

# A Statistical Approach to the High Mortality Rate of Israeli Citizens Held Hostage in Gaza

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**ABSTRACT** **Background:** According to Hamas sources, many Israeli hostages in Gaza were killed by indiscriminate Israeli airstrikes, together with a large number of Palestinian citizens. **Objectives:** To verify whether the estimated death rate of Israeli hostages was similar to the estimated death rate of Gaza citizens from these acts of war. **Methods:** We used two estimates of hostage death rates, one obtained from Israeli intelligence sources, and one published by a Hamas spokesperson. We used the Palestinian casualty rates published by the Palestinian Ministry of Health. We compared death rates using Fisher’s exact test. **Results:** By 30 December 2023, the rate of Israeli hostage death was 23/238 (9.7%) according to Israeli intelligence sources, and 60/238 (25.2%) according to Hamas. Both figures are strikingly and significantly higher than the death rate among Palestinians, estimated to be 19,667/2.2 million (0.89%) by 19 December 2023 ( $P < 0.0001$ ). **Conclusions:** Israeli airstrikes as the cause of death of Israeli hostages are implausible unless they were specifically exposed to these strikes more than Palestinian citizens.

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**KEY WORDS:** mortality rate, warfare, hostages, cause of death

On 7 October 2023 Hamas and the Islamic Jihad launched a concerted attack into southern Israel and took in captivity 238 hostages, most of them civilians [1]. These hostages were documented to be alive, mostly from videos taken at the time of their abduction by Palestinian sources, when they were paraded in the streets of Gaza, and from the report of some released hostages [1]. Many of the hostages died, and according to Hamas sources, always from Israeli airstrikes [2]. On 9 October, Hamas’ al-Qassam Brigades, the group’s military arm, officially threatened to execute these hostages on camera if the Israeli government continued bombing Palestin-

ian lands and demanded that all Palestinians (more than 5000) detained in Israeli prisons (mostly after conviction for security offenses) be released [3]. Hamas did not publish such executions, and to this date, it is not completely clear how many of them died after their abduction.

The purpose of this article is to offer a statistical approach to the probable cause of death of Israeli hostages. We hypothesized that a random, high death rate from airstrikes is not plausible.

## PATIENTS AND METHODS

We used data reported from two sources. The first was the formal report from the spokesperson of the Israeli communication ministry provided on 30 December 2023 [4]. The second one is the 5 November 2023, formal report of Israeli hostage casualties by a Hamas spokesperson [2] together with a report of Palestinian casualties published on 19 December 2023 by the Palestinian Ministry of Health [5].

Statistical analysis comparing death from airstrike rates between Palestinian citizens of Gaza and Israeli hostages was conducted using the Fisher’s exact test calculator obtained from GraphPad [Available from Analyze a 2x2 contingency table (graphpad.com)].

## RESULTS

By the end of November Hamas had released 109 hostages, following a ceasefire agreement that included hostage–prisoner exchanges [1].

According to the Israeli communication ministry, based on Israeli intelligence, it was estimated that by 30 December 2023, 129 hostages were being held by Hamas, among them 23 confirmed by Israeli authorities to have died in captivity [4]. According to Hamas sources, pub-

lished Palestinian figures are actually much higher, since on 5 November 2023, Hamas's armed wing, Al-Qassam Brigades, stated that 60 Israeli hostages had been killed in Israeli airstrikes in the Gaza Strip since 7 October 2023. Its spokesman, Abu Obeida, said that after search operations, "still there are 23 bodies (of hostages) lost under the rubble." [2]. If we use the lower Israeli estimate of 23 hostages killed in captivity from an initial total of 238 hostages, it constitutes a death rate of 9.7%. That rate is nearly 10 times higher than the death rate of Palestinians (by Palestinian estimates). Indeed, the Gaza Health Ministry has reported that since the initiation of the war on 7 October 2023, 19,667 people of an estimated 2.2 million inhabitants of Gaza were killed by Israeli airstrikes from 7 October 2023 until 19 December 2023, a death rate of 0.89% [5]. A Fisher's exact test comparing the death rate of Israeli hostages (9.7%) and of Palestinian residents of Gaza (0.89%) gives us a highly significant difference with a  $P$ -value of  $< 0.0001$ . If we use the Hamas figures of 60 Israeli hostages killed in Israeli airstrikes, then 25% of Israeli hostages died, 28 times more than Palestinians (with an even higher significance level).

## DISCUSSION

We demonstrated that during the Iron Swords war the risk of Israeli hostages to be killed by airstrikes was 10 to 28 times greater than that of Palestinians in Gaza. Thus, the null hypothesis that Israelis and Palestinians should have died in similar circumstances, at similar rates, can be rejected. Limitations of our findings include the sources of information that these analyses are based on. On the Israeli side, the data are protected intelligence figures, and we are unable to verify the sources. However, the mortality from airstrikes of hostages reported by Hamas is much higher, and if accurate, would only reinforce the strength of our analysis. Second, mortality from airstrikes among Palestinians is most likely much lower than the figure of 19,667 individuals (0.89%) since many were actually combatants killed during the war by means other than airstrikes. This number is unclear, but if it were to be subtracted from the total of 19,667 individuals, the death rate from airstrikes would be even more strikingly different among Israeli hostages and Palestinians from Gaza. Third, this war is far from being finished and there are dynamic changes in numbers. Besides Abu Obeida's admission of the death

of 60 hostages, Hamas did not provide any additional numbers showing the fate of all hostages still in their hands. Fourth, data on Israeli hostages and Palestinian casualties were not reported on the same day; there was a 15-day lag between the two estimates.

## CONCLUSIONS

There are many possible interpretations for the striking difference in hostage mortality and Palestinian mortality from airstrikes. The first is that the Israeli hostages were kept in locations less protected from airstrikes than that of the Palestinians. An alternative explanation is that they were purposefully exposed to the airstrikes. This explanation is not logical as many hostages who were released reported to have been kept in tunnels located tens of meters below the ground. Another possible explanation is more chilling: the hostages were not killed during airstrikes but were actually murdered. We hope that the truth will eventually come out of these tunnels.

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