**Table S1:** summary characteristics of the included articles

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Study title** | **Study design** | **Relevance to planetary health** | **Health focus** | **Tech** | **Key Findings** |
| Strengthening public health surveillance through blockchain technology  Bhattacharya et al., 2019  [[27]](https://paperpile.com/c/JAjThd/7Y68) | Conceptual framework | Public health surveillance can be supported through the use of BCT | Surveillance  Pandemics and outbreaks | BCT | Surveillance at community level: outbreaks (AMR, IDs, biosafety), early threats (national lav system, real-time surveillance, human resource development), rapidly and effectively repond (emergency response systems, development of rapid response team, intersectoral coordination) |
| Disruptive Technologies for Environment and Health Research: An Overview of Artificial Intelligence, Blockchain, and Internet of Things  Bublitz et al., 2019  [[35]](https://paperpile.com/c/JAjThd/k0K0) | Literature review | A review on the use of innovative technologies, and their potential to support development of monitoring and surveillance activities associated with environmental impacts on health and within the health system. | Surveillance  Environmental impacts | IOT  BCT | IOT can support with data monitoring: ambient assisted living for older people, remote patient monitoring, environment monitoring for extreme weather events, etc.  BCT can support with overcoming data fragmentation and interoperability issues, thus putting data (ownership and power) into the hands of patients. |
| Blockchain during COVID-19: The Technology to Help Society  Capece & Passiatore, 2021  [[44]](https://paperpile.com/c/JAjThd/0sKq) | Literature review | Health system responses to pandemic can have lots of cross-applicability to planetary health | Financing & Governance  Medicines and devices  Covid-19 | BCT | BCT used to support COVID-19 pandemic management - supporting data sharing between:  - Healthcare infrastructures  - Donations of money  - Donations of technical and sanitary materials |
| Blockchain in Health Care Innovation: Literature Review and Case Study From a Business Ecosystem Perspective  Chang & Chen, 2020  [[45]](https://paperpile.com/c/JAjThd/unfJ) | Conceptual framework | A review of BCT in healthcare innovation; with some scalability and applicability for common-goods and population level health. | | BCT | Blockchain-enabled health care information exchange may unleash the power of blockchain to reduce frictions among siloed databases as well the costs from intermediaries.  In a health care ecosystem, records of goods, such as drugs, and service flows could be recorded on-chain to provide better logistics visibility and timeliness. |
| Blockchain technology in migrant and refugee health: A scoping review  Corte-Real et al., 2022  [[41]](https://paperpile.com/c/JAjThd/GXfp) | Scoping review | The increase of forcibly displaced people worldwide is a challenge for health systems and their ability to provide access and equity in Health as a universal right | | BCT | Migrants and refugees may pass through a number of geographical and health system environments; BCT can support health data consolidation, transparency, and global surveillance efficiency issues, alongside creating and supporting a consistent identity. |
| The potential application of blockchain technology in HIV research, clinical practice, and community settings  Garett & Young, 2021  [[30]](https://paperpile.com/c/JAjThd/BWKX) | Conceptual framework | HIV research, clinical practice and community settings supported through BCT | Pandemics | BCT | Decentralized system allows for greater control of data, heightened privacy and confidentiality, and convenience for patients, research participants, and those who are at high risk for infection. This is especially useful for stigmatised diseases, such as HIV. Similarly, researchers, health providers, and public health stakeholders can take advantage of the transparency and immutability blockchain affords |
| Blockchain and population health  Gaynor et al., 2022  [[31]](https://paperpile.com/c/JAjThd/EtmY) | Conceptual framework | Explores how BCT could improve population health as we move past COVID-19 and into the future of healthcare | Population health | BCT | BCT has potential application for data, medicines, surveillance (disease outbreaks; medicines); and population health interventions |
| Potential Uses of Blockchain Technology for Outcomes Research on Opioids  Gonzales et al., 2021  [[32]](https://paperpile.com/c/JAjThd/cuIu) | Conceptual framework and expert panel | The applications of blockchain technology and illustrates potential ways in which it could be applied to strengthen the validity of outcomes research on the opioid epidemic | Population health  Addiction  Equity | BCT | Five primary applications of blockchain to opioids: clinical trials and pharmaceutical research, incentivizing data donation and behavior change, secure exchange and management of e-prescriptions, supply chain management, and secondary use of clinical data for research and public health surveillance |
| The Emerging Role of Blockchain Technology Applications in Routine Disease Surveillance Systems to Strengthen Global Health Security  Chattu et al., 2019  [[34]](https://paperpile.com/c/JAjThd/FVcG) | Conceptual framework | Use of BCT in disease surveillance | Outbreaks  Disease surveilance  NCDs | BCT | BCT could enhance global health security and allow rapid detection and response to disease threats, supporting the achievement of the Global Health Securty Agenda (GHSA). |
| Cryptodamages: Monetary value estimates of the air pollution and human health impacts of cryptocurrency mining  Goodkind et al., 2020  [[33]](https://paperpile.com/c/JAjThd/87pu) | Primary research | Explored the negative consequences of cryptocurrency mining on health and environment | Environmental health | BCT | Results illustrate a case (for Bitcoin) where the health and climate change “cryptodamages” roughly match each $1 of coin value created. Negative externalities are not currently priced into mining costs. |
| Financing Orphan Drugs Through a Blockchain-Supported Insurance Model  Ho et al., 2022  [[36]](https://paperpile.com/c/JAjThd/FAtr) | Conceptual framework | Reducing the prices of orphan drugs and prices by proposing an alternative insurance mechanism | Financing & Governance  Medicines and devices  Data  Health Equity | BCT  Smart contracts | Massive group insurance can support citizens to buy drugs at cost-price. Specifically, this supports the pricing of 'orphan drugs' which are usually financially out of reach of most patients. BCT supports ease of use, low costs of administration, data security, and access to authenticated and secure data. |
| Comprehensive Survey of IoT, Machine Learning, and Blockchain for Health Care Applications: A Topical Assessment for Pandemic Preparedness, Challenges, and Solutions  Imran et al., 2021  [[40]](https://paperpile.com/c/JAjThd/SBvP) | Literature Review | Pandemic preparedness through leveraging disruptive technologies | All WHO building blocks  Panedmics  Chronic disease management | BCT  IoT  Machine Learning  Smart contract | BCT can support pandemic preparedness and healthcare application to improve access, equity and healthcare delivery to population, including through: pattern recognition; real time data; maintaining supply chain; oracles and inputs (e.g. maintaining cold chain during medicines transportation) |
| Blockchain in healthcare, research, and scientific publishing  Johnson & Manion, 2019  [[28]](https://paperpile.com/c/JAjThd/TQV0) | Narrative Review - descriptive analysis | Use of BCT in healthcare and global health research. | Financing  Medicines and devices  Service delivery  Research | BCT | Value of BCT for data storage and management in healthcare.  Use of BCT in scientific publishing and research |
| Blockchain Technologies: Opportunities for Solving Real-World Problems in Healthcare and Biomedical Sciences  Justinia, 2019  [[43]](https://paperpile.com/c/JAjThd/E6Ay) | Narrative Review - descriptive analysis | Explored the application of BCT in healthcare through 20 real world use-case scenarios. | ALL | BCT  IoT | Various use-cases beyond individual health: health governance, manufacturing, and supply chain, among others. A blockchain for healthcare would need to include technological solutions for three key elements: scalability, access security and data privacy |
| Applying Blockchain Technology to Address the Crisis of Trust During the COVID-19 Pandemic  Khurshid, 2020  [[29]](https://paperpile.com/c/JAjThd/ZeIS) | Narrative Review - descriptive analysis | BCT solutions for data-related trust problems in the context of covid-19 pandemic and its impact on health systems | Governance  Data | BCT | The COVID-19 crisis was an information crisis that impacted global populations, made worse by centralised institutions who, as intermediaries of trust, are slow to react and respond to changes in the environment.  BCT can help overcome such obstacles through "trustless" systems. |
| Blockchain Applications to combat the global trade of falsified drugs  Kostyuchenko & Jiang, 2020  [[37]](https://paperpile.com/c/JAjThd/4gE4) | Literature Review | How to combat the trading of falsified drugs and substandard pharmaceutical products through BCT | Medicines and devices  Health workforce | BCT | Falsified and substandard drugs impact population health and play a vital role in aspects such as public trust in healthcare. BCT can reduce substandard or falsified drugs through supply chain monitoring. BCT can be intergated with IoT to ensure the credibility of data input of blockchain application. |
| Application Of Disruptive Technologies On Environmental Health: An Overview Of Artificial Intelligence, Blockchain And Internet Of Things  Kumar et al., 2021  [[38]](https://paperpile.com/c/JAjThd/AD3F) | Narrative Review - descriptive analysis | Application of BCT and other technologies in Environmental Health | Governance  Financing  Data | Web3, IoT, Artificial Intelligence | Disruptive technologies can support managing environmental health impacts health at a population level, through: surveillance (e.g. of weather conditions, air quality); interoperability and data exchange; decentralisation/peer-to-peer exhange; forecasting |
| Design of a Vaccine Passport Validation System Using Blockchain-based Architecture: Development Study  Lee et al., 2022  [[42]](https://paperpile.com/c/JAjThd/o6Sy) | Development Study | A global vaccination record could provide transparency, bring attention to vaccine inequity, and serve as a crucial data insight for new, or re-emerging, infectious diseases requiring vaccination. | Medicines and Devices: vaccines | BCT  Smart contracts | Blockhchain technology, when adopted, can accurately achieve global vaccine passport verification |
| Advancing Health Equity for People Experiencing Homelessness Using Blockchain Technology for Identity Management: A Research Agenda  Mercer & Khurshid, 2021  [[23]](https://paperpile.com/c/JAjThd/2Scg) | Conceptual framework | Homeless people are particularly vulnerable to new/resurgening diseases that result from climate change, air pollution, and extreme weather. | Service delivery  Health equity  Homelessness | BCT | Lack of proof of identity is a major barrier for recieving health care and social services for PEH and exacerbated health inequities.  Blockchain tech for identity management was generally acceptable, but needs more vetting at scale |
| Incentivizing Change Within Social Determinants of Health Using Blockchain Technology  McFarlane et al., 2020  [[24]](https://paperpile.com/c/JAjThd/9LMe) | Conceptual framework | Much of the network of factors within the SDoH remain untracked by data systems and we fail to capture the social conditions that aggrevate and prevent disease with siloed data. BCT could be a crucial bridge for this. | SDOH  Health equity | BCT  Smart contracts | Tracking of SDOH between individuals and their environment. BCT can support data linking and care co-ordination around issues such as housing/food/financial stability/social support |
| IoMT amid COVID-19 pandemic: Application, architecture, technology, and security  Mohd Aman et al., 2021  [[39]](https://paperpile.com/c/JAjThd/aww8) | Lierature review | How IoMT systems are being utilized within the context of COVID-19 | Pandemic and outbreaks  Accessible healthcare  Covid-19 | IoMT  BCT | The scalability of IoT supports the monitoring of a large number of patients from their homes or hospitals without exposing HCW to infection. |
| From blockchain technology to global health equity: can cryptocurrencies finance universal health coverage?  Till et al., 2017  [[25]](https://paperpile.com/c/JAjThd/1IXc) | Conceptual framework | Mulitilateral financing mechanims for UHC and global health equity, crucial for planetary health.  Universal access to financing mechanisms | Financing & Governance - UHC | BCT  Smart contracts | By removing financial institutions as third-party intermediaries, BCT can promote global equity by allowing those previously without access to trusted financial institutions due to instabilty or corruption to bypass the costs of accessing financial institutions. |
| Blockchain, health disparities and global health  Vervoort et al., 2021  [[26]](https://paperpile.com/c/JAjThd/wEeV) | Literature review | Focus of BCT within global health in terms of cyptrocurrencies and health financing, supply chain management, health records, identification and telehealth. | All WHO health building blocks  Global health equity  SDOH | BCT/ cryptocurrencies  Smart contracts | Cryptocurrencies could help bypass financial loss due to admin costs in aid sector. BCT oppurtunities for improving healthcare services and access to care during future pandemics. |

Abbreviations: BCT: blockchain technology; IoT: Internet of Things; IoMT: Internet of Medical Things; SDOH: Social Determinants of Health; WHO: World Health Organisation

**Table S2:** Full search strategy for the database search

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| --- | --- |
| Database | Terms |
| **Ovid MEDLINE(R)**  **171 results** | 1 Blockchain/ 385  2 (blockchain\* or block chain\* or web3 or "web3.0" or web 3 or "web 3.0" or distributed ledger or cryptocurrenc\* or crypto currenc\*).ti,ab,kf,kw. 1395  3 1 or 2 1408  4 Global Health/ 53839  5 One Health/ 742  6 Environmental Health/ 14681  7 Healthcare Financing/ 1182  8 Population Health/ 1594  9 Health Equity/ 2836  10 "Social Determinants of Health"/ 5620  11 exp Climate Change/ 26337  12 Ecology/ 28603  13 11 or 12 54355  14 Health/ 25007  15 13 and 14 222  16 4 or 5 or 6 or 7 or 8 or 9 or 10 or 15 78961  17 (health or healthcare or ehealth or wellbeing or well being).ti,ab,kf,kw. 2543692  18 (planet or planetary or global or one health or one medicine or environment or environmental or financ\* or governance or population or equity or equality or common goods or community or social determinant\* or climate change or ecology or interconnectivity or indigenous).ti,ab,kf,kw. 3600634  19 17 and 18 900057  20 16 or 19 947128  21 3 and 20 171  22 limit 21 to yr="2008 -Current" **171** |
| **Global Health**  **Results 18** | 1 (blockchain\* or block chain\* or web3 or "web3.0" or web 3 or "web 3.0" or distributed ledger or cryptocurrenc\* or crypto currenc\*).ti,ab,id. 145  2 health/ 149632  3 e-health/ 13  4 health care/ 135899  5 2 or 3 or 4 270351  6 environment/ 14194  7 finance/ 3578  8 governance/ 1224  9 populations/ 3249  10 communities/ 19622  11 exp climate change/ 11722  12 ecology/ 17197  13 6 or 7 or 8 or 9 or 10 or 11 or 12 67939  14 5 and 13 13266  15 environmental health/ 18666  16 14 or 15 31169  17 (health or healthcare or ehealth or wellbeing or well being).ti,ab,id. 835597  18 (planet or planetary or global or one health or one medicine or environment or environmental or financ\* or governance or population or equity or equality or common goods or community or social determinant\* or climate change or ecology or interconnectivity or indigenous).ti,ab,id. 927290  19 17 and 18 358266  20 16 or 19 369258  21 1 and 20 18  22 limit 21 to yr="2008 -Current" **18** |
| **GEOBASE**  **Results: 16** | 1 (blockchain\* or block chain\* or web3 or "web3.0" or web 3 or "web 3.0" or distributed ledger or cryptocurrenc\* or crypto currenc\*).ti,ab,kw. 691  2 general health/ 50  3 health care/ 19249  4 2 or 3 19292  5 environment/ 862  6 environmental change/ 15169  7 finance/ or financial system/ 10007  8 governance/ 27796  9 equity/ 5284  10 exp climate change/ 125771  11 ecology/ 2704  12 indigenous population/ 8748  13 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 189778  14 4 and 13 1209  15 (health or healthcare or ehealth or wellbeing or well being).ti,ab,kw. 205434  16 (planet or planetary or global or one health or one medicine or environment or environmental or financ\* or governance or population or equity or equality or common goods or community or social determinant\* or climate change or ecology or interconnectivity or indigenous).ti,ab,kw. 1419305  17 15 and 16 114463  18 14 or 17 114627  19 1 and 18 **16** |
| **Web of Science**  **Results 850** | TS=(blockchain\* or "block chain\*" or web3 or web3.0 or "web 3" or "web 3.0" or "distributed ledger" or cryptocurrenc\* or “crypto currenc\*”) and TS=(health or healthcare or ehealth or wellbeing or "well being") and TS=(planet or planetary or global or "one health" or “one medicine” or environment or environmental or financ\* or governance or population or equity or equality or "common goods" or community or "social determinant\*" or "climate change" or ecology or interconnectivity or indigenous) and PY=(2008 or 2009 or 2010 or 2011 or 2012 or 2013 or 2014 or 2015 or 2016 or 2017 or 2018 or 2019 or 2020 or 2021 or 2022 or 2023) |
| **Scopus**  Results 1450 | ( TITLE-ABS-KEY ( blockchain\* OR "block chain\*" OR web3 OR web3.0 OR "web 3" OR "web 3.0" OR "distributed ledger" OR cryptocurrenc\* OR "crypto currenc\*" ) AND TITLE-ABS-KEY ( health OR healthcare OR ehealth OR wellbeing OR "well being" ) AND TITLE-ABS-KEY ( planet OR planetary OR global OR "one health" OR "one medicine" OR environment OR environmental OR financ\* OR governance OR population OR equity OR equality OR "common goods" OR community OR "social determinant\*" OR "climate change" OR ecology OR interconnectivity OR indigenous ) ) AND PUBYEAR > 2007 |
| **ACM Guide to Computing Literature**  **Results 189** | [[[Title: blockchain\*] OR [Title: "block chain"] OR [Title: "block chains"] OR [Title: web3] OR [Title: web3.0] OR [Title: "web 3"] OR [Title: "web 3.0"] OR [Title: "distributed ledger"] OR [Title: cryptocurrenc\*] OR [Title: "crypto currency"] OR [Title: "cryptocurrencies"]] AND [[Title: health] OR [Title: healthcare] OR [Title: ehealth] OR [Title: wellbeing] OR [Title: "well being"]]AND [[Title: planet] OR [Title: planetary] OR [Title: global] OR [Title: "one health"] OR [Title: "one medicine"] OR [Title: environment] OR [Title: environmental] OR [Title: financ\*] OR [Title: governance] OR [Title: population]OR [Title: equity] OR [Title: equality] OR [Title: "common goods"] OR [Title: community] OR [Title: "social determinant"] OR [Title: "social determinants"]OR [Title: "climate change"] OR [Title: ecology] OR [Title: interconnectivity] OR [Title: indigenous]]] OR [[[Abstract: blockchain\*] OR [Abstract: "block chain"]OR [Abstract: "block chains"] OR [Abstract: web3] OR [Abstract: web3.0] OR [Abstract: "web 3"] OR [Abstract: "web 3.0"] OR [Abstract: "distributed ledger"]OR [Abstract: cryptocurrenc\*] OR [Abstract: "crypto currency"] OR [Abstract: "cryptocurrencies"]] AND [[Abstract: health] OR [Abstract: healthcare] OR [Abstract: ehealth] OR [Abstract: wellbeing] OR [Abstract: "well being"]] AND [[Abstract: planet] OR [Abstract: planetary] OR [Abstract: global] OR [Abstract: "one health"] OR [Abstract: "one medicine"] OR [Abstract: environment] OR [Abstract: environmental] OR [Abstract: financ\*] OR [Abstract: governance] OR [Abstract: population] OR [Abstract: equity] OR [Abstract: equality] OR [Abstract: "common goods"] OR [Abstract: community] OR [Abstract: "social determinant"] OR [Abstract: "social determinants"] OR [Abstract: "climate change"] OR [Abstract: ecology] OR [Abstract: interconnectivity] OR [Abstract: indigenous]]] OR [[[Keywords: blockchain\*] OR [Keywords: "block chain"] OR [Keywords: "block chains"] OR [Keywords: web3] OR [Keywords: web3.0] OR [Keywords: "web 3"] OR [Keywords: "web 3.0"] OR [Keywords: "distributed ledger"] OR [Keywords: cryptocurrenc\*] OR [Keywords: "crypto currency"] OR [Keywords: "cryptocurrencies"]] AND [[Keywords: health] OR [Keywords: healthcare] OR [Keywords: ehealth] OR [Keywords: wellbeing] OR [Keywords: "well being"]] AND [[Keywords: planet] OR [Keywords: planetary] OR [Keywords: global] OR [Keywords: "one health"] OR [Keywords: "one medicine"]OR [Keywords: environment] OR [Keywords: environmental] OR [Keywords: financ\*] OR [Keywords: governance] OR [Keywords: population] OR [Keywords: equity] OR [Keywords: equality] OR [Keywords: "common goods"] OR [Keywords: community] OR [Keywords: "social determinant"] OR [Keywords: "social determinants"] OR [Keywords: "climate change"] OR [Keywords: ecology] OR [Keywords: interconnectivity] OR [Keywords: indigenous]]] AND [Publication Date: (01/01/2008 TO 31/12/2022)] |
| **IEEE Xplore**  Results 551 | ("All Metadata":blockchain\* OR "All Metadata":"block chain\*" OR "All Metadata":web3 OR "All Metadata":web3.0 OR "All Metadata":"web 3" OR "All Metadata":"web 3.0" OR "All Metadata":"distributed ledger" OR "All Metadata":cryptocurrenc\* OR "All Metadata":“crypto currenc\*”) AND ("All Metadata":health OR "All Metadata":healthcare OR "All Metadata":ehealth OR "All Metadata":wellbeing OR "All Metadata":"well being") AND ("All Metadata":planet OR "All Metadata":planetary OR "All Metadata":global OR "All Metadata":"one health" OR "All Metadata":“one medicine” OR "All Metadata":environment OR "All Metadata":environmental OR "All Metadata":financ\* OR "All Metadata":governance OR "All Metadata":population OR "All Metadata":equity OR "All Metadata":equality OR "All Metadata":"common goods" OR "All Metadata":community OR "All Metadata":"social determinant\*" OR "All Metadata":"climate change" OR "All Metadata":ecology OR "All Metadata":interconnectivity OR "All Metadata":indigenous)  Filters Applied: |