the aim of the present study, other studies have examined the effect of lockdown on glycemic control among people with diabetes. One study of a simulation model predicted that the lockdown would cause a worsening of diabetes outcomes [41], but results from recent studies on the impact of COVID-19 lockdown on glycemic control have not confirmed these predictions. Two studies have reported no changes in glycemic control during lockdown in people with T1D and elderly people with T2D, respectively [42,43]. Interestingly, several studies have found an improvement in glycemic control in individuals with T1D during the lockdown [44–46]. These findings suggest that slowing down routine daily activities, while having a more regular lifestyle with extra time concentrated on self-management, can have beneficial effects on T1D management, at least in the short term [47]. This is further supported by our finding on positive effects of lockdown, in which several participants emphasized how the lockdown had allowed them to focus on their

diabetes management, indicating that they might have experienced a similar improvement in their glycemic control due to the time on lockdown.

Another finding of the current study concerned the types of management-related worries people with diabetes had during lockdown. The results showed that the interviewees were worried about their risk of COVID-19 when exposed to other people, diabetes management in the event of infection, the impact of a less healthy lockdown lifestyle on glycemic control, and the adequacy of diabetes supplies. These worries are in line with findings from other studies on the topic, as Chowdhury and Goswami [47] stated that one concern among people with diabetes was interruption in the availability of insulin and glucose meter test strips, Joensen et al. [24] found that worries among participants with diabetes comprised risk of infection and ability to self-manage their illness in the event of infection, and other studies have established a significant fear of COVID-19 infection among people with diabetes [23,25–27]. The relation between COVID-19-related worries and self-management behaviors has also been addressed in previous research. Mukhtar and Mukhtar [22] suggested that fear of COVID-19 and the consequent distress over these worries could have a negative impact on the ability of people with diabetes to self-manage their illness. On the other hand, Joensen et al. [24] found that participants who experienced COVID-19-related worries were more likely to exercise more than usual, be more aware of medication taking, and check blood glucose more often, indicating a positive link between self-management behaviors and COVID-19 worries. Further studies on the impact of worries about self-management tasks are needed to determine the relation between worries and illness management, as health crises, like the current pandemic, will inevitably cause various worries among the population and, in particular, populations with chronic illnesses.

To understand how people with diabetes develop COVID-19-related worries about daily life, perspectives on how perception of risk is amplified can be incorporated. The Social Amplification of Risk Framework [48] identifies four mechanisms that contribute to and influence amplification of risk perceptions. According to the framework, large volume of information, the degree of dispute and debates among experts about the information, the extent of dramatization used in the mass media (e.g., sensational headlines), and the symbolic connotations of the information (i.e., terms that have different meanings in different groups) are factors that can increase the perception of risk regarding a specific topic. Several of these factors were present in the COVID-19 pandemic, specifically for people with diabetes who were struggling with their efforts to translate these risk assessments to everyday tasks. Concurrent with the rapid increase in COVID-19 cases, there was a large increase in information about COVID-19 in the news media and on social media platforms [49,50]. A considerable proportion of information on the pandemic was, however, misinformation characterized by eye-catching, dramatic headlines [51,52]. Furthermore, the communication about COVID-19 among authorities has been inconsistent [53]. In Denmark, the information from the health authorities to citizens with diabetes about their risk of COVID-19 has varied during the course of the pandemic [24]. The wording "not well-regulated" was used by the Danish health authorities to identify people with diabetes at high risk of COVID-19 [54], but they failed to define the meaning of "well-regulated," leading to confusion about the term as well as focusing and amplifying attention on the everyday task of blood glucose regulation. Taken together, all four mechanisms known to amplify the perception of risk were present for people with diabetes during the pandemic in Denmark, suggesting some of the reasons for COVID-19-related worries among people with diabetes. This aspect should be highlighted in future research.

The present study is strengthened by the timeliness of the data collection, which was initiated and conducted shortly after the lockdown in Denmark. However, to ensure timeliness, the interviews were collected rather rapidly. To minimize rushed mistakes, we decided to keep the interview guide rather basic and open. Despite the open interview guide, the qualitative data provided rich descriptions of daily diabetes management routines, changes in these routines and the burden of worries among the interviewees.

Although the interviews were rather open, we did semi-structure them around four main topic areas: (1) general everyday diabetes management such as medication exercise and diet, (2) Overall quality of life and well-being, (3) perception of illness-related risk and the communication about risk, and (4) close relationships, social life and the experiences of support. These four topic areas were chosen based on our experience with studies of diabetes everyday life without COVID-19 and they proved to be suitable topics to generate data containing rich enough detail to provide for thorough analysis and interpretation leading to the main findings regarding everyday life during the first wave of COVID-19 lockdown: (1) There were significant changes and challenges in daily self-management (2) There were significantly different ways of adapting diabetes routines to life during lockdown (3) There were widespread worries related to self-management during lockdown

The variation in diabetes type, age, and gender of the interviewees can be viewed as both a strength and a limitation of the study. On the one hand, the diversity of the interviewees provided a broad and realistic insight into everyday life with diabetes during lockdown. On the other hand, the diversity compromised a narrow focus on how a specific group with diabetes managed diabetes while on lockdown, leading to a rather overall depiction of diabetes self-management during this period. We found significant differences between the way interviewees with T1D and T2D had coped with living while on lockdown and performed their daily diabetes tasks: The majority of the interviewees with T1D reported experiencing a disruption in their diabetes routine and making proactive changes to their self-management practices, while many of the interviewees with T2D had continued their usual everyday life, but adopted a more relaxed approach to their diet during lockdown. This suggests that people with T1D and T2D had different approaches to life and self-management during lockdown. However, as there was a fairly large age difference between the interviewees with T1D and T2D, we cannot determine whether the differences among the diabetes types identified in the current study are due to diabetes type or to age. Hence, studies focusing solely on one diabetes type and including an age-diverse study population are needed to explore the self-management behaviors specific to T1D and T2D, respectively.

Our findings could be useful in efforts to improve information and support for people with diabetes, helping them manage their diabetes successfully during the current pandemic and in similar, disrupted crisis situations. Participants in the present study had received no guidance or information on how to adjust self-management to life during lockdown and had to independently find strategies to cope with the changed daily routines. Thus, our findings suggest that people with diabetes might experience a need for information about ways to successfully manage diabetes within the confines of the home or other safe locations. Important implications of the current study include the need for more research and knowledge about management of diabetes in situations that require a degree of isolation as well as future interventions targeting successful diabetes management in changed, confined, and isolated contexts.

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