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Emerging Health Information Technologies

A list of health information technologies created following a review of the academic, commercial and grey literature for a workshop focused on identifying the patient safety challenges associated with emerging digital health technologies.

	Technology	Explanation	Examples	Key references
1	Wearables	Sensors that are worn on the body in clothing or directly attached or imbedded.	Fitbit for heart rate monitoring (Benedetto et al., 2018); Actiwatch for sleep tracking (Danzig et al., 2020); Eating, activity and sleep (Crimarco et al., 2018)	Accuracy and metrological characteristics (Cosoli & Scalise, 2019)
2	Immersive technology, a.k.a. Virtual, Augmented and Mixed Reality	"*technologies that interact with, or leverage, the neuroscience of the human brain*" via computer-generated visualisations (Bremner et al., 2020)	Decision making (Kobayashi et al., 2018; Li et al., 2020); Neurology (K. H. Kim, 2016); Urology (Hamacher et al., 2016); Mental health (Freeman et al., 2017)	Reviews as applied healthcare (Bremner et al., 2020; John & Wickramasinghe, 2020);
3	Internet of Things an Industry Internet of Things	"*a network of devices all embedded with electronics, software, sensors, and connectivity to enable them to connect, interconnect, and exchange data*" (Wickramasinghe & Bodendorf, 2020)	Smart Continuous Glucose Monitors (Facchinetti, 2016); Parkinson's disease monitoring via Apply Watch (Bot et al., 2016)	Managing the risks of IoT (Paxton & Branca, 2020)
4	A.I.-assisted clinical decision support	Any software that informs a clinical decision or prompts clinical action.	Sepsis (Komorowski et al., 2018 with critique by Habli et al., 2020)	Opinion on AI for CDS (Shortliffe & Sepúlveda, 2018); Methodological appraisal of A.I. approaches for suitability to CDS (Abbasi & Kashiyarndi, 2006; Aljaaf et al., 2015)

5	Drones	"*devices which are capable of sustained flight, which do not have a human on board, and are under sufficient control to perform useful functions*" (Scott & Scott, 2020)	Chronic disease in rural areas (S. J. Kim et al., 2017)	Review of drone-delivery models for healthcare (Scott & Scott, 2020); Review of drones in healthcare (Wulfovich et al., 2018); Challenges and opportunities of drones in healthcare (Amukele, 2019)
6	Mobile health app's and Patient Portals	Clinicians' mobile access to electronic healthcare records, and patient access to their own electronic healthcare record.	Pharmacist-facing, medication-review app (Lu et al., 2017); Patient portal (McAlearney et al., 2016)	Gaps in mobile patient portal service to enable patient-centred care (Noteboom & Abdel-Rahman, 2020)
7	Swallowables	Technology that can be ingested	Local drug delivery (Goffredo et al., 2016), Imaging (Intzes & Meng, 2016), Diagnostics (Schmidt et al., 2019); General healthcare applications (Olano, 2019)	(Kalantar-Zadeh & Ward, 2019)
8	Mail-order prescription	Self-ordering pharmaceuticals online or using an online intermediary for clinician-prescribed pharmaceuticals	Amazon's acquisition of PillsPacks; Capsule; NowRx	Centralised system (Kappenman et al., 2019); Adherence in mail-order and community pharmacies (Farley et al., 2019; Schwab et al., 2019)
9	Neural implants and interfaces	Embedded or surface devices sensitive to neural potentials that are used to inform or operate action	Neuralink; DARPA; Kernel; Facebook	An introduction (Fekete & Pongrácz, 2017); Challenges (Das et al., 2020; Koch et al., 2019)
10	Loneliness and social isolation	Any digital technology intended to reduce loneliness or social isolation	Geriatric (Poscia et al., 2018); General healthcare examples (Chen & Schulz, 2016)	Review of problems (Stojanovic et al., 2017); Planned review and meta-analysis of the effectiveness of digital interventions (Shah et al., 2019)
11	Blockchain	Open, decentralised, cryptographic ledgers	Prescribing (Seitz & Wickramasinghe, 2020); General healthcare	Challenges (McGhin et al., 2019)

			examples (Agbo et al., 2019; Hölbl et al., 2018)	
12	Biohacking	D.I.Y., citizen-science, biological investigations and interventions	General healthcare examples (Zettler et al., 2019)	An introduction (Yetisen, 2018)
13	Digital Twin	"*a digital representation of a physical item or assembly using integrated simulations and service data*" (Vrabič et al., 2018)	General healthcare example (Angulo et al., 2019)	The technology, its applications, and the challenges (Fuller et al., 2019)
14	Omics	High-dimensional and high-throughput analytics.	Deep-learning example (Chaudhary et al., 2018); Attempt to combine large datasets (Karczewski & Snyder, 2018)	Technical review of methods (Bersanelli et al., 2016); Challenges (Cambiaghi et al., 2017; Gomez-Cabrero et al., 2014); Problems (Lay et al., 2006)
15	Conversational A.I.	"*systems that mimic human conversation using text or spoken language*" (Laranjo et al., 2018)	Apple's Siri; Google Now; Microsoft Cortana; Amazon Alexa prize (Ram et al., 2018); Geriatrics (Fadhil, 2018b); Medication adherence (Fadhil, 2018a)	Perspectives on evaluation (Jadeja & Varia, 2017); A technical review (Gao et al., 2019); Review of applications in healthcare (Laranjo et al., 2018)
16	Commercial telemedicine	Remote provision of medical advice by commercial providers	Amazon.care; Apple's AC Wellness; Diabetes (Garg & Parkin, 2019); Teledoc (Uscher-Pines et al., 2016)	General resource (Darkins & Cary, 2000)

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