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**Pirated Manuscripts from Radiology's Most Impactful Journals:
National and International Characteristics of Copyright
Infringing Downloads**

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Nothing to Disclose



Subscription Scientific Literature

- Price of journal subscriptions has grown at a rate faster than inflation for the last several decades
- Between 2013 and 2017, journal subscription costs have increased by 25%
- Average annual research library journal subscription costs \$1,396
- Despite majority of underlying research being publicly or philanthropically funded, only a small percentage of the world's population can afford to access scientific literature without an institutional affiliation.



Sci-Hub

- World's largest scholarly literature pirate website
- Founded in 2011
- Stated mission of removing inequality in knowledge access by making literature available for every person, regardless of income, social status, or geographical location
- Hosts over 60 million scientific manuscripts, allowing readers to bypass publisher paywalls



Pirating in Radiology Literature

- Our goal was to investigate the prevalence and impact of copyright-infringing downloads through Sci-Hub on scientific literature in the fields of Radiology and Radiation Oncology.
- We selected Radiology and Radiation Oncology journals with a Thompson Reuters Impact Factor greater than 2 (49 total journals) between September 2016 and February 2016



Top Radiology Article Downloads

Journal	Article Name	Article Type	Year of Publication	Number of Downloads
European Radiology	Cranial bacterial infection	Review	2004	126
Radiographics	Mosaic Attenuation: Etiology, Methods of Differentiation, and Pitfalls.	Review	2015	119
NeuroImage	The brain functional connectome is robustly altered by lack of sleep	Clinical Research	2016	118
Radiographics	American Thoracic Society-European Respiratory Society Classification of the Idiopathic Interstitial Pneumonias.	Review	2015	117
Radiographics	Bacterial, Fungal, and Parasitic Infections of the Central Nervous System.	Review	2015	95
Radiographics	Internal Hernias in the Era of Multidetector CT: Correlation of Imaging and Surgical Findings.	Review	2016	84
Radiographics	Proximal Femoral Fractures: What the Orthopedic Surgeon Wants to Know	Review	2015	70
Radiographics	Imaging of Atlanto-Occipital and Atlantoaxial Traumatic Injuries: What the Radiologist Needs to Know	Review	2015	67
Radiographics	CT of Gastric Emergencies	Review	2015	64
Radiographics	CT Evaluation of Acute Enteritis and Colitis: Is It Infectious, Inflammatory, or Ischemic?: Resident and Fellow Education Feature	Review	2015	58
Radiographics	Benign Conditions That Mimic Prostate Carcinoma: MR Imaging Features with Histopathologic Correlation	Review	2016	58
Radiographics	Bronchiectasis: Mechanisms and Imaging Clues of Associated Common and Uncommon Diseases.	Review	2015	57
Radiographics	A Practical Guide to MR Imaging Safety: What Radiologists Need to Know.	Review	2015	54
Radiographics	Imaging Pregnant and Lactating Patients.	Review	2015	53
Radiographics	IgG4-related Disease from Head to Toe.	Review	2015	53
American Journal of Roentgenology	Acute Pancreatitis: Revised Atlanta Classification and the Role of Cross-Sectional Imaging	Review	2015	50
Radiographics	CT of Normal Developmental and Variant Anatomy of the Pediatric Skull: Distinguishing Trauma from Normality.	Review	2015	49
Radiographics	Molecular Imaging of Prostate Cancer.	Review	2016	49
Radiographics	Safe Use of Contrast Media: What the Radiologist Needs to Know	Review	2015	48
American Journal of Neuroradiology	Differentiation between Cystic Pituitary Adenomas and Rathke Cleft Cysts: A Diagnostic Model Using MRI.	Clinical Research	2015	48
Radiographics	Primary Pulmonary Lymphoid Lesions: Radiologic and Pathologic Findings	Review	2016	46
NeuroImage	Complex network measures of brain connectivity: uses and interpretations	Review	2010	44
Radiographics	Cardiac Physiology for Radiologists: Review of Relevant Physiology for Interpretation of Cardiac MR Imaging and CT.	Review	2015	44
Radiology	Assessment of radiologic tests: control of bias and other design considerations.	Review	1988	43
Radiotherapy & Oncology	ESTRO-ACROP guideline "target delineation of glioblastomas".	Guidelines	2016	42
Radiographics	Normal Anatomy and Compression Areas of Nerves of the Foot and Ankle: US and MR Imaging with Anatomic Correlation.	Review	2015	41
IEEE Transaction on Medical Imaging	A new supervised method for blood vessel segmentation in retinal images.	Review	2011	41
International Journal of Radiation Oncology, Biology, Physics	Contouring Guidelines for the Axillary Lymph Nodes for the Delivery of Radiation Therapy in Breast Cancer.	Clinical Research	2015	40
American Journal of Roentgenology	Skull Vault Lesions: A Review.	Review	2015	40

Thirty most frequently downloaded pirated high impact radiology journal articles between September 1, 2015 and February 28, 2016.

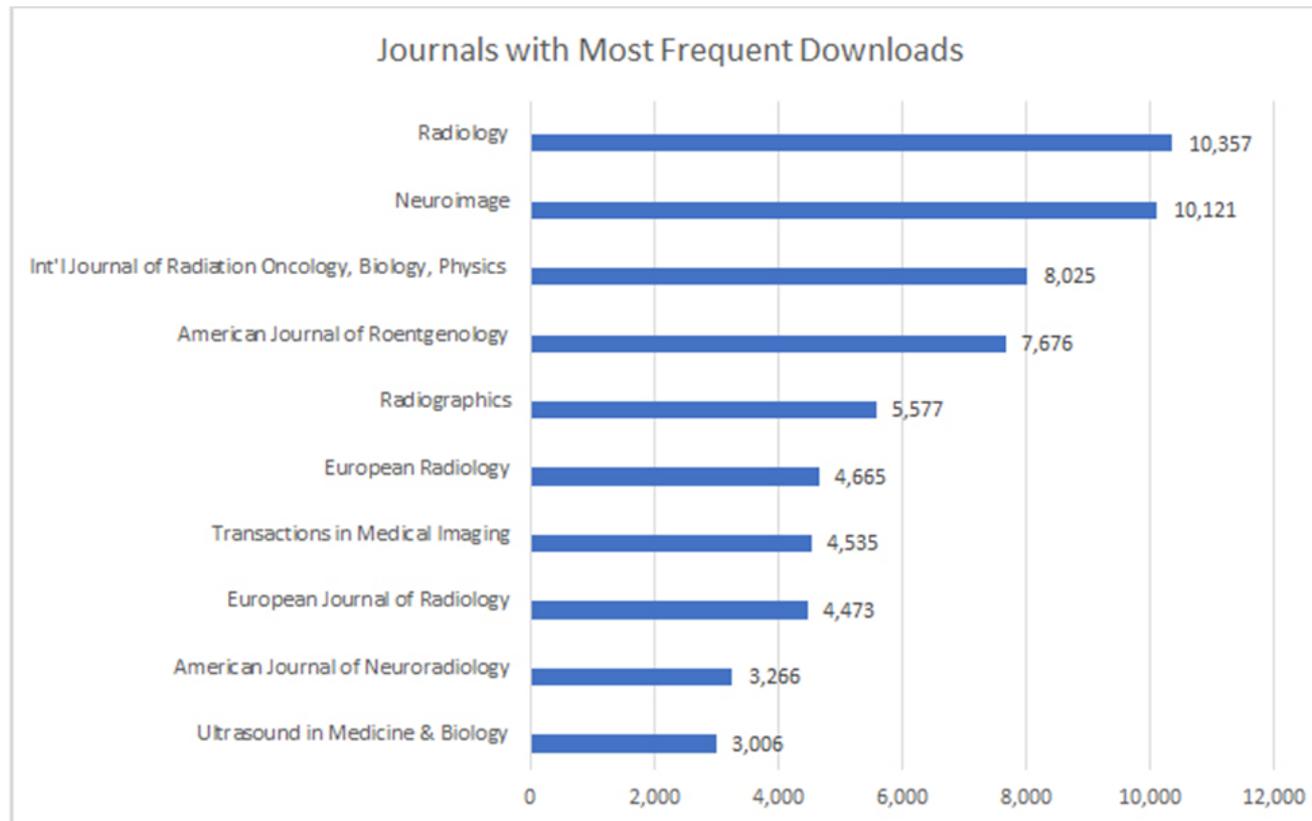


Download Characteristics

- Of 27,819,965 total pirated articles on Sci-Hub, 105,075 (0.4%) were from those 49 Radiology and Radiation Oncology journals
- Monthly radiology download requests ranged from 6,715 to 24,449
- Top 4 Most frequently downloaded journals: *Radiology*, *Neuroimage*, *International Journal of Radiation Oncology Biology*, and *American Journal of Roentgenology*
- Of the Top 30 most frequently downloaded articles, the majority (60%) were review articles published in *Radiographics*



Most Frequent Journal Downloads



Ten high-impact radiology journals with the most frequent pirated paper downloads between September 1, 2015 and February 28, 2016.

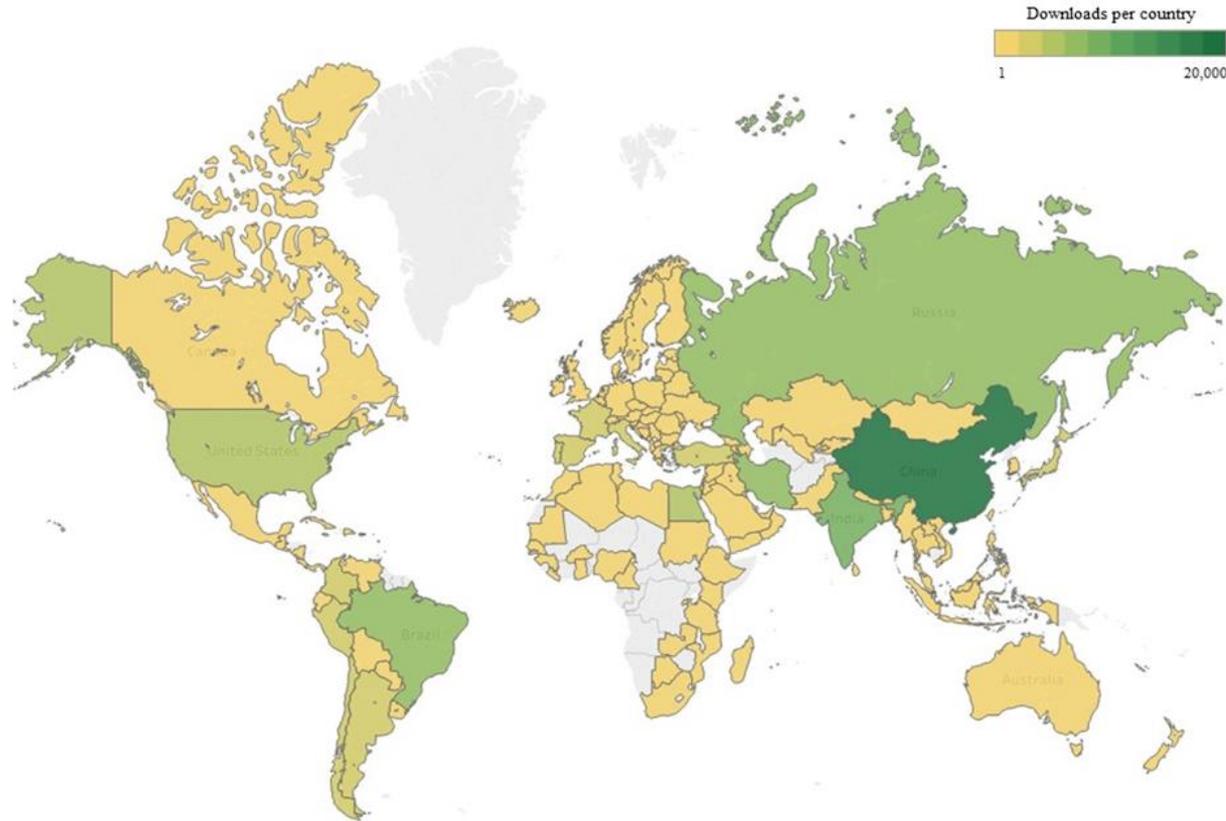


Geographic Characteristics

- Most frequent total downloads by country: China (17.1%), India (7.6%), and Iran (6.0%)
- Adjusted for country population, most frequent downloads per capita: Portugal, Chile, and Tunisia
- United States only accounted for 4% of total global downloads
- States with the most total downloads as a percentage of total US downloads: California (35.2%), New York (10.8%), and Virginia (8.5%)



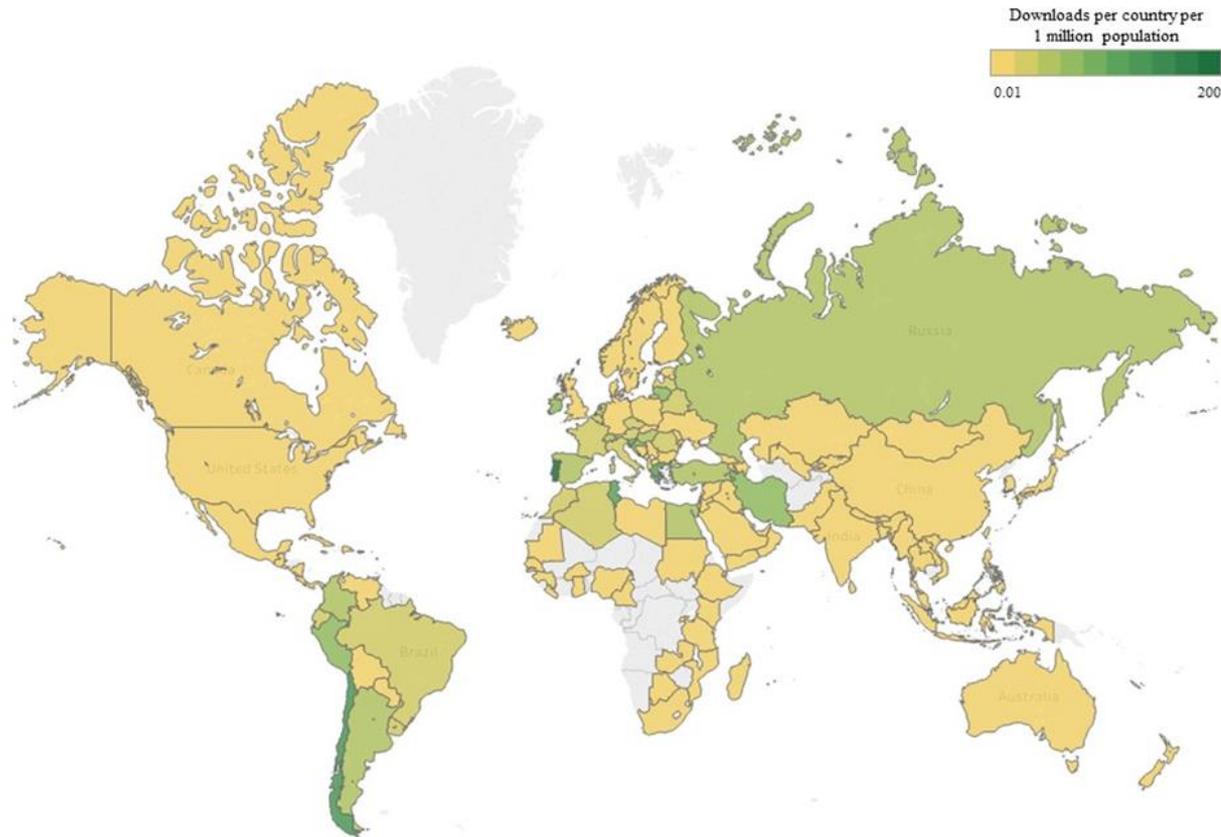
Total Global Downloads



World map of pirated article downloads from high-impact radiology journals by country based on number of downloads



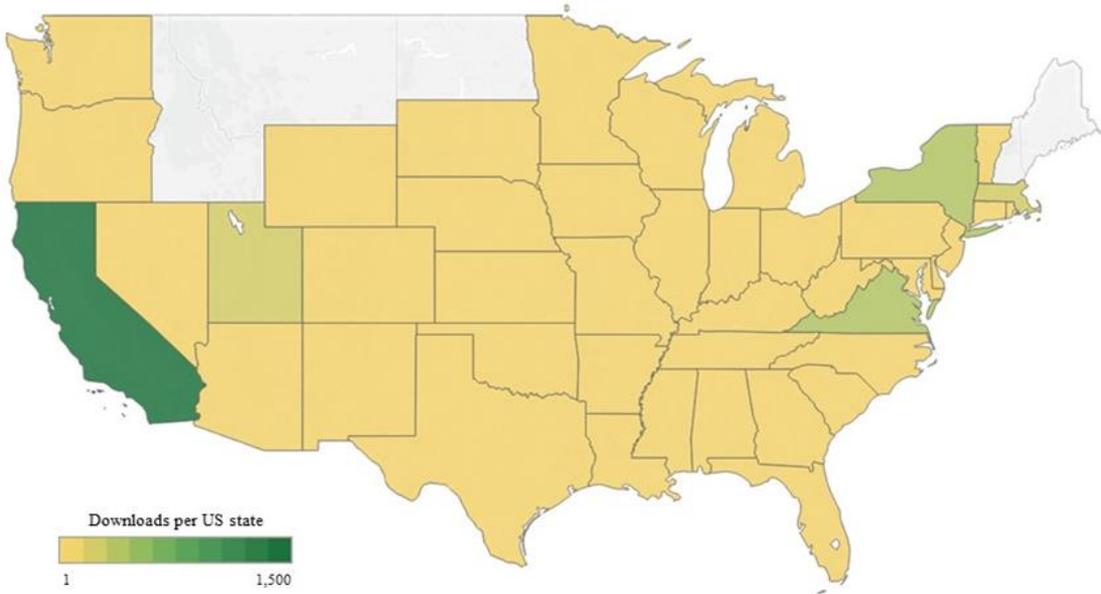
Per Capita Downloads



World map of pirated article downloads from high-impact radiology journals by country based on number of downloads per 1 million residents.



United States total downloads



US map of pirated article downloads from high-impact radiology journals by state based on number of downloads



Summary

- Copyright-infringing downloading of pirated journal articles is frequent and popular both within and outside the United States.
- Downloading affects nearly all top impact factor Radiology and Radiation oncology journals as well as their respective publishers.
- Without resources for access, independent clinicians, researchers, educators, and patients will continue to seek alternatives to expensive subscription journal models.
- The emergence of Sci-Hub and its popularity demonstrate a real need to reexamine publisher pricing and business models to ensure the long term sustainability of peer reviewed radiology research.

