Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Psychosocial health in people with diabetes during the first three months of the COVID-19 pandemic in Denmark

Kristoffer Panduro Madsen a,⁎, Ingrid Willaing a,b, Naja Hulvej Rod c, Tibor V. Varga c, Lene Eide Joensen a

a Steno Diabetes Center Copenhagen, Niels Steensens Vej 6, DK-2820 Gentofte, Denmark
b Section for Health Services Research, Department of Public Health, University of Copenhagen, Øster Farimagsgade 5, DK-1014 København K, Denmark
c Section of Epidemiology, Department of Public Health, University of Copenhagen, Øster Farimagsgade 5, DK-1014 København K, Denmark

ABSTRACT

Aims: To analyze trajectories of psychosocial health among people with diabetes during the first three months of lockdowns and reopenings of the COVID-19 pandemic in Denmark.

Methods: An online longitudinal survey of 2430 people with diabetes consisting of six questionnaire waves (Q1-Q6) was conducted between March 19 and June 25, 2020. Psychosocial outcomes assessed were COVID-19 worries, quality of life, feelings of social isolation, psychological distress, diabetes distress, anxiety, and general and diabetes-specific loneliness. Trajectories in psychosocial health were analyzed with linear multilevel mixed-effects models. Subgroup analyses were conducted.

Results: In total, 1366 (56%) people with diabetes responded to the first questionnaire. COVID-19 worries, feelings of social isolation, psychological distress, anxiety and general loneliness had all improved at Q6 compared to Q1 (p < 0.001). In general, improvements in psychosocial health started after the first opening phase (April 15); however, general loneliness increased up to the first reopening phase (p ≤ 0.001) before decreasing, and quality of life decreased up to the first reopening phase (p = 0.002), with no improvements to follow. Subgroup analyses revealed that women had larger decreases in feelings of social isolation (p < 0.001) and in psychological distress (p = 0.035) and increases in quality of life (p < 0.001), between Q1 and Q6, compared to men.

Conclusions: Psychosocial health in people with diabetes improved following reopening of society. However, increases in loneliness and decreases in quality of life during lockdown indicates a potential need to mitigate the acute effects of such policies.

© 2021 Elsevier Inc. All rights reserved.

1. Introduction

The coronavirus disease 2019 (COVID-19) was declared a global pandemic by the World Health Organization on March 11, 2020. Since then, the pandemic has taken its toll on societies across the world, including economies, social relations, and physical and mental well-being. Prior to the pandemic’s emergence in the Western world, a study of 1210 respondents documented the psychological impact of the COVID-19 pandemic in China. The study found that 54% of respondents rated the psychological impact of the COVID-19 outbreak as moderate or severe. Furthermore, people with a chronic illness, such as diabetes, experienced higher levels of stress, anxiety and depression compared to people with no chronic illness. Early studies of general populations in the Western world also documented psychological impacts of the pandemic. For example, a study in the general population of the UK found that the prevalence of clinically relevant levels of mental distress increased from 19% to 27% between 2019 and April 2020 (one month into the lockdown). Similarly, a study of the general population from the USA found that 36% of Americans reported that the COVID-19 pandemic seriously affected their mental health, while 48% were anxious about the risk of infection.

COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and presents, in most people, with symptoms like a common cold. However, certain groups have an increased risk of experiencing more severe symptoms. As such, people with diabetes have been identified as a high-risk group with a two-fold higher mortality rate and a three-fold higher risk of a more severe COVID-19 infection when compared to people without diabetes. COVID-19-related mortality rates in people with diabetes are highest for those who are obese or underweight, and those who suffer from cardiovascular and/or renal complications of diabetes. Whereas some studies suggest high HbA1c as an important risk factor for COVID-19 related mortality, other studies dispute this. To date, the role of COVID-19 in the interplay between diabetes and psychosocial health has mostly been studied in cross-sectional studies. We found in a preceding study that having diabetes-specific worries about the COVID-19 pandemic was associated with...
poorer psychosocial health with regards to feelings of isolation, loneliness and diabetes distress. Another study found that people with diabetes were more worried about being infected than people without diabetes. Thus, it is likely that the pandemic exacerbated psychosocial challenges that are often experienced under “normal” circumstances by people with diabetes.

Research conducted among people with diabetes prior to the COVID-19 pandemic shows that women compared to men, younger compared to older people, people with type 1 compared to type 2 diabetes, and people with a history of mental illness compared to people without, experience higher levels of diabetes distress and lower levels of mental well-being. Social ties also impact psychosocial health in people with diabetes. For instance, people living alone have lower psychological well-being compared to people living with a partner.

The aim of this paper was to analyze trajectories of general and diabetes-specific psychosocial health among people with diabetes during the first three months of lockdowns and reopenings of the COVID-19 pandemic in Denmark.

2. Materials and methods

2.1. Study design and setting

A longitudinal study was conducted using online questionnaires that were distributed via e-mail to Danish adults (≥18 years) with diabetes who were members of user panels at either Steno Diabetes Center Copenhagen, a specialist diabetes clinic, or the Danish Diabetes Association. Data were collected between March 19 and June 25, 2020. Thus, the information analyzed in this paper ranges from the first week to roughly three months after the first lockdown ensued in Denmark. Details of survey development, user panels and recruitment strategy have been reported previously. Briefly, the survey is a diabetes-specific version of the Copenhagen Corona-Related Mental Health questionnaire, and consisted of six questionnaire waves (Q1–Q6). All respondents who answered the first questionnaire (Q1) received questionnaires at all subsequent waves (Q2–Q6) regardless of having missed one or more waves. The study was approved by the Danish Data Protection Agency (P-2020-271).

Fig. 1 provides a timeline overview of the first three months of the COVID-19 pandemic in Denmark, including details on key messages from the Danish Health Authority, information on lockdown and reopening phases, and questionnaire distribution dates.

2.2. Survey content

Questions about psychosocial health were included in all six questionnaires; items on health and sociodemographic status were only included at Q1 and Q6. Wording of each item in the survey can be found in the Supplementary material (S1).

2.2.1. Psychosocial health

Psychosocial health was assessed with visual analogue scales (VAS) and questionnaire scales.

Worries about COVID-19, quality of life and feelings of social isolation, respectively, were measured on 1–10-point VAS with 1 representing the lowest degree and 10 the highest.

Psychological distress was measured with a five-item questionnaire scale specifically developed to assess distress during the COVID-19 pandemic. The scale consists of adapted items from the validated GAD-7, CES-D and Event Scale Revised questionnaire scales, and asks how often in the past week the respondent has experienced being (1) nervous, anxious, or on edge, (2) depressed, (3) lonely, (4) hopeful about the future, and (5) had physical reactions that can be linked to the Coronavirus. The scale has four response categories ranging from ‘rarely or none of the time (<1 day)’ to ‘most or all of the time (5–7 days)’, weighing 1–4 points in the total score calculation (range 5–20), respectively.

Diabetes distress was measured with two items from the Diabetes Distress Scale: ‘feeling overwhelmed by the demands of living with diabetes’ and ‘feeling that I am often failing with my diabetes routine’.
Study sample characteristics at Q1 (n = 1366).

| Variables                      | Descriptive statistics | Missing observations |
|--------------------------------|------------------------|----------------------|
| Age in years                   | 61.7 (12.8), [55, 64, 71] | 137                  |
| Age in groups                  |                         |                      |
| <65 years                      | 615 (50)                |                      |
| 65–79 years                    | 570 (46.4)              |                      |
| ≥80 years                      | 44 (3.6)                | 62                   |
| Sex                            |                         |                      |
| Female                         | 580 (44.5)              |                      |
| Male                           | 724 (55.5)              |                      |
| Education                      |                         | 157                  |
| Primary school                 | 79 (6.5)                |                      |
| Secondary (high school/vocational) | 395 (32.7)       |                      |
| Short-medium-cycle             | 681 (56.3)              |                      |
| Long-cycle                     | 54 (4.5)                |                      |
| Cohabitation status            |                         | 165                  |
| Lives alone                    | 314 (26.1)              |                      |
| Lives with partner and/or children | 887 (73.9)          |                      |
| Employment status              |                         |                      |
| Employed                       | 429 (35.5)              | 165                  |
| Retired                        | 669 (55.3)              |                      |
| Sick leave or unemployed        | 111 (9.2)               |                      |
| Diabetes type                  |                         | 83                   |
| Type 1                         | 461 (35.9)              |                      |
| Type 2                         | 822 (64.1)              |                      |
| Diabetes duration              | 19.5 (15), [8, 16, 26]  | 270                  |
| Diabetes complications<sup>a</sup> |                      | 30                   |
| 0                             | 980 (73.4)              |                      |
| 1                             | 266 (19.9)              |                      |
| 2+                            | 90 (6.7)                |                      |
| HbA1c (mmol/mol)               | 56.6 (14.5), [48, 54, 554]<sup>d</sup> |  |
| HbA1c (%)                      | 61.8                    |                      |
|                               | 7.3 (3.5), [6.5, 7.1, 7.8] |                   |
| HbA1c in groups               |                         | 554<sup>d</sup>      |
| Low (<70 mmol/mol/11.1%)       | 703 (86.6)              |                      |
| High (>70 mmol/mol/11.1%)      | 109 (13.4)              |                      |
| Comorbidities<sup>b</sup>      |                         | 79                   |
| 0                             | 560 (43.5)              |                      |
| 1+                            | 727 (56.5)              |                      |
| Mental illness<sup>c</sup>     |                         | 79                   |
| 0                             | 1137 (88.3)             |                      |
| 1+                            | 150 (11.7)              |                      |
| COVID-19 worries, range: 1–10  | 5.9 (2.49), [4, 6, 8]   | 139                  |
| Quality of life, range: 1–10   | 7.1 (1.9)               | 126                  |
| Feelings of social isolation, range: 1–10 | 5.5 (2.7) | 156                 |
| Psychological distress, range: 5–20 | 7.7 (2.9), [5, 7, 9]  | 119                  |
| Diabetes distress, range: 1–6  | 1.8 (1.00), [1, 1.5, 2] | 154                  |
| None to low diabetes distress (DDS2 ≤ 2) | 914 (75.4) |  |
| Moderate to high diabetes distress (DDS2 > 2) | 298 (24.6) | |
| Anxiety, range: 0–4            | 0.5 (0.06), [0, 0.25, 0.19] | 0.75                  |
| <10% risk of anxiety disorder  | 1004 (80.5)             |                      |
| 20% risk of anxiety disorder   | 182 (14.6)              |                      |
| 30% risk of anxiety disorder   | 45 (3.6)                |                      |
| 40% risk of anxiety disorder   | 13 (1.1)                |                      |
| 45% risk of anxiety disorder   | 3 (0.2)                 |                      |
| General loneliness, range: 3–9 | 48.1 (16.4), [3, 5, 6]  | 154                  |
| Often or sometimes lack company | 690 (56.9)            |                      |
| Often or sometimes feel left out | 348 (28.7)            |                      |
| Often or sometimes feel isolated from others | 742 (56.6) | 154                 |
| Diabetes-specific loneliness, range: 2–6 | 27 (11.3), [2, 2, 3] |  |
| Often or sometimes miss someone to talk to about diabetes | 279 (23) |  |
| Often or sometimes feel lonely with diabetes | 393 (32) |  |

Descriptive statistics for categorical data are given as frequency (percent) and for continuous data as mean (standard deviation) with median and percentiles in brackets [P25, median, P75]. Abbreviations: P25/P75, 25th/75th percentiles.

<sup>a</sup> Diabetes complications include 1 or more of the following: retinopathy, nephropathy, neuropathy, foot ulcer and cardiovascular disease.

<sup>b</sup> Comorbidities include 1 or more of the following: asthma, attherosclerosis, arthritis, back disease, cancer, chronic obstructive pulmonary disease, impaired hearing, migraine and stroke.

<sup>c</sup> Mental illness includes anxiety and depression or whether the participant had ever been diagnosed with any other psychiatric disorder by a physician.

<sup>d</sup> The relatively large amount of missing data on HbA1c is primarily due to underreporting by people with type 2 diabetes.
Panel A

Panel B
Stata 15.1 using restricted maximum likelihood and assuming unstructured covariance matrices.

3. Results

3.1. Retention and baseline characteristics

The first questionnaire was distributed to 2430 individuals with diabetes of whom 1366 (56%) responded (Supplementary material S2). A response rate between 70 and 80% of the initial 1366 respondents was maintained at Q2-Q4, dropping to 66% and 60% at Q5 and Q6, respectively.

At baseline, psychosocial health mean scores were as follows: COVID-19 worries = 5.9 (range: 1–10); Quality of life = 7.1 (1–10); Social isolation = 5.5 (1–10); Psychological distress = 7.7 (5–20); DDS2 = 1.8 (1–6); SCL-ANX4 = 0.5 (0–4); UCLA = 4.8 (3–9); UCLA-D = 2.7 (2–6) (Table 1). There were roughly 25% who had moderate to severe diabetes distress, and 19.5% of the sample had a 20% risk or more of an anxiety disorder. More than half of the respondents often or sometimes felt either lack of company or isolated from others, while just under 1/3 often or sometimes felt left out. Responses to the UCLA-D revealed that one in four of the respondents often or sometimes missed someone to talk about diabetes and that one in three did so with regards to feeling alone with their diabetes.

There were no statistically significant differences in socioeconomic or health status characteristics between questionnaires, nor any differences between Q1 and Q6.

3.2. Trajectories in psychosocial outcomes

Fig. 2 and Table 2 show trajectories and regression coefficients, respectively, from Q1 through Q6 for each psychosocial outcome assessed by the VAS and the questionnaire scales. Zoomed-in versions and full regression tables of Fig. 2 can be found in the Supplementary material (S3–S4).

Degree of COVID-19 worries went unchanged from Q1-Q3 and began to decrease at Q4 (Δ = −0.23, p = 0.005), Q5 (Δ = −0.76, p < 0.001) and Q6 (Δ = −1.07, p < 0.001) compared to Q1. Quality of life decreased at Q2 (Δ = −0.159, p = 0.016), Q3 (Δ = −0.259, p < 0.001) and Q4 (Δ = −0.220, p = 0.002) compared to Q1 and remained at that level through Q6. Feelings of social isolation did not change at Q2-Q4 compared to Q1, but decreased at Q5 (Δ = −0.738, p < 0.001) and Q6 (Δ = −1.234, p < 0.001) compared to Q1.

Psychological distress decreased at Q5 (Δ = −0.23, p = 0.020) and Q6 (Δ = −0.58, p < 0.001) compared to Q1 after having increased from Q2 to Q4 (0.14, p = 0.022). Diabetes distress decreased at Q2 (Δ = −0.06, p = 0.034) and Q4 (Δ = −0.08, p = 0.009) compared to Q1, but no statistically significant changes were found at Q5 and Q6 compared to Q1. Comparing Q1 to Q6, both anxiety (Δ = −0.11, p < 0.001) and general loneliness (Δ = −0.42, p < 0.001) decreased. However, general loneliness increased from Q1 to Q4 (Δ = 0.21, p < 0.001) before decreasing. Diabetes-specific loneliness remained stable when comparing Q1 to Q6, except for Q5 where a statistically significant increase was observed (0.08, p = 0.037).

3.3. Subgroup findings

Figures and underlying regression tables of subgroup analyses can be found in the Supplementary material (S5–S11).

3.3.1. Age and sex

The oldest age group, compared to the youngest, had a statistically significant decrease in quality of life at Q6 compared to Q1 (between-group difference −1.59, p = 0.003). Women had a larger decrease in feelings of social isolation (between-group difference −0.697, p < 0.001) and psychological distress (−0.44, p = 0.035) from Q1 to Q6 compared to men. There were statistically significant within-group improvements for both men and women with regards psychological distress when comparing Q1 to Q6 (−0.39, p = 0.005 and −0.83, p < 0.001, respectively). Quality of life also increased more in women compared to men at Q3-Q6 (between-group differences: Q3: 0.339, p = 0.017 | Q4: 0.372, p = 0.009 | Q5: 0.311, p = 0.042 | Q6: 0.519, p = 0.003) relative to Q1. Within-group analyses revealed that whereas quality of life had increased in women at Q6 (0.426, p = 0.001) compared to Q1, it decreased in men at Q2-Q4 compared to Q1 (Q2: −0.221, p = 0.010 | Q3: −0.394, p < 0.001 | Q4: −0.369, p < 0.001). Anxiety levels had also decreased more for women compared to men at Q6 (between-group difference −0.15, p < 0.001). Within-group analysis revealed a statistically significant decrease at Q6 only for women (−0.19, p < 0.001).

3.3.2. Cohabitation status

Respondents living with a partner and/or children had a larger increase in diabetes-specific loneliness at Q5 and Q6 relative to Q1 compared to respondents living alone (between-group differences: Q5: 0.24, p < 0.001 | Q6: 0.20, p = 0.031), and a larger increase in general loneliness at Q5 (0.331, p = 0.021).

3.3.3. Mental illness history

Compared to Q1, having a history of mental illness was associated with a greater decrease in COVID-19 worries at Q2 (−0.67, p = 0.010), Q3 (−0.59, p = 0.032) and Q4 (−0.55, p = 0.050) compared to having no history of mental illness; however, this between-group difference disappeared at Q5 and Q6. The same tendency was observed for anxiety, with a larger decrease in anxiety in respondents with a history of mental illness (Q2: −0.08, p = 0.065 | Q3: −0.18, p < 0.001 | Q4: −0.21, p < 0.001) compared to respondents without. Psychological distress decreased more in respondents with a history of mental illness at Q2 through Q4 compared to Q1 than in respondents without (between-group difference −0.73 −1.18, p < 0.001), but this difference was not statistically significant at Q5 and Q6. Within-group analyses revealed that psychological distress decreased only in the mental illness group from Q1 to Q6 (−0.61, p < 0.001). Diabetes distress initially decreased more in respondents with a history of mental illness compared to no mental illness; however, this between-group difference was statistically significant exclusively at Q4 (−0.32, p < 0.001).

3.3.4. Diabetes type, diabetes complications and HbA1c

Anxiety increased in respondents with type 2 diabetes compared to respondents with type 1 diabetes at Q2 (between-group difference 0.07, p = 0.024), Q3 (0.07, p = 0.025) and Q4 (0.10, p = 0.001) relative to Q1. Respondents with two or more diabetes complications had a larger increase at Q6 relative to Q1 in feelings of social isolation compared to respondents without complications (0.91, p = 0.014), a larger increase in diabetes distress at Q5 (0.47, p < 0.001) and a larger decrease in general loneliness at Q4 (−0.541 p < 0.001) Respondents with high HbA1c (>70 mmol/mol / 11.1%) had an increased diabetes-specific loneliness score compared to respondents with low HbA1c at Q5 (between-group difference 0.30, p < 0.004) and Q6 (0.28, p = 0.017) relative to Q1.

Fig. 2. Trajectories for psychosocial outcomes. Panel A: Trajectories for COVID-19 worries, quality of life and feelings of social isolation (measured with visual analogue scales) with 95% confidence intervals. Panel B: Trajectories for psychological distress, diabetes distress, anxiety, general and diabetes-specific loneliness (measured with questionnaire scales) with 95% confidence intervals.
4. Discussion

This study documents several changes in psychosocial health in a population of people with diabetes during the first three months of the COVID-19 pandemic in Denmark.

The initial level of psychological distress measured at the beginning of the pandemic in March was relatively low (7.7) compared to reported levels (8.7) in a study of 10,000 respondents from the US general population between March 19–24, 2020 (i.e., the same time as Q1 of this study), using the same distress measure.25 The proportion of respondents initially feeling isolated did not differ when compared to levels before the pandemic, but a larger than usual proportion of respondents with diabetes felt left out and stavred for company.12,32 Baselie levels of COVID-19 worries, quality of life, and feelings of social isolation were similar to initial levels found in a time-series study of the Danish general population conducted between March 20 and April 16 using similar VAS measures.24

COVID-19-specific worries, feelings of social isolation, psychological distress, anxiety, and general loneliness all improved, on average, in mid-May (Q5) compared to the beginning of the pandemic (Q1). The timing of these improvements may be related to reductions in the spread of the COVID-19 virus and the lifting of societal restrictions, as the Danish society began to re-open from May 8 (phase 1) (Fig. 1). The second phase of the re-opening and announcements of further lifting of restrictions in the beginning of June may also have exerted a positive influence on psychological indicators, as COVID-19 worries, feelings of social isolation, psychological distress, anxiety and general loneliness continued to improve.

Studies in the general population in Denmark and in Germany confirm improvements in psychosocial health during the re-opening of society.24,33 A Danish study found an age and sex-adjusted decrease in COVID-19-specific worries, and an increase in quality of life, between March 20 and April 16.24 In the same study, feelings of social isolation increased slightly from March 20 to March 26, but then reversed. Comparing these findings to our results indicates that the psychosocial health of people with diabetes might be more affected and for a longer period of time compared to the general population. A study of the general German population, using the same measure of psychological distress as our study, found similar reductions in psychological distress between March 24 and April 21.23 Other studies conducted in the general population of Germany and Austria between March and June showed that loneliness was low before the pandemic, highest during lock-down, and decreased during re-opening.23,35 Although this evidence suggests that loneliness during the pandemic was short-lived, an American survey of more than 1000 individuals found that 43% experienced ‘high’ loneliness in April,26 which increased by June despite relaxations in societal restrictions.23 Another study found markedly different levels in loneliness among general populations of the US, South Korea, France and Hong Kong over the course of the pandemic, adding further evidence of country-specific effects on psychosocial health.36 Although psychosocial health of people with diabetes in our study was comparable to that of the Danish (and other) general populations, this is not necessarily the case in diabetes populations in other countries.18

Contrary to the many positive changes in general psychosocial health during the reopening phases, there were no improvements in diabetes-specific psychosocial health at Q6, on average, in the pooled sample. This may be due to the relatively low initial levels of diabetes distress and diabetes-specific loneliness. For example, the level of diabetes distress in the studied population corresponds with what is found in diabetes populations under normal circumstances.17,18 Whereas this may indicate that the first COVID-19 lockdown in Denmark had little if any impact on diabetes-specific psychosocial health, it may also reflect instead the result of the acute and relatively short lockdown period. That is, the three-month period may not have been enough to spike any real impact, with more general aspects (such as quality of life and loneliness) being more at the forefront of one’s psychosocial well-being than diabetes-specific ones. However, a study from the US found that diabetes-related stress increased along with negative impact on diabetes management during the pandemic.16 These findings were based on participants’ self-reported level of stress and worries related to their diabetes when compared to self-reported levels before the pandemic. The same study also reported that half of the participants felt that their diabetes was more difficult to manage during the pandemic than before and the authors link this to the increase in feelings of distress and isolation.16

In our study, women had larger decreases in feelings of social isolation, anxiety and psychological distress, and larger increases in quality of life compared to men. Likewise, psychological distress was also higher in women in the aforementioned German study.18 In our study, women experienced higher levels of anxiety and psychological distress at baseline, as also found in the American survey study,25 suggesting an initially stronger psychological reaction to the pandemic. However, it cannot be ruled out that women had higher anxiety and psychological distress levels than men already before the pandemic. Adding to this, a Danish study found improvements in psychological well-being in both men and women between the beginning and end of April and attribute this improvement to reduction of symptoms of anxiety and depression.29

We also observed larger improvements in psychosocial health for people with a history of mental illness during the study period. This finding can also potentially be attributed to higher baseline levels in this subgroup; however, as noted by Holingue et al., people with preexisting mental illness are more susceptible to psychological distress during pandemics.50

Whereas we did not observe statistically significant changes in diabetes-specific psychosocial health in the pooled sample, we observed some interesting changes in diabetes-related subgroups. For instance, respondents with 2+ diabetes complications and those with high HbA1c had increased feelings of social isolation and diabetes-specific loneliness, respectively, compared to those without complications and those with low HbA1c. This suggests that the Danish Health Authority’s communication regarding risk factors in people with diabetes may have had an impact on psychosocial health (see Fig. 1).
Strengths of this paper include the relatively large sample size and high retention rate across the study, and the unique and timely survey that was specifically designed to capture aspects of psychosocial health in individuals with diabetes throughout the COVID-19 pandemic. The most important limitation of this study is that data on psychosocial health was not collected in the same population before the pandemic, prohibiting direct before/after comparisons, and requiring that psychosocial health instead be compared to other pre-pandemic studies. Another limitation of this study is that the analyzed population is overrepresented by people of older age, retirees and people living alone, thus limiting the generalizability of the findings. The nature of the questionnaires used to assess diabetes distress and diabetes-specific loneliness may also be limiting. For example, the DDS2 is mainly used in the clinical setting as a screening tool and may not be as suitable for research purposes as the full Diabetes Distress Scale. Nevertheless, we chose this and other abbreviated instruments to mediate potential psychological strain on respondents in an already straining situation. Finally, to our knowledge, no longitudinal studies using similar measures have been conducted in people with diabetes, preventing direct comparisons. However, it is also a strength of this study to be among the first to report on this topic, contributing with an extensive analysis that will provide useful in planning support for people with diabetes during the current and future pandemics.

4.1. Conclusions

To conclude, general measures of psychosocial health in people with diabetes improved, on average, during the first three months of the pandemic in Denmark; diabetes-specific measures did not. These findings both confirm and contrast those of other studies. Just as deteriorations in quality of life and increases in loneliness were observed immediately after lockdown, improvements in psychosocial health were observed in relation to reopening phases of society. However, given different trajectories of lockdown and re-openings in different countries, generalization of the presented findings may not be advisable. Nevertheless, our findings highlight the need for attention regarding the impact of the pandemic on psychosocial health, not least for people with chronic illness, and especially in relation to acute effects on loneliness and quality of life. Psychosocial health is highly and rapidly influenced by social restrictions that follow a pandemic, rendering it a crucial task to provide psychosocial support for people with diabetes during sudden and/or prolonged pandemics.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Acknowledgements

We wish to give thanks to the respondents for their participation in the study, and to Lone Holm and Andrea Aen Petersen (Steno Diabetes Center Copenhagen) and Kasper Arnskov Nielsen (Danish Diabetes Association) for their indispensable efforts in participant recruitment. Finally, we would like to thank the research team at the University of Copenhagen behind ‘Standing together – at a distance’ (www.coronaminds.dk), whom the survey was developed in close collaboration with.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jdiacomp.2021.107858.

References

1. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Biomed 2020;91:1-5.
2. Wang C, Pan R, Wan X, et al. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int J Environ Res Public Health 2020;17.
3. Peeters M, Hope H, Ford T, et al. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. Lancet Psychiatry 2020;7:883-92.
4. American Psychiatric Association. New poll: COVID-19 impacting mental well-being: Americans feeling anxious, especially for loved ones; older adults are less anxious. , https://www.psychiatry.org/newsroom/news/releases/new-poll-covid-19-impacting-mental-well-being-americans-feeling-anxious-especially-for-loved-ones-older-adults-are-less-anxious. Accessed September 22, 2020.
5. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun 2020;109:102433.
6. Kumar A, Arora A, Sharma P, et al. Diabetes mellitus associated with mortality and severity of COVID-19: A meta-analysis. Diabetes Metab Syndr 2020;14:535-45.
7. Wang X, Fang X, Cai Z, et al. Coronavirus related diseases and acute organ injuries are strongly correlated with disease severity and mortality among COVID-19 patients: a systemic review and meta-analysis. Research (Washington, DC) 2020; 2020: 3402961.
8. Holman N, Knighton P, Kar P, et al. Risk factors for COVID-19–related mortality in people with type 1 and type 2 diabetes in England: a population-based cohort study. Lancet Diabetes Endocrinol 2020;8:823-33.
9. Apicella M, Campopiano MC, Mantuano M, et al. COVID-19 in people with diabetes: understanding the reasons for worse outcomes. Lancet Diabetes Endocrinol 2020;8:782-92.
10. Alberca RW, Oliveira LM, Branco A, et al. Obesity as a risk factor for COVID-19: an overview. Crit Rev Food Sci Nutr 2020;1-15.
11. Agarwal S, Schecter C, Southern W, et al. Preadmission diabetes-specific risk factors for mortality in hospitalized patients with diabetes and coronavirus disease 2019. Diabet Care 2020;43:2339-44.
12. Joensen LE, Madsen KP, Holm L, et al. Diabetes and COVID-19: psychosocial consequences in people with diabetes in Denmark who characterizes people with high levels of COVID-19-related worries? Diabet Med 2020;37:1146-54.
13. Nachimuthu S, Vijayalakshmi R, Sudha M, et al. Coping with diabetes during the COVID – 19 lockdown in India: results of an online pilot survey. Diabetes Metab Syndr 2020;14:759-82.
14. Sankar P, Ahmed WN, Mariam Koshy V, et al. Effects of COVID-19 lockdown on type 2 diabetes, lifestyle and psychosocial health: a hospital-based cross-sectional survey from South India. Diabetes Metab Syndr 2020;14:1815-9.
15. Yan AF, Sun X, Zheng J, et al. Perceived risk, behavior changes and health-related outcomes during COVID-19 pandemic: findings among adults with and without diabetes in China. Diabetes Res Clin Pract 2020;167:108350.
16. Fisher L, Polonsky W, Asnui A, et al. The early impact of the COVID-19 pandemic on adults with type 1 or type 2 diabetes: a national cohort study. J Diabetes Complications 2020;34:107748.
17. Perrin NE, Davies MJ, Robertson N, et al. The prevalence of diabetes-specific emotional distress in people with type 2 diabetes: a systematic review and meta-analysis. Diabet Med 2017;34:1508-20.
18. Sturt J, Dennick R, Due-Christensen M, et al. The detection and management of diabetes distress in people with type 1 diabetes. Curr Diab Rep 2015;15:101.
19. Fisher L, Polonsky WH, Hessler DM, et al. Understanding the sources of diabetes distress in adults with type 1 diabetes. J Diabetes Complications 2015;29:572-7.
20. Joensen LE, Tapager I, Willaing I. Diabetes distress in type 1 diabetes—a new measurement fit for purpose. Diabet Med 2013;30:1132-9.
21. Eiser JR, Riazi A, Eiser C, et al. Predictors of psychological well-being in types 1 and 2 diabetes. Psychol Health 2007;16:99-110.
22. Boehme S, Geiser C, Renneberg B. Functional and self-rated health mediate the association between physical indicators of diabetes and depressive symptoms. BMC Fam Pract 2014;15:157.
23. Joensen LE, Willaing I, Holt RI, et al. Household composition and psychological health: results of the second diabetes attitudes, wishes and needs (DAWNZ) study. J Diabetes Complications 2017;31:340-6.
24. Clowther A, Dissing AS, Nguyen TL, et al. “Standing together – at a distance”: documenting changes in mental-health indicators in Denmark during the COVID-19 pandemic. Scand J Public Health 2020;48(1):79-87.
25. Holmgaard C, Badillo-Goscinka E, Riehn KE, et al. Mental distress during the COVID-19 pandemic among US adults without a pre-existing mental health condition: findings from American trend panel survey. Prev Med 2020;139:106231.
26. Fisher L, Glasgow RE, Mullan JT, et al. Development of a brief diabetes distress screening instrument. Ann Fam Med 2008;6:246-52.
27. Fisher L, Polonsky WH, Hessler D. Addressing diabetes distress in clinical care: a practical guide. Diabet Med 2019;36:803-12.
28. Christensen KS, Fink P, Toft T, et al. A brief case-finding questionnaire for common mental disorders: the CMD-2. BMJ Open 2005;5:224-57.
29. Lasgaard M. Reliability and validity of the Danish version of the UCLA loneliness scale. Personal Individ Differ 2007;42:1359-66.
30. Joensen LE, Meldgaard Andersen M, Jensen S, et al. The effect of peer support in adults with insulin pump-treated type 1 diabetes: a pilot study of a flexible and participatory intervention. Patient Prefer Adherence 2017;11:1879-90.
31. Danish Health Authority. Personer i eget risiko [People at increased risk], https://www.sst.dk/da/corona/personer-i-oeget-risiko. 2020. Accessed September 18, 2020.
