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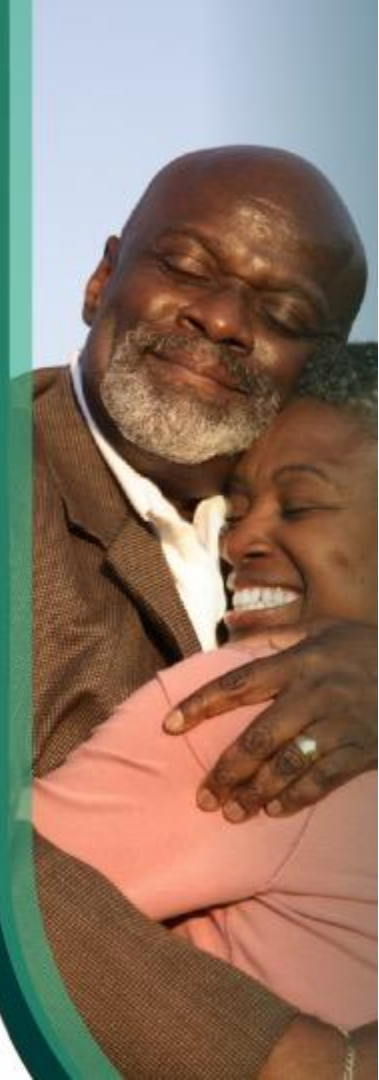
School for Public Health Environments Research at Exeter



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The roles of AI in public health

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Team and Funding

- The National Institute for Health and Care Research (NIHR) Public Health Research Programme (PHR) Reviews Team is a collaboration between Universities of Exeter, Cardiff and Birmingham (2024-2028)

- The NIHR-PHR requests that we conduct reviews in priority areas to help refine commissioned calls:
  - Identify evidence gaps where further research is required
  - Identify promising interventions that could be evaluated

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The roles of AI in public health

- **Past**: AI-assisted interventions for reducing engagement with alcohol drinking, smoking, and physical inactivity
- **Present**: how AI is currently being used in public health practice
- **Future**: the potential roles and risks of AI in public health

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Definitions

- **AI:** algorithms integrated into systems and tools, learn from data to perform automated tasks without explicit human programming, for example, machine learning, natural language processing, and generative AI

- **Public health**: "*to protect and improve the health of communities and populations at local, regional, national, and global level*" (FPH) – in our reviews, typically interpreted *primarily* aiming to improve population health without using NHS resources

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The role of AI in interventions to reduce engagement with drinking alcohol, smoking, and physical inactivity

Screening Stage	Alcohol	Smoking	Physical Inactivity
Title and abstract	4,775	7,165	19,175
Full-text	650	910	2,431
Included RCTs	4	12	17
Types of AI	3 chatbots 1 "rules-based AI"	8 chatbots 4 recommender systems	5 chatbots 4 recommender systems 4 reinforcement learning 1 machine learning 2 case-based reasoning 1 unclear AI
Risks of bias	4 High risk	10 High risk 2 Some concerns	11 High risk 5 Some concerns

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The role of AI in interventions to reduce engagement with drinking alcohol, smoking, and physical inactivity

- There was no strong evidence of a beneficial effect of AI-assistance, either:
  - when added to existing interventions
  - when comparing AI-assisted interventions with no intervention
- No evidence at all for large language models
- High risks of bias across studies

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The current roles of AI in public health

- Scoping review: 5,400 records and 155 full texts screened, 8 reports included
- **Health improvement**: Texas WIC (Maya) and WHO (S.A.R.A.H.) website chatbots, health monitoring system for socially isolated people (CareCall, a voice-based LLM)
- **Healthcare public health**: Health service demand forecasting
- **Health protection**: Evidence synthesis (evidence monitoring, prioritised screening, duplicate removal), COVID-19 symptom chatbot (Chloe), mpox symptom screening app

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The current roles of AI in public health

- While assessing the effectiveness of the AI tools was beyond the scope of this review, the evidence from included reports was mixed

- A memorable quote for the WHO website chatbot: “[the chatbot had] all the ingredients to serve not only as a useless tool in the quest to improve the information ecosystem and reduce the dangers infodemics pose to public health but also as a potential threat to erode trust in the WHO itself"

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The current roles of AI in public health

- All included reports were authored by larger (national and global) public health organisations
  - Smaller public health teams may not be conducting trials of AI, or may not be *publishing* their trials of AI
- We may have missed evidence for using AI in public health practice, though if the evidence is not easily found, it is difficult to use
- Overall, the very limited evidence from public health practice makes it difficult to know which uses of AI, if any, would be useful to adopt

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The future roles and risks of AI in public health

- Scoping review: 1,805 records and 320 full texts screened, 67 reports included
- 44 potential uses of AI across 8 public health contexts (numbers in brackets are the number of reports discussing a use in that context):

Communication (18) Education (3) Emergencies (10)	Evidence reviews (8) Forecasting (12) Interventions (19)	Public health organisations (12) Surveillance (2)

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The future roles and risks of AI in public health

Communication - how AI (particularly machine and deep learning, natural language processing, generative AI, and chatbots) could be used to improve public health communication (15, 24-40):

- creating targeted messaging for public health communication interventions, for example by considering demographics, culture, and literacy levels (15, 30, 31, 35, 37, 39)
- generating images to assist in public health communication (15)
- improving clarity of communication (15, 31, 39)
- improving engagement with public health communication (35), for instance by using chatbots and generative AI to give the public better access to, and engagement with, public health information online (15, 26, 27, 30, 31, 33)
- monitoring of public health indicators in real-time to help develop strategies to address emerging health concerns (35), for example using machine learning, deep learning, natural language processing, or generative AI to assess topical trends, or public concerns or sentiment, and adapting communication as necessary (25, 26, 29, 30, 32, 36, 38, 40) or debunking rumours or misinformation (28, 30, 34, 38)
- translating public health information (15, 24, 35, 39)

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The future roles and risks of AI in public health

- Bias and generalisability, which could lead to perpetuation or reinforcement of health inequalities and discrimination, a reduction in public trust for public health communications and interventions, and inaccurate or unreliable predictions, unintended consequences, or ineffective interventions (15, 26, 27, 30, 31, 33-35, 37-39, 41, 46, 52, 57, 65-68, 71, 73-76, 78, 83, 85, 86, 88)
- Concerns that AI lacked transparency, had concerns around data management, privacy, security, and confidentiality, or had ethical, legal, and regulatory concerns (15, 26, 27, 30, 31, 34, 35, 38, 41, 44, 45, 48, 56, 57, 65, 71-74, 76-78, 81, 83-86)
- Existing health inequalities could be exacerbated by a lack of workforce capacity, training, infrastructure, equipment, or resources (15, 24, 27, 48, 63, 72-74, 76, 77, 81, 85, 88)
- Inaccurate or incorrect content created by generative AI (27, 34, 55-57, 65)
- Barriers to AI technology adoption in the public, which could lead to digital exclusion of vulnerable populations (27, 72, 81)
- Concerns about the interpretability of AI outputs (63, 81, 83)

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The future roles and risks of AI in public health

- The risks of AI were typically universal (1):
  - bias and generalisability, leading to health inequalities, discrimination, reduction in public trust, inaccurate or unreliable predictions, unintended consequences, ineffective interventions
  - inaccurate or incorrect content created by generative AI
  - lack of workforce capacity, training, infrastructure, equipment, or resources
  - barriers to AI technology adoption in the public

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The future roles and risks of AI in public health

- The risks of AI were typically universal (2):
  - lack of transparency, concerns around data management, privacy, security, and confidentiality, or had ethical, legal, and regulatory concerns
  - interpretability of AI outputs
  - plagiarism when using generative AI
  - technical challenges, such as data accessibility and integration issues, system interoperability, and algorithmic complexity
  - deskilling and overconfidence of public health professionals

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The future roles and risks of AI in public health

- We did not consider how plausible or beneficial these roles may ultimately be
- Many included reports were vague when discussing the potential roles of AI
- The potential risks add weight to the view that understanding the potential risks of an intervention before adoption is necessary even for non-clinical interventions

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Overall summary: Implications for research

- More evaluations of the effectiveness of AI interventions across the range of public health domains to create an evidence base from which future decisions about AI tools can be made
- Assess the potential of inequity generating impacts and harms
- Develop or adapt AI-specific reporting guidelines for AI interventions and tools used within public health practice

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Overall summary: Implications for policy

- Meaningful community engagement and co-production with diverse and underrepresented people to help mitigate against inequity (and improve trust) when adopting AI tools

- Public health specific regulatory compliance for AI interventions should be developed, centring public health values

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Overall summary: Implications for practice

- Carefully consider the potential effectiveness and cost-effectiveness of adopting AI interventions alongside any risks
- AI has the potential to be used across all public health contexts, but in general, there is very little current evidence to support the use AI in any given role
- Strategic and careful thought and planning, including workforce training and support, would be useful to prevent chaotic diffusion of innovation, including the adoption of AI tools that are ineffective, embed inequity, or reduce trust in the organisation

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  - Local Government Association AI Network