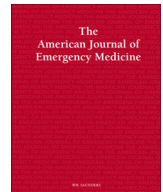




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## Postponing calls to EMS due to religious observances - A nationwide study

The arrival time of emergency medical services (EMS) may directly affect functional outcomes and survival [1–3]. In a “natural experiment”, we examined calls to Magen David Adom for cardiac arrest, trauma, cerebrovascular accident (CVA), and dyspnea, during September–October (the holiday season, including Yom Kippur) 2019–2020. We compared calls across weekdays, weekends, and holidays, and between predominantly orthodox and predominantly non-orthodox Jewish communities in southern Israel. Orthodox Jews fast on Yom Kippur (the holiest day of the year) for nearly 25 h, and generally spend most of the day in synagogue services. During the Sabbath (Saturday) and Jewish holidays, including Yom Kippur, orthodox Jews refrain from and do not travel by car. However, the preservation of human life is paramount to Jewish laws. Thus, travel for medical help is permitted, as is the operation of electrical appliances to assist medical care or call for help. Orthodox Jews often prefer to make urgent trips by ambulance, so as not to raise questions regarding their travelling on Saturday. Most non-orthodox Jews do not drive on Yom Kippur. Paradoxically, since roads are nearly empty from cars, many non-orthodox Jews spend Yom Kippur riding bikes. Magen David Adom, Israel's national EMS, serves the entire population of Israel, 24/7, 365 days a year (including Yom Kippur).

Predominantly orthodox communities were defined as over 85% of the votes in the 2019 election for parties representing the religious communities. All the calls with the same diagnosis, date, and hour were summed. Time period indicators of Shabbat and holidays when driving was not allowed by the Jewish religion was the main exposure of interest. The Jewish calendar is lunar; thus, days start and end in the evening. Accordingly, immediately at the end of each Saturday or holiday when

driving is prohibited, a few hours remain during which driving is allowed.

Separately, for the orthodox and non-orthodox communities, we calculated prevalence ratios (PRs) of EMS calls for Yom Kippur, the hours after Yom Kippur, and Shabbat and other holidays during which driving is prohibited in the Jewish religion, compared to regular days. The Poisson regression was used to compare incidence rates of EMS calls per hour; and accounted for overdispersion by using a quasi-Poisson distribution. The modification effect of a non-weekend day (Yom Kippur, or Shabbat or holiday) on the frequency of the EMS calls by religion was analyzed by an interaction term between time periods and population sub-groups. A three-way interaction term between annual trend, religion, and specific time periods (2020, during the COVID-19 pandemic, compared to 2019) was used to assess a possible effect of the COVID-19 pandemic on the data.

Altogether, 219,931 EMS calls were recorded during 122 days. In orthodox communities, on Yom Kippur and other periods when driving was not allowed, the EMS calls due to trauma, CVA, and dyspnea events were all lower than their expected proportional counts (Table 1). In non-orthodox communities, EMS calls due to trauma were higher on Yom Kippur than their expected proportional counts. Table 2 and Fig. 1 present PRs of EMS calls for the four medical conditions examined, for various time periods, compared to “regular days” (when driving was allowed) as a reference. During Yom Kippur, the PRs in the orthodox compared to the non-orthodox communities were 1.93 vs. 0.86 for cardiac arrest, 0.69 vs. 1.23 for trauma, 0.39 vs. 0.59 for CVA, and 0.67 vs. 1.01 for dyspnea. During the hours immediately after Yom Kippur, the respective PRs for the orthodox compared to the non-orthodox communities were 0.77 vs. 0.79, 1.45 vs. 0.99, 2.52 vs. 2.50 and 1.61 vs. 1.57.

In the non-orthodox communities, the increased PR for trauma on Yom Kippur may be explained by the increased prevalence of recreational biking activities. In the orthodox communities, the low PR for trauma on Yom Kippur, as well as on Shabbat and other holidays, can be explained by decreases in activity that could cause traumatic injury.

**Table 1**

Observed compared to expected EMS calls, proportional to the duration.

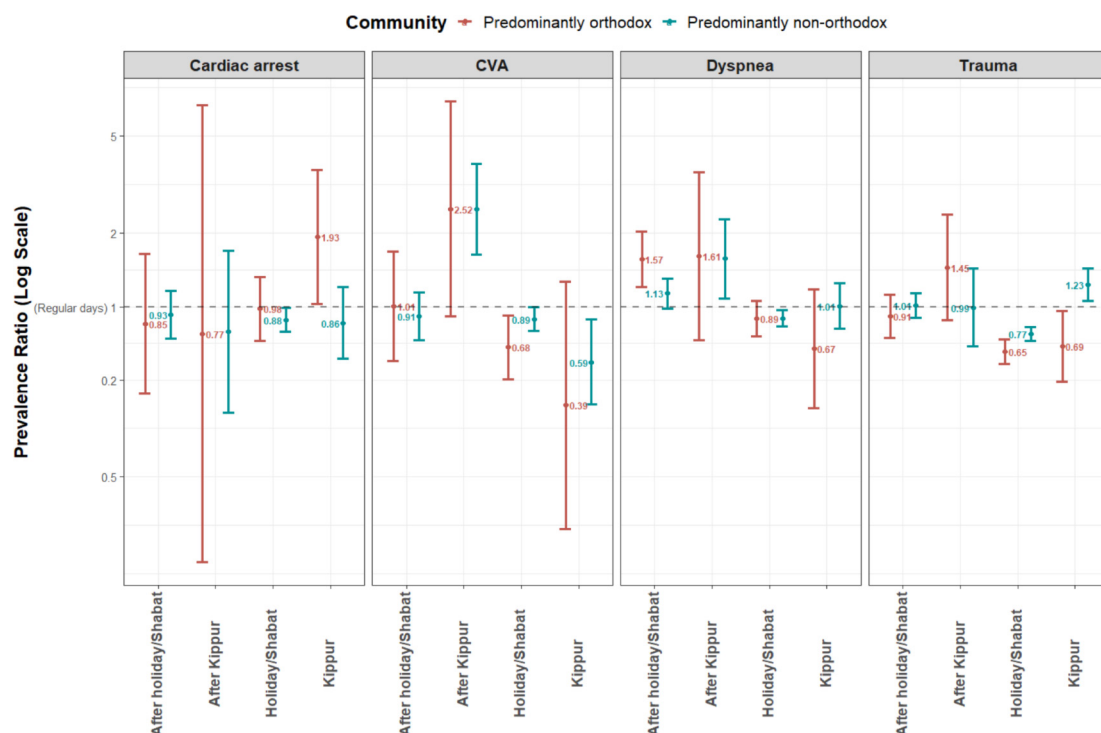
	Type of events	Driving was allowed	Driving was not allowed (other than Yom Kippur)	Yom Kippur
Predominantly non-orthodox communities	Expected events in relation to time segment (%)	82.0%	16.4%	1.6%
	Cardiac arrest observed n/N (%)	2732/3263 (83.7%)	484/3263 (14.8%)	47/3263 (1.4%)
	Trauma observed n/N (%)	29,075/34278 (84.8%)	4488/34278 (13.1%)	715/34278 (2.1%)
	CVA observed n/N (%)	2791/3319 (84.1%)	495/3319 (14.9%)	33/3319 (1.0%)
	Dyspnea observed n/N (%)	6467/7746 (84.5%)	1150/7746 (14.95%)	129/7746 (1.7%)
Predominantly orthodox communities	Cardiac arrest observed n/N (%)	309/382 (81.0%)	61/382 (16.0%)	12/382 (3.0%)
	Trauma observed n/N (%)	4139/4739 (87.3%)	543/4739 (11.5%)	57/4739 (1.2%)
	CVA observed n/N (%)	384/439 (87.5%)	52/439 (11.9%)	3/439 (0.7%)
	Dyspnea observed n/N (%)	1070/1270 (84.3%)	186/1270 (14.7%)	14/1270 (1.1%)

<sup>1</sup>Equal contribution

**Table 2**

Prevalence ratios (PRs) of a number of diagnoses, for various time periods compared to regular days, in orthodox and non-orthodox communities, according to the Poisson model.

		Time period	PR	95% CI	p-value
Cardiac arrest	Predominantly non-orthodox	Regular days	1		
		Holiday/ Shabbat	0.88	0.79; 0.99	0.031
		After Holiday/ Shabbat	0.93	0.74; 1.16	0.518
		Yom Kippur	0.86	0.61; 1.20	0.371
		After Yom Kippur	0.79	0.37; 1.70	0.542
	Predominantly orthodox	Regular days	1		
		Holiday/ Shabbat	0.98	0.72; 1.33	0.895
		After Holiday/ Shabbat	0.85	0.44; 1.64	0.625
		Yom Kippur	1.93	1.02; 3.63	0.043
		After Yom Kippur	0.77	0.09; 6.66	0.813
Trauma	Predominantly non-orthodox	Regular days	1		
		Holiday/ Shabbat	0.77	0.72; 0.82	<0.001
		After Holiday/ Shabbat	1.01	0.90; 1.14	0.812
		Yom Kippur	1.23	1.06; 1.43	0.007
		After Yom Kippur	0.99	0.69; 1.43	0.962
	Predominantly Orthodox	Regular days	1		
		Holiday/ Shabbat	0.65	0.58; 0.73	<0.001
		After Holiday/ Shabbat	0.91	0.75; 1.12	0.386
		Yom Kippur	0.69	0.49; 0.96	0.027
		After Yom Kippur	1.45	0.88; 2.38	0.147
CVA	Predominantly non-orthodox	Regular days	1		
		Holiday/ Shabbat	0.89	0.79; 0.99	0.040
		After Holiday/ Shabbat	0.91	0.73; 1.15	0.437
		Yom Kippur	0.59	0.40; 1.15	0.011
		After Yom Kippur	2.50	1.63; 3.84	<0.001
	Predominantly orthodox	Regular days	1		
		Holiday/ Shabbat	0.68	0.51; 0.92	0.012
		After Holiday/ Shabbat	1.01	0.60; 1.69	0.980
		Yom Kippur	0.39	0.12; 1.27	0.118
		After Yom Kippur	2.52	0.91; 6.94	0.075
Dyspnea	Predominantly non-orthodox	Regular days	1		
		Holiday/ Shabbat	0.90	0.83; 0.97	0.006
		After Holiday/ Shabbat	1.13	0.98; 1.31	0.084
		Yom Kippur	1.01	0.81; 1.25	0.962
		After Yom Kippur	1.57	1.08; 2.28	0.018
	Predominantly orthodox	Driving allowed	1		
		Holiday/ Shabbat	0.89	0.75; 1.05	0.179
		After Holiday/ Shabbat	1.57	1.20; 2.03	0.001
		Yom Kippur	0.67	0.38; 1.18	0.165
		After Yom Kippur	1.61	0.73; 3.56	0.239

**Fig. 1.** Prevalence ratios of EMS calls due to cardiac arrest, cerebrovascular accident (CVA), dyspnea, and trauma, in orthodox and non-orthodox communities, for several exposures compared to regular days.

However, in these communities, the dramatically increased PR for trauma immediately following Yom Kippur suggests a possible delay in calls (Fig. 1).

In both orthodox and non-orthodox communities, the PRs of EMS calls due to CVA and dyspnea were greatly increased immediately after Yom Kippur compared to during Yom Kippur (Fig. 1). The increases were more prominent in the orthodox communities, probably because for minor symptoms, self-evacuation to hospitals by private cars is more common among the non-orthodox population.

In contrast to dyspnea and CVA, the manifestation of cardiac arrest is dramatic when medical assistance is delayed. Therefore, the number of EMS calls presumably accurately reflects the actual onset. That said, cardiac arrest events increased markedly during Yom Kippur in the orthodox communities. A possible explanation is that due to the holiness of Yom Kippur, featured by high emotional engagement, especially among orthodox persons, unattended cardiac conditions on a minor scale, such as a myocardial infarction, may result in cardiac arrest. Another possibility is that elderly people may stay home alone while family members are at synagogue, and be unable to call for medical assistance in cases of myocardial infarction, which could develop to cardiac arrest.

A three-way interaction analysis of annual trend, orthodox vs. non-orthodox community, and the COVID-19 time period did not reveal a statistically significant change in the primary study analysis during the pandemic. This contrasts with studies that reported decreases in EMS calls during the COVID-19 pandemic [4-6]. The implication is that the COVID-19 pandemic did not affect the number of EMS calls on Shabbat and holidays compared to regular days; nor the differences observed between the orthodox and non-orthodox communities. As in the current study, others showed greater decreases in EMS calls during the COVID-19 pandemic, for medical conditions that may appear less urgent [4,6].

This study is limited by not accounting for weather and seasonal effects (length of day), and evacuations other than by ambulance. Nevertheless, the findings should prompt health educational programs to stress the importance of timely calls for medical help, even regarding conditions with “non catastrophic” manifestations.

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## Declaration of Competing Interest

No relevant conflicts of interest.

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