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.

Table II. Treatment distributions for primary encounter diagnoses for incarcerated patients

Total treatment recommendations	Teledermatology, n = 335 n (%)	Face-to-face, n = 444 n (%)	*P* value*
Procedure			.03
Cryosurgery	4 (1.2)	44 (9.9)	
Electrodessication and Curettage	0 (0.0)	18 (4.1)	
Excision	0 (0.0)	10 (2.3)	
Injection, intralesional	0 (0.0)	2 (0.5)	
Medication			.001
Antibiotic	24 (7.2)	20 (4.5)	
Antifungal	3 (0.9)	3 (0.7)	
Antihistamine	7 (2.1)	5 (1.1)	
Antiviral	2 (0.6)	0 (0.0)	
Field therapy	0 (0.0)	7 (1.6)	
Immunomodulatory/Immunosuppressants	87 (26.0)	53 (11.9)	
Other†	5 (1.5)	4 (0.9)	
Retinoid	49 (14.6)	18 (4.1)	
Systemic corticosteroid	8 (2.4)	20 (4.5)	
Topical corticosteroid	99 (29.6)	85 (19.1)	
Referral			.06
Allergy	0 (0.0)	1 (0.2)	
Mohs	4 (1.2)	45 (10.1)	
Narrowband, ultraviolet B	1 (0.3)	0 (0.0)	
Surgical management	9 (2.7)	26 (5.9)	
No intervention required/noted	33 (9.9)	83 (18.7)	

*P values were calculated using t test for continuous variables and Pearson χ^2 test for categorical variables. Percentages in each column total 100% for each location, but P values were calculated for each treatment group.
†Gabapentin, spironolactone, and naproxen for teledermatology and warfarin and pentoxifylline for face to face.

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Using simulation modeling to minimize patient-to-patient contact time while optimizing clinical operations during a pandemic

To the Editor: The COVID-19 pandemic significantly stressed outpatient operations. In March 2020, ambulatory visits declined by nearly 60%, and many practices closed to decrease transmission.[1] As clinics reopened, they had to quickly readjust clinical operations—balancing telemedicine and in-person visits to minimize patient-to-patient contact (PTPC) during in-person visits.[2,3] By leveraging a previously validated simulation model, we studied how to vary resources to minimize patient exposure risk while maximizing physician utility by maintaining patient volume and access during the COVID-19 pandemic.[4]

We performed a time study of 570 patients between July 27, 2020, and August 7, 2020, at the Department of Dermatology, Tufts Medical Center, and compared the results with those from our study in 2018.[4] Although there were variations in in-person patient and physician volume during the COVID-19 pandemic, no significant difference existed in process flow, rendering the existing simulation model valid for use in this study.[4] We evaluated differences in PTPC between before and during the COVID-19 pandemic when baseline resources, defined as 1 medical assistant (MA), 1 resident, and 3 rooms, are assigned (Table I). We measured PTPC based on the percentage of patients who wait in the waiting area with 1 or more patients and their average wait time (AWT).

Table I. Comparison of patient-to-patient contact as measured through percentage of patients who wait in the waiting area with 1 or more patients and average wait time between before and during COVID-19 operations*†

Clinic characteristics		COVID-19 (July or August 2020)	Before COVID-19 (November 2018)
In-person	Patient volume/ week‡	285	508
	Patients per attending	15	14.5
	PPWA, %§	46.9	67.1
	AWT in waiting area, min§	29.7	28.1
Telemedicine	Patient volume/ week	113	0

AWT, Average wait time; *PPWA*, percentage of patients in the waiting area with 1 or more patients.

*Comparison of patient-to-patient contact was performed when 1 medical assistant, 1 resident, and 3 rooms were assigned per attending.

†Details of the simulation model parameters for the base-case scenario can be found in the study by Suhaimi et al.[4]

‡Patient volume before no-shows. Decreases in in-person volume during the COVID-19 pandemic were, in part, due to increase in the use of telemedicine services.

§PPWA and AWT were calculated only for in-person patients who wait with 1 or more patients in the waiting area.

Despite an average in-person patient volume reduction of 43.9% during the COVID-19 pandemic (due, in part, to some physicians using telemedicine), using baseline resources, the percentage of patients who wait in the waiting area with 1 or more patients and AWT were 46.9% and 29.7 minutes, respectively (Table I). Thus, we simulated 120 scenarios with varying numbers of MAs, residents, rooms, and patients (Table II) with the goal of minimizing PTPC by decreasing AWT to <15 minutes based on the Centers for Disease Control's exposure guidelines.[5]

Increasing MAs from 1 to 2 while keeping other volume or resources constant demonstrated the least improvement, whereas increasing the number of rooms and residents had larger effects. Compared with the baseline, the percentage of patients who wait in the waiting area with 1 or more patients only decreased from 46.9% to 46.5% with 1-unit increase of MA but decreased to 35.2% and 30.5% with 1-unit increase in the number of residents and rooms, respectively. Similarly, AWT decreased from 29.7 to 29.4 minutes with the increase of 1 MA but decreased to 27.4 and 26.7 minutes with the increase of 1 resident and room, respectively. Decreasing the patient volume also decreased AWT, but using baseline resources, the patient volume needed to decrease by 40% for AWT to be <15 minutes. Instead, we allocated 2 MAs, 5 rooms, and 2 residents per physician to avoid decreasing patient volume and preserving in-person attending physician utilization (highlighted in Table II).

The results in Table II demonstrate the use of a simulation in guiding decision making, even in times of crisis, to understand interdependent operational outcomes. We were able to quickly operationalize and minimize PTPC while preserving attending physician utilization and in-person patient volume. A key limitation in PTPC measurement is that AWT is an approximation of the true PTPC. In the future, we recommend integrating agent-based modeling to assess the actual time patients wait with another patient. Although this study had a single-institutional workflow and fixed resources, this work demonstrates opportunities for dermatology and other outpatient clinics to understand the impacts of varying resource constraints to assist in clinical operational decision making.

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Conflicts of interest

None disclosed.

Table II. Effects of patient volume, number of medical assistants, residents, and rooms per attending on the percentage of patients who wait in the waiting area with 1 or more patients and average wait time as measures of patient-to-patient contact*

			PPWA†				AWT†			
			No. of rooms				No. of rooms			
No. of medical assistants	No. of residents	Patient volume	2	3	4	5	2	3	4	5
1		−40%	25.8%	13.4%	7.7%	4.1%	36.5	24.6	25.9	14.0
		−20%	51.6%	35.2%	27.6%	15.5%	50.2	40.7	34.8	31.2
	0	Baseline	80.2%	66.8%	51.0%	43.2%	73.1	59.0	52.2	49.4
		+20%	89.0%	86.6%	81.7%	73.3%	105.4	96.2	80.2	73.0
		+40%	94.2%	90.5%	86.9%	85.2%	152.3	130.8	120.3	115.5
		−40%	19.9%	6.7%	1.5%	1.9%	20.9	11.9	6.2	3.6
		−20%	42.6%	21.3%	14.3%	6.9%	32.7	22.5	22.6	18.6
	1	Baseline	67.7%	46.9%‡	30.5%	17.4%	43.2	29.7‡	26.7	20.0
		+20%	83.4%	69.6%	62.0%	53.6%	68.9	51.0	46.9	40.7
		+40%	91.1%	85.2%	78.4%	72.1%	90.0	80.9	67.0	62.1
		−40%	16.0%	3.6%	1.7%	-	18.5	15.5	4.9	2.1
		−20%	39.4%	17.8%	6.9%	3.8%	28.0	19.0	15.4	7.0
	2	Baseline	56.6%	35.2%	18.2%	6.9%	35.1	27.4	22.0	11.8
		+20%	80.2%	59.6%	37.7%	27.5%	50.0	35.2	28.9	27.0
		+40%	90.3%	75.6%	65.1%	48.7%	74.5	51.5	41.7	34.9
2		−40%	21.1%	11.7%	4.6%	1.8%	25.9	33.3	15.6	11.4
		−20%	54.4%	37.8%	25.9%	14.3%	47.8	33.7	34.4	25.6
	0	Baseline	80.1%	69.7%	55.8%	44.7%	75.0	62.4	47.1	41.1
		+20%	88.8%	82.3%	78.1%	70.2%	99.7	89.6	76.5	67.4
		+40%	93.2%	91.5%	87.2%	83.8%	140.9	134.3	118	102.8
		−40%	17.6%	7.8%	2.4%	0.5%	16.0	20.4	13.3	1.6
		−20%	42.1%	20.5%	12.0%	5.4%	28.9	25.9	20.8	9.3
	1	Baseline	63.1%	46.5%	27.9%	24.4%	40.7	29.4	23.2	28.9
		+20%	81.4%	71.6%	52.7%	45.1%	61.1	50.8	38.2	35.4
		+40%	92.1%	83.0%	74.3%	66.5%	84.2	73.7	64.1	53.0
		−40%	13.0%	3.8%	2.3%	0.5%	12.5	13.8	5.6	-
		−20%	27.9%	15.0%	6.1%	2.1%	18.6	15.2	12.4	4.8
	2	Baseline	49.4%	28.8%	17.5%	10.4%	26.9	19.5	18.6	12.2
		+20%	72.4%	51.1%	36.7%	26.4%	41.6	29.1	25.4	24.2
		+40%	86.7%	71.8%	57.6%	48.0%	58.8	43.9	33.9	28.3

AWT, Average wait time; *PPWA*, percentage of patients in waiting area.
*Baseline refers to COVID-19 in-person patient volume, as shown in Table I.
†PPWA and AWT were calculated only for in-person patients who wait with one or more patients in the waiting area as measures of patient-to-patient contact.
‡Indicates baseline resourcing scenario.

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