

ORIGINAL ARTICLE



Impact of the Covid-19 pandemic on dental practices in Denmark

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ABSTRACT

Objective: To investigate the impact of the Covid-19 pandemic on the patient flow and economy as experienced by dental practices in Denmark.

Material and methods: A survey regarding experience of patient flow, economical turnover, financial strain and willingness to pay for large treatments during the first year of the Covid-19 pandemic (March 2020 to March 2021), along with information on the characteristics of the practice (specialist practice, ownership, practice operation and size) was distributed to all dental practices in Denmark in March 2021.

Results: Of the 1728 practices, 581 (33.6%) answered the survey. A decline in patient flow and a decline in economical turnover were reported by 79% and 84.4% of the practices, respectively. Financial strain was reported by 15.8% and an increased willingness to pay for large treatments was reported by 32.1%. A large decline in turnover and financial strain were associated with non-specialized practices, practices with a single owner and small practices. Logistic regressions showed that practices not receiving referrals had an odds ratio of 2.34 (CI: 1.32–4.14) for having a large decline in economic turnover compared with practices receiving referrals and that small practices had an odds ratio of 1.92 (CI: 1.16–3.19) for reporting financial strain compared with large practices.

Conclusions: Reportedly, the Covid-19 pandemic resulted in a decline in both patient flow and economical turnover in Danish dental practices. Large and more specialized practices seem to have managed the economic crisis better.

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Introduction

By June 2022, almost 550,000,000 cases of Covid-19 and > 6 million deaths associated with Covid-19 have been registered worldwide [1]. Since Covid-19 was new to the world, handling of the pandemic varied greatly between countries; however, mitigation and suppression policies, with the goal to contain the pandemic, seem to be much used strategies [2]. The combination of this and the actual disease has taken a heavy toll on societies all around the world and especially many small businesses have suffered [3].

Temporary policies restricting the mobility in the Danish society were seen between March 2020 and August 2021 and as part of pandemic containment, dental practices in Denmark were demanded closed for non-critical functions from March to June 2020. Because of their critical role in society and within the health care system, the practices were re-opened and have been open since, but more time consuming and cumbersome hygiene procedures were imposed on the practices, heavily affecting the daily routines in the practices, to avoid any spread of infection.

Most studies on dental practices in the Covid-19 pandemic discuss the role of dental care in the pandemic including the practice as a source of infection [4], and the knowledge and awareness of dental personnel of Covid-19 [5]. Some studies have also shown that the Covid-19 pandemic has reduced

patient flow and income in dental practices [6–9], and that more studies are needed to investigate such outcomes [9]. As governmental handling of dental care during the pandemic have varied a lot between countries [4], it is relevant to investigate the impact of the pandemic on dental practices from as many countries as possible. Supplying the experience from Denmark will add to the evidence and help clarify how dental care strategies affect the dental profession.

At the same time, no one has studied whether structural differences between practices are associated with how well they manage to get through the pandemic. In Denmark, the dental care system for adults is based on private practices with some variation in how dental clinics are organized and managed, which makes Denmark an excellent site for investigating the impact of the pandemic on the dental business. Whether some types of practice constructions are more resilient with regard to fluctuations in the economy than others, is valuable knowledge both for the dental profession and for the decision makers.

The aim of this study was therefore to investigate the impact of the Covid-19 pandemic on the patient flow and economy as experienced by dental practices in Denmark. The hypotheses were that the pandemic led to a decline in patient flow, had a negative impact on the economy of the

practices and that large and more specialized practices had less decline in patient flow and economic turn-over.

Material and methods

Setting and data collection

The unit of investigation was dental practices in Denmark and the mode of data collection was an online survey, which means all data were reported by the practices themselves. The questions were distributed as part of the Danish Dental Associations biannual survey to the 1728 dental practices in Denmark in March 2021. This implies that the survey was conducted one year after the first restrictions were introduced for dental practices in Denmark while the pandemic was still ongoing. The survey was distributed *via* e-mail with a personal link to all dental practice owners in Denmark. The owner decided if she or he filled in the survey themselves or delegated the task to an employee. Two reminders were sent during April 2021 to practice owners who had not responded to the survey.

The questions in the survey were developed by the Danish Dental Association. Apart from the questions regarding Covid-19, all questions have previously been used by the Danish Dental Association in different surveys to Danish dental practices.

Outcome variables

The outcome variables in this study were (i) patient flow, (ii) economic turnover, (iii) financial strain and (iv) willingness to pay for large treatments. Patient flow was measured with the questions (answers): *Does your practice experience that patients seek care less frequently due to Covid-19? (yes, no). Does your practice experience difficulties in making appointments with the patients due to fear of Covid-19 infection? (yes, no).* For analytical purposes, a combined variable of these two questions was created with the categories *no decline in patient flow* (no to both questions) and *decline in patient flow* (yes to either of the questions). Economic turnover was measured with the question (answers): *How big a decline in turnover has the practice experienced in relation to the Covid-19 pandemic? (No decline, 0-10%, 11-20%, 21-30%, 31-40%, 41-50%, 51-60%, 61-70%, 71-80%, 81-90%, 91-100%, don't know/do not wish to answer).* For analytical purposes, the variable was dichotomized into *no/small decline* (0–10%) and *medium/large decline* (11–100%). This division was done because medium/large decline represents a higher and more severe impact and normal fluctuation in turnover within 10% could be expected. Financial strain was measured with the question (answer): *Does your practice experience financial strain due to the Covid-19 pandemic? (yes, no).* Willingness of the patients to pay for larger treatments (*yes/no*) was included as the amount of free funds in the Danish population increased during the pandemic due to less spending on dining, travel and the like.

Regarding the patient flow, a question on who among patients came less frequently to the practice was included to

describe any general trends in a reduced patient flow. The possible patient groups were elderly patients, patients with chronic disease, socially vulnerable patients, young patients, parents and others. The practice had the option to answer that no specific patient groups stayed away from the practice.

Explanatory variables

The explanatory variables describe the type and organization of the dental practices, with the following characteristics: Specialized care practice, ownership, operation of the practice and size of the practice. Specialized care practices were defined in two manners. The first definition was if the practice had one or more orthodontists or oral surgeons permanently employed, being the only two formal dental care specialties in Denmark. The second definition was if the practice reported to receive referrals from other dentists due to special treatment skills, independent of the type of treatment. Ownership of the practice was categorized in single owner and multiple owners. The practice operation was categorized as a solo practice or jointly operating practice. The reason for this variable is that more dental retail chains and communities are seen in Denmark. The size of the practice was defined by a combination of the number of patients reported to be affiliated with the practice and the economic turnover; if a practice had 2000 or fewer patients affiliated or an economic turnover under 2000,000 DKR, the practice was categorized as small. The variable was considered missing if the practice failed to report number of patients and/or economic turnover.

Besides the organizational characteristics of the practice, the Region in which the practice is situated was registered. This was the only variable obtained from both participating and non-participating practices. The practices were divided to belong to the Capital Region or one of the other four Regions of Denmark. This was decided as population density is markedly higher and distances to the dentist in general shorter in the Capital Region compared with the other regions.

Lastly, as willingness to pay for large treatments might influence the practices' economy, this variable was included as an explanatory variable in analyses with economic turnover and financial strain as outcomes.

Analyses

The analyses were performed using IBM's SPSS version 27 and a significance level of 0.05 was applied.

Initially, the distribution of the variables was investigated using descriptive statistics. Hereafter bivariate analyses were performed to investigate the association between the outcome and the explanatory variables using Chi-square tests. Lastly, logistic regression analyses were performed to investigate the explanatory variables of combined association with the dichotomized outcome variables. As the primary hypothesis was to investigate the association between the organizational characteristics of the practice and patient flow as well

Table 1. Distribution of explanatory variables regarding the characteristics of practice and their view on patients' willingness to pay for large dental treatments.

Variable	Distribution
Practice with orthodontist/oral surgeon	
Yes	38 (6.5%)
No	543 (93.5%)
Referral practice	
Yes	95 (16.4%)
No	486 (83.6%)
Ownership	
Single	328 (56.5%)
Multiple	253 (43.5%)
Practice operation	
Solo	457 (78.7%)
Joint	124 (21.3%)
Size	
Large	375 (65.3%)
Small	199 (34.7%)
Region	
Capital Region	200 (34.4%)
Other	381 (65.6%)

as economy, the explanatory variables *size*, *referral*, and *ownership* were included in the models. This selection was also made because of high intercorrelation between some of the explanatory variables.

Results

Practices

Of the 1728 practices in Denmark invited to participate, 581 (33.6%) answered the survey. No significant difference in the regional location of the practices was found between participating and non-participating practices. It was not possible to compare participating and non-participating practices in other variables included in the study.

Most practices were general dental practitioners with solo operation of the practice (Table 1). A little more than half of the practices had a single owner, about 65% were large, and 66% were placed outside the Capital Region.

Patient flow

Most practices reported a decline in patient flow (79%) and especially elderlies (64%) and patients with chronic disease (66%) ceased seeking care (Table 2). There was no statistically significant difference in the decline in patient flow between any of the categories of any of the explanatory variables (Table 3) and the logistic regression yielded no significant explanations for decline in patient flow (Tables 3–6).

Economic turnover, financial strain, and willingness to pay for large treatments

Most practices reported some decline in economic turnover (84.4%). More than half the practices (56.9%) reported a medium or large decline in economic turnover, but few practices (2.9%) reported more than 40% decline and 15.8% reported to have financial strain due to Covid-19. An increased willingness in the patients to pay for large treatments was reported by 32.1% (Table 2). The Chi-square

Table 2. Distribution of outcome variables regarding patient flow and economy in the practices.

Variable	Distribution
Decline in patient flow	
Yes	460 (79.2%)
No	121 (20.8%)
Absence specific patient groups	
Elderlies	371 (63.9%)
Chronic ill	383 (65.9%)
Socially vulnerable	71 (12.2%)
Young	35 (6.0%)
Parents	21 (3.6%)
Others	8 (1.4%)
No specific group	83 (14.3%)
Decline in economical turnover	
No decline	81 (14.6%)
0–10%	143 (25.8%)
11–20%	176 (31.8%)
21–30%	71 (12.8%)
31–40%	34 (6.1%)
41–50%	7 (1.3%)
51–60%	1 (0.2%)
61–70%	2 (0.4%)
71–80%	3 (0.5%)
81–90%	0 (0.0%)
91–100%	2 (0.4%)
Don't know/do not wish to answer	34 (6.1%)
Decline in economical turnover	
No/small	224 (43.1%)
Medium/large	296 (56.9%)
Financial strain	
Yes	92 (15.8%)
No	489 (84.2%)
Willingness to pay for large treatments	
Increased	153 (27.8%)
The same	294 (53.6%)
Decreased	29 (5.3%)
Don't know	73 (13.3%)

Table 3. Association between decline in patient flow and characteristics of practice.

Variable	Decline in patient flow		P	OR (CI)
	No	Yes		
Referral				
Yes	23 (24.2%)	72 (75.8%)	0.37	Ref.
No	98 (20.2%)	388 (79.8%)		1.11 (0.65–1.90)
Orthodontist/oral surgeon				
Yes	8 (21.1%)	30 (78.9%)	0.97	NA ^a
No	113 (20.8%)	430 (79.2%)		
Ownership				
Multiple	60 (23.7%)	193 (76.3%)	0.13	Ref.
Single	61 (18.6%)	267 (81.4%)		1.27 (0.80–2.00)
Practice operation				
Own	90 (19.7%)	367 (80.3%)	0.41	NA ^a
Joint	31 (25.0%)	93 (75.0%)		
Size				
Large	83 (22.1%)	292 (77.9%)	0.26	Ref.
Small	36 (18.1%)	163 (81.9%)		1.14 (0.70–1.85)
Region				
Capital Region	37 (18.5%)	163 (81.5%)	0.24	NA ^a
Other	84 (22.0%)	297 (78.0%)		

^aExplanatory variable not included in the regression analysis due to multicollinearity issues.

OR: odds ratio and CI (95%): confidence interval.

analyses showed that a large decline in turnover and financial strain were associated with non-specialized practices, practices with a single owner and small practices (Tables 4 and 5). None of the explanatory variables were significantly associated with willingness to pay for large treatments (Table 6). The results from the logistic regressions are shown in

Table 4. Association between decline in economical turnover and characteristics of practice.

Variable	Decline in economical turnover		<i>P</i>	OR (CI)
	No/small	Medium/large		
Referral				
Yes	47 (56.0%)	37 (44.0%)	0.01	Ref. 1.57 (0.96–2.55)
No	177 (40.6%)	259 (59.4%)		
Orthodontist/oral surgeon				
Yes	21 (61.8%)	13 (38.2%)	0.02	NA ^a
No	203 (41.8%)	283 (58.2%)		
Ownership				
Multiple	113 (52.3%)	103 (47.7%)	<0.01	Ref. 1.52 (1.02–2.27)
Single	111 (36.5%)	193 (63.5%)		
Practice operation				
Own	173 (41.7%)	242 (58.3%)	0.20	NA ^a
Joint	51 (48.6%)	54 (51.4%)		
Size				
Large	161 (47.9%)	175 (52.1%)	<0.01	Ref. 1.39 (0.92–2.11)
Small	62 (34.4%)	118 (65.6%)		
Region				
Capital Region	71 (38.8%)	112 (61.2%)	0.15	NA ^a
Other	153 (45.4%)	184 (54.6%)		
Willingness to pay for large treatments				
Increased	67 (46.9%)	76 (53.1%)	0.25	NA ^a
The same/decreased	127 (41.1%)	182 (58.9%)		

^aExplanatory variable not included in the regression analysis due to multicollinearity issues.

OR: odds ratio and CI (95%): confidence interval.

Table 5. Association between financial strain and characteristics of practice.

Variable	Financial strain		<i>P</i>	OR (CI)
	Yes	No		
Referral				
Yes	7 (7.4%)	88 (92.6%)	0.01	Ref. 2.12 (0.93–4.81)
No	85 (17.5%)	401 (82.5%)		
Orthodontist/oral surgeon				
Yes	2 (5.3%)	36 (94.7%)	0.07	NA ^a
No	90 (16.6%)	453 (83.4%)		
Ownership				
Multiple	26 (10.3%)	227 (89.7%)	<0.01	Ref. 1.50 (0.84–2.53)
Single	66 (20.1%)	262 (79.9%)		
Practice operation				
Own	75 (16.4%)	382 (83.6%)	0.47	NA ^a
Joint	17 (13.7%)	107 (86.3%)		
Size				
Large	43 (11.5%)	332 (88.5%)	<0.01	Ref. 1.92 (1.16–3.19)
Small	47 (23.6%)	152 (76.4%)		
Region				
Capital Region	37 (18.5%)	163 (81.5%)	0.20	NA ^a
Other	55 (14.4%)	326 (85.6%)		
Willingness to pay for large treatments				
Increased	19 (12.4%)	134 (87.6%)	0.15	NA ^a
The same/decreased	57 (17.6%)	266 (82.4%)		

^aExplanatory variable not included in the regression analysis due to multicollinearity issues.

OR: odds ratio and CI (95%): confidence interval.

Tables 3–6. Practices with a single owner had an odds ratio of 1.52 (CI: 1.02–2.27) for having a large decline in economic turnover compared with practices with multiple owners and small practices had an odds ratio of 1.92 (CI: 1.16–3.19) for reporting financial strain compared with large practices.

Discussion

This study indicates that the majority of dental practices experienced a decline in patient flow, hence adult dental care has been in a recession, in Denmark, during the Covid-19 pandemic. There are indications that the characteristics of the dental practices may be associated with how well a crisis is managed with signs of more resilience towards recessive

economic turnover among larger practices and more specialized dental practices.

In a study performing an economic analysis of the impact of the Covid-19 pandemic on dental practices in Germany, it was also found that the pandemic had a profound effect on dental practices. The study found that utilization of dental care in the study period dropped from 68% (assessment services) to 80% (preventive services) and that the revenue decreased by 16–19% [6].

Substantial decline in patient flow in dental practice has also been reported in studies from Switzerland, Lichtenstein and Norway [9,10]. Few studies have reported on patient flow decline quantitatively and in absolute numbers, but a study from the Czech Republic reported 35–50% of dentists

Table 6. Association between willingness to pay for large treatments and characteristics of practice.

Variable	Willingness to pay for large treatments		<i>P</i>	OR (CI)
	Increased	The same/decreased		
Referral				
Yes	32 (39.0%)	50 (61.0%)	0.14	Ref. 1.43 (0.86–2.39)
No	121 (30.7%)	273 (69.3%)		
Orthodontist/oral surgeon				
Yes	10 (30.3%)	23 (69.7%)	0.82	NA ^a
No	143 (32.3%)	300 (67.7%)		
Ownership				
Multiple	65 (31.6%)	141 (68.4%)	0.81	Ref. 1.32 (0.85–2.05)
Single	88 (32.6%)	182 (67.4%)		
Practice operation				
Own	117 (30.9%)	262 (69.1%)	0.24	NA ^a
Joint	36 (37.1%)	61 (62.9%)		
Size				
Large	109 (34.8%)	204 (65.2%)	0.12	Ref. 1.52 (0.95–2.42)
Small	44 (27.7%)	115 (72.3%)		
Region				
Capital Region	52 (32.7%)	107 (67.3%)	0.85	NA ^a
Other	101 (31.9%)	216 (68.1%)		

^aExplanatory variable not included in the regression analysis due to multicollinearity issues.

OR: odds ratio and CI (95%) = confidence interval.

had a decrease in patient flow due to Covid-19 [11]. This is somewhat lower than the roughly 80% found in our study. The reason might be that we included a question on the difficulty for patients to come to the practice, in our patient flow outcome. Nevertheless, the decline in patient flow due to Covid-19 seems genuine and of a significant volume. From our study, it seems that especially elderlies and patients with chronic diseases were the ones staying away. This is not too surprising since chronic ill patients and the elderly are in higher risk of severe complications if infected by Covid-19.

Concerning income and financial problems, other studies also indicate that the pandemic negatively influenced these economic parameters [7,8,12]. Our finding that 84.4% of the practices reported having a decline in turnover can be compared with studies from Iran and Italy, that found a frequency in decrease in income of 97% and 86.5% respectively [7,8]. The study from Iran also reported that 43% of the practices had financial problems, which is high compared with our finding of roughly 16%. The differences in governmental financial aids to dental practices and general handling of the pandemic between the countries could explain the differences. A study from Spain found that half the dentists working in private practice had loss of income above 10,000 EURO per month [12]. Overall, the pandemic has a significant impact on the economy of dental practices, which is not surprising since dental practices often can be considered small businesses that have suffered throughout the world [3].

Our second hypothesis was that different susceptibility to pandemic induced changes in patient flow and financial conditions, may be seen in relation to the characteristics of the practices. In relation to economy, larger practices, i.e. practices with many patients and high turnover, and specialized practices receiving professional referrals, encounter financial problems less often. It seems plausible that large practices are more flexible and are more capable to catch up on any lost turnover compared with small practices with fewer practitioners and patients. Specialized care practices often

provide more complex and larger treatments, and as an increased willingness to pay for such treatments was frequently reported, this finding also makes sense. It disharmonizes, however, with a study from Spain that found no difference in loss of income between any dental specialties including general dentists [12]. The association between ownership and financial problems found in our study is also worth mentioning, even though the association was not significant in the logistic regressions. The characteristics of the dental practices thus seem to be a relevant parameter to take into account with regard to financial discussions in times of pandemic crisis and maybe even other future crisis impacting the dental care business. Our findings are therefore relevant for decision makers and dental professionals.

Self-reported measures, chosen to reflect the dental practitioners' viewpoint on the Covid-19 pandemic, have inherent limitations, i.e. recall bias, availability bias and maybe even conflicts of interests regarding the outcome of the study and needs to be taken into account. Furthermore, the questions used in our study have not been validated in other studies. However, a recent study [13] confirms the decline in patient flow and further post-pandemic studies for instance by means of administrative data on delivered dental care services, from national registers, will probably confirm the experienced decline in patient flow.

Another limitation is the relatively low response rate resulting in small power in our study. This is a problem as it hampers our possibilities to yield significant results but more importantly could question the representativeness of our findings (14). This is further reinforced by our limited information on the non-participating practices. We believe, however, that the sample makes a solid base for our results as it includes a broad spectrum of dental practices in Denmark. More studies using more quantifiable measures, i.e. data from national registries would be relevant.

The outcome variables provide valuable information on two important aspects of dental practice: patient flow and the related economy. Other outcomes would be relevant to

investigate, such as psychological impacts on the dental professionals and the quality of dental care during a pandemic crisis and its effect on the health of patients. A basic prerequisite for dental professionals to be able to deliver high quality oral health care is that their basis of existence is not threatened. Psychological consequences from living and working through a pandemic have been reported to be a problem among health care workers [15], and in dental practice as well [16]. Concerning the categories of the outcome variables, it can be discussed if a decline in turnover of 11% is an appropriate cut-off between low and medium. Because we had 10% intervals in this outcome, the alternative was 21%, which we considered too high as the economic turnover in Danish dental practice was estimated to increase in these years [17,18]. We believe the explanatory variables included in our study are relevant although other variables may have been relevant to include, such as regional infection numbers and if practices received sufficient governmental financial aid [9,12].

Conclusions

The Covid-19 pandemic has influenced Danish dental practices resulting in decline in both patient flow and economic turnover and reports of financial strain due to the pandemic. The decline in patient flow was mainly seen among the elderly and patients with chronic disease, and was not influenced by the characteristics of the dental practice. Decline in economic turnover was frequent but of a limited magnitude and was, along with report of financial strain, somewhat influenced by the characteristics of the dental practices, with larger and more specialized practices seemingly better able to overcome the crisis compared with smaller and general dental practices. These findings are important for the decision makers to evaluate if financial aid programs for dental practice are sufficient and if criteria for allocation are fair. Furthermore, dental practitioners may use the findings to reflect upon and evaluate if they are sufficiently prepared for potential future pandemics and/or financial crisis.

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Disclosure statement

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