

Evidence of Widespread and Systematic Bombardment of Ukrainian Healthcare Facilities

SUMMARY

17 MAY 2022

EXECUTIVE SUMMARY | *The Yale Humanitarian Research Lab (HRL) has identified 22 healthcare facilities in Ukraine that sustained damage from apparent Russia-aligned bombardment between 24 February and 29 March 2022. The HRL verified damage through cross-corroboration of very high resolution satellite imagery and open source information. Based on a review of nearly 300 facilities across five cities and regions, the HRL has concluded that Russia-aligned forces have engaged in widespread and systematic bombardment of Ukrainian healthcare facilities.*

The HRL's full report was provided to the Organization for Security and Co-operation in Europe's (OSCE) Moscow Mechanism mission of experts. The following summary presents the key findings of the full report, including a more detailed explanation of the methodology used by HRL and a geographic breakdown of where apparently damaged facilities have been identified. Only the summary is being released due to the highly sensitive nature of the location data contained within the full report transmitted to the OSCE.

OVERVIEW | The Yale Humanitarian Research Lab (HRL) has identified 22 healthcare facilities in Ukraine that sustained damage from apparent Russia-aligned bombardment between 24 February and 29 March 2022. The HRL verified damage through cross-corroboration of very high resolution satellite imagery and open source information. Based on a review of nearly 300 facilities across five cities and regions, the HRL has concluded that Russia-aligned forces have engaged in widespread and systematic bombardment of Ukrainian healthcare facilities.

The HRL's full report was provided to the Organization for Security and Co-operation in Europe's (OSCE) Moscow Mechanism mission of experts. Due to the report's granularity and the potential use of sensitive information for targeting purposes, only this summary and examples of annotated imagery depicting damage to seven (7) of these health facilities (including before/after imagery, 20 images total) are being released publicly. The full report will be made available as needed to international accountability mechanisms.

The HRL verified visible damage at approximately eight percent of the 277 facilities. The total assessment classified facilities as sustaining "no visible," "minimal," "partial," "significant partial," or "total" damage based on available satellite imagery at the time. The initial report does not attempt to determine whether an individual incident of a healthcare facility being bombarded is the result of indiscriminate fire or intentional targeting. It is important to note that both indiscriminate and intentional targeting of healthcare facilities can constitute a war crime.

LEGAL CONTEXT | Healthcare facilities and medical personnel are protected by international humanitarian law (IHL). These protections are enshrined in the 1949 IV Geneva Conventions. Violations of prohibitions against attacking these protected objects can constitute a war crime under the Rome Statute of the International Criminal Court (ICC).

FINDINGS | A total of 277 healthcare facilities were identified and examined in Mariupol, Kharkiv, Kyiv Oblast, Chernihiv, and Izyum. As stated above, the HRL verified damage sustained by 22 of those 277 facilities (approximately 8 percent). The HRL classified levels of damage based

1. Organization for Security and Co-operation in Europe (OSCE), "Ukraine appoints mission of experts following invocation of the OSCE's Moscow Mechanism," 15 March 2022, <https://www.osce.org/odihr/513973>

on satellite imagery analysis. Based on damage visible in satellite imagery captured between 24 February and 29 March 2022, three (3) healthcare facilities sustained total damage while nineteen (19) facilities sustained significant, partial or minimal damage. Eleven (11) facilities were classified as having surrounding visible damage. The evidence of bombardment-related damage to healthcare facilities presented below was universally not visible in satellite imagery captured prior to 24 February 2022.

SUMMARY STATISTICS						
Location of facility	Locations Identified	Imagery Available	Apparently Damaged Facilities Present in Imagery	Damage to Surrounding Area Present in Imagery	Supporting Open Source Material	Open Source and Imagery Cross-Corroborate Damage to Facility
Mariupol	22	22	Total = 1 Significant Partial = 3 Partial = 6 Minimal = 4 No visible damage = 2	6	7	7
Kharkiv	63	61	No visible damage = 63	0	2	0
Kyiv Oblast	172	118	Total = 1 Partial = 2 No visible damage = 167	2	2	2
Chernihiv	17	17	Significant Partial = 2 Partial = 1 No visible damage = 12	2	2	2
Izium	3	3	Total = 1 Partial = 1	1	2	2
Total	277	221	22	11	15	13

ASSESSMENT & METHODOLOGY | This report defines healthcare facilities as hospitals, clinics, and other types of medical treatment facilities. The HRL examined healthcare facilities located in Mariupol, Kharkiv, Kyiv Oblast, Izium, and Chernihiv. The HRL classified the evidence of damage to healthcare facilities through satellite imagery as “not visible,” “minimal,” “partial,” “significant partial,” or “total” damage. This damage scale aligns with damage scales used by the United Nations Satellite Centre (UNOSAT) for complex emergencies. Additionally, sites were classified as having “surrounding visible damage” if there was damage within a 400 meter radius of the healthcare facility, but no visible damage to the facility itself was assessed. This reflects the potential impact of aerial bombardment within approximately 400 meters of a facility, which can lead to blown out windows and doors, as well as damage to exterior walls that may not be readily apparent in satellite imagery.

The investigative methodology for this report combines very high resolution (VHR) satellite imagery analysis and open source investigation. The VHR imagery used to support this investigation was obtained through the U.S. Government NextView License, which provides access to unclassified, commercially available imagery captured by Maxar Technologies, Planet Labs, and other commercial satellite imagery providers. The high level of spatial and temporal resolution in this imagery allowed analysts to closely assess changes in infrastructure and the natural environment, both of which often visibly reveal the impacts of war.

Healthcare sites in the five (5) cities and regions were identified using open source datasets and map products. Specific alleged incidents of bombardment were identified using photographic and videographic evidence from open sources. This methodology relied on identifying, re-verifying and

citing the work of other open source investigative groups whose fact-checking practices were clearly documented. The team utilized current best practice standards in open source geolocation consistent with training by the Human Rights Center at UC Berkeley School of Law, including the use of specific visual identifiers, building features, and other visually apparent data (and available metadata) across multiple media sources to confirm the precise coordinates of a site and its function as a medical facility.

The HRL reviewed satellite imagery to assess visible damage based on the timeline and location of incidents identified. Multiple geospatial analysts analyzed available satellite imagery for each facility across a range of pre- and post-incident dates. The analysts assessed the imagery and noted if the facility and/or its surroundings were visibly damaged and to what extent, while also commenting on any limitations related to image quality, availability, obscuration by trees or clouds, and angle of capture. Open source investigation provided additional verification of incidents using publicly available materials.

Building damage assessments conducted primarily using satellite imagery limit what is visible to analysts and may not always show damage, even extensive damage, to a structure's sides and interior. Off-nadir satellite imagery provides additional angles for assessment. This report provides a conservative estimate of damage at the sites located. Combining this data with ground-level assessments and additional sensors would more accurately capture the full scope and degree of damage, and should be expected to return higher figures and more detailed ratings overall.

The HRL investigated 277 health facilities. The full report includes:

- Legal context, background of events documented, full methodology, challenges and limitations;
- Case files with supporting documentation of geolocation, methodologies used, and imagery analysis annotation;
- Annex of sites identified and classification of visible building damage;
- Annotated imagery with satellite source, acquisition date, ground sampling distance, off-nadir angle, damage classification, key findings showing pre- and post-impact of apparent bombardment on structures; and
- Image files (unannotated) and complete associated metadata.

IMAGERY | Imagery provided under US Department of State NextView license to the Humanitarian Research Lab at Yale University School of Public Health.

All imagery © YYYY Maxar, NextView License

CITATION | Khoshnood, Kaveh, Nathaniel A. Raymond et al. "Evidence of Widespread and Systematic Bombardment of Ukrainian Healthcare Facilities: Summary." New Haven: Humanitarian Research Lab at Yale School of Public Health, 17 May 2022.