

# RSE

*The Royal Society  
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Advice paper

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# Data strategy for health and social care



## Summary

The Royal Society of Edinburgh (RSE), Scotland's National Academy, in conjunction with the Young Academy of Scotland (YAS), welcomes the opportunity to respond to the Scottish Government's consultation on the Data Strategy for health and social care. We are well placed to offer supporting evidence to this consultation by drawing on our varied expertise across health and social care. A working group was formed to contribute to this consultation response, including experts in medical research, bioinformatics, clinical trials, artificial intelligence, big data, and medical statistics. The comments from the working group have informed the below response.

Methods that enable health and social care data to be created and appended without relying on individual consent should be explored in a way that maintains public trust in the ability of organisations to act as trustworthy stewards of personal data.

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More should be done to communicate the purposes for which data is being used through carefully considered communication strategies or Government statements. Every effort should be made to ensure individuals understand how their data is used and for what purpose.

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The perpetuation of an increasingly complex care landscape will likely further exacerbate existing regional inequalities, such as those in the ability of Scottish health and social care services to collect data to serve those with protected characteristics. This complexity is compounded by the irregular quality of data produced by these different bodies.

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There is a general skills gap within the digital economy, particularly within data management. There is already a growing need to re-skill people working within sectors.

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It would be helpful to have clear statements/guidance from the Government around what is and is not possible when using data, in order to boost confidence levels in the use of data among those who require it in their working practice.

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It would be worthwhile to consider how population health researchers can, with consent, obtain access to the wealth of health data that is collected by technology firms such as Apple, Fit Bit, and Google Fit. The data that is collected through these sources may have the potential to prevent ill health and provide new insights into diseases.

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## Summary (continued)

There is a need for ongoing, centralised, routine maintenance and enhancement of quality conducted on data sets. Currently, there is a tendency to leave data accumulating and only assess its quality as and when it is required. A cultural shift is required to move away from spending long periods of time cleaning data towards proactively monitoring datasets before they become out of control.

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RSE contends that both industry and innovators should widen the range of health and social care data that are used to improve outcomes. For example, using more qualitative data, such as patients' thoughts/feelings, in clinical trials.

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There is a relative scarcity of public funding for clinical research in the UK, such as clinical trials, in both commercial and public sector research. We suggest that the health and social care sector should work with commercial enterprises to enable organisations to target new medicines and develop effective interventions at a faster rate.

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RSE note the immense potential of artificial intelligence, when used appropriately and well, to improve the delivery of health and social care. However, more work needs to be undertaken to ensure the appropriate use of artificial intelligence technologies and techniques, including machine learning, for example, to train against biases and mitigate against misdiagnoses.

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## Introduction

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1. The Royal Society of Edinburgh (RSE), Scotland's National Academy, in conjunction with the Young Academy of Scotland (YAS), welcomes the opportunity to respond to the Scottish Government's consultation on the Data Strategy for health and social care. We are well placed to offer supporting evidence to this consultation by drawing on our varied expertise across health and social care. A working group was formed to contribute to this consultation response, including experts in medical research, bioinformatics, clinical trials, artificial intelligence, big data, and medical statistics. The comments from the working group have informed the below response.

2. Given the length and breadth of the consultation, our response does not attempt to address every consultation question in turn, but rather responds to a series of questions in accordance with the expertise of working group members.

## Part 1: Empowering people

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- *When considering the rights of individuals who are unable to interact with their own health and social care data, do you feel that delegating access to a guardian/carer/trusted individuals would be appropriate?*
- *In relation to the above question, what safeguards need to be in place?*

3. RSE contends that methods that enable health and social care data to be created and appended without relying on individual consent, through for example the delegation of access to data and the abstraction and anonymisation of data, should be explored. However, we note that maintaining public confidence in the ability of organisations to act as trustworthy stewards of personal data is of paramount importance and should be a key priority within the Scottish Government's Data Strategy.<sup>1</sup> Indeed, the creation of stakeholder groups, data cooperatives, and other intermediaries that are able to aggregate data in ways that make it useful, could be considered.

4. RSE suggests that every effort should be made to ensure individuals understand how their data is used and for what purpose. Delegated access could play a particularly important role in safeguarding the rights of children, people with disabilities, and people with dementia.

5. However, we are unsure as to whether a guardian, carer, or trusted individual will always be best placed to understand what is meant by the use of data in various contexts. More should be done to raise awareness about the complexity of delegated access and what it involves in order to enable as many people as possible to make informed decisions about their own data.

6. Similarly, greater clarity is required as to what decisions should be made about health and social care data via delegated access. In response, more should be done to communicate about the purposes for which data are being used, through carefully considered communication strategies or Government statements.

7. RSE recommends that any decisions about data usage should be guided by the law. If doctors are trusted to make decisions about people's health and wellbeing, they should axiomatically be trusted to make decisions about patient data. This should be incorporated within any new schema for the delegation of responsibility.

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<sup>1</sup> See for example: Van Staa, T.P., Goldacre, B., Buchan, I. and Smeeth, L. (2016) Big health data: the need to earn public trust, *Bmj*, 354. Available online: [https://www.research.manchester.ac.uk/portal/files/47207562/47207513.s1\\_in2273981795844769\\_1939656818Hwf185514874IdV\\_193236228422739817PDF\\_HI0001.pdf](https://www.research.manchester.ac.uk/portal/files/47207562/47207513.s1_in2273981795844769_1939656818Hwf185514874IdV_193236228422739817PDF_HI0001.pdf); see also Gille, F., Smith, S. and Mays, N. (2017) Towards a broader conceptualisation of 'public trust' in the health care system, *Social theory & health*, 15(1): 25-43.

- *To what extent do you believe it is important to collect data to enable our health and social care services to understand how they are serving those with protected characteristics?*

**8.** RSE believes that it is important to collect data to enable our health and social care services to understand how they are serving those with protected characteristics but suggests that it is important not to underestimate the challenges involved in doing so.

**9.** To avoid the perpetuation of disparities, it is critical that any imbalance in the quality and coverage of health and social care data across Scotland be addressed before any decisions involving data relating to individuals with protected characteristics are made.<sup>2</sup> This imbalance is often caused by the generation of care data from a range of different care providers and local authorities with varying reporting standards. These multiple sources of data result in a complex and varied landscape of responsibility for delivering care, whether through the NHS or local authorities.

**10.** The perpetuation of an increasingly complex care landscape will likely further exacerbate existing regional inequalities, such as those in the ability of Scottish health and social care services to collect data to serve those with protected characteristics. This complexity is compounded by the irregular quality of data produced by these different bodies. Indeed, data provided often ranges from lab records to demographic data to outcome data or even untransformed video files. Social care data are often sourced from a variety of bodies, including the social care system, councils, and pharmacies. These complexities threaten to give rise to new forms of inequality, in socio-economic status, access to resources, and further to exacerbate the digital divide.<sup>3</sup>

**11.** RSE notes that the answers to many high priority research questions are often derived from data pertaining to the most vulnerable individuals in society and involve the use of particularly sensitive data. The health burden associated with drug use is a case in point. In this instance, the majority of the data are sourced from the judiciary, which often supplies data in multiple formats with variable levels of assurance. However, if a level of assurance around collecting data from various sources can be guaranteed, and data can be accessed from a 'whole life perspective', there is huge potential to be unlocked.

## Part 2: Empowering those delivering health and social care services

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- *What are the top skills and training gaps relating to data in Scotland's health and social care sector? Examples given to choose from Understanding/use of management information by managers, Data visualisation, understanding of what data exists and where to find it, Knowledge of how to access data, Confidence in using data, Understanding of governance and any others skills.*
- *How do you believe skills and training gaps should be addressed?*
- *Is there a skills gap in terms of understanding governance?*

**12.** RSE understands that there is a general skills gap within the digital economy, particularly within data management. There is already a growing need to re-skill people working within sectors that are becoming more reliant on the use of data.<sup>4</sup> However, barriers to the use and collection of data have arisen from a lack of confidence in its use, largely caused by anxieties around the legality of using data linked to individuals and personal concerns about the data we share.

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<sup>2</sup> Indeed, Audit Scotland has drawn attention to the severe and continuing pressures on health services in Scotland and the concomitant need to enhance resourcing and improve data availability. Indeed, a key message from the report was that a lack of reliable data across areas, including health inequality, is hindering the NHS's recovery plan. Policymakers should implement the recommendations from this report to prioritise health inequalities during Covid-19 recovery planning. For more information see: Audit Scotland (2021) *NHS in Scotland 2021* [online] available at: [https://www.auditScotland.gov.uk/uploads/docs/report/2022/nr\\_220224\\_nhs\\_overview.pdf](https://www.auditScotland.gov.uk/uploads/docs/report/2022/nr_220224_nhs_overview.pdf).

<sup>3</sup> Leslie, D., Mazumder, A., Peppin, A., Wolters, M. K. and Hagerty, A. (2021) *Does 'AI' stand for augmenting inequality in the era of Covid-19 healthcare?*, *bmj*, 372. Available online here: <https://www.bmj.com/content/bmj/372/bmj.n304.full.pdf>.

<sup>4</sup> Royal Society of Edinburgh (2022) *Response to the UK Parliament's 'Post-Pandemic economic growth: UK labour markets' inquiry*. Paper not yet published. To access a copy, please contact [swebb@theRSE.org.uk](mailto:swebb@theRSE.org.uk).

**13.** General awareness training around what data are already held and how they are used would be helpful in encouraging data capture and reporting. People are not always willing to share health data, particularly with commercial industries, which can create barriers to data collection.<sup>5</sup> It is possible that people perceive health data sharing as a threat to their personal individual privacy more. The level of trust in authorities or businesses to hold their data, may vary according to the individual, their level of education, income, or ethnicity. However, people often sacrifice their data to use digital platforms, for shopping or social media without realising that much personal information can be inferred from the data we already agreed to share to use these apps/websites. Increased awareness of these data usages may help people to become more comfortable with the collection and use of their health and social care data.

**14.** It would be helpful to have clear statements/guidance from Government around what is and is not possible when using data, in order to boost confidence levels in the use of data among those who require it in their working practice. The majority of problems lie in people being reticent to use data due to potential privacy issues or the public being unable to use data due to GDPR implications.<sup>6</sup> A statement about the benefits of using data in health and social care, and clear guidance on when and in what circumstances data can be used (as well as associated benefits and costs) would be helpful.

- *What actions must be taken as a priority to ensure that the public have access to health and social care data that they can understand and use?*

**15.** RSE finds that there is a need to find more ways for people to have easier access to data. The benefits of easier access to data were highlighted during the Covid-19 pandemic, where infrastructure and collaboration enabled faster access to data. This ensured the success of the vaccine rollout and allowed researchers meaningfully to inform public policy over short time periods.<sup>7</sup> However, concerns about greater privacy risks often accompany improved access to data. Creating systems that allow more access to data will always carry and inherent risk, and whilst we should always endeavour to ensure that data sharing is done in a reasonably safe and confidential way, this should not impede progress towards securing greater access to data. The mitigation of mishaps and misuse of data should be treated as a separate exercise.

**16.** Alongside ensuring the public have greater access to data, from a clinical trial and treatment appraisal perspective, it would also be beneficial for the public to have a way of contributing to their own health records. If practitioners could calibrate records with information about people's feelings/attitudes about their treatments, this would help create a more inclusive way to evaluate both new and existing treatments, which considers the user's experience.<sup>8</sup>

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<sup>5</sup> Alford, J. (2020) *Public trust in health data sharing has sharply declined, survey reveals* [online] Available at: <https://www.imperial.ac.uk/news/200436/public-trust-health-data-sharing-sharply/>.

<sup>6</sup> Indeed, during a recent Covid-19 Recovery Committee evidence session RSE Fellows agreed that the fear and risk-averse culture within the public sector is an unintended consequence generated by GDPR regulations with significant health implications. These health implications come from a lack of data-sharing within the health sector in Scotland, and well as between health services and scientists. For more information on this see: Scottish Parliament (2022) *Covid-19: communication of public health information*. [online] Available at: <https://www.parliament.scot/chamber-and-committees/committees/current-and-previous-committees/session-6-covid19-recovery-committee/business-items/covid-19-communication-of-public-health-information>; see also National Data Guardian (2020) *Survey report: Information sharing to support direct care* [online] Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/906788/NDG\\_survey\\_report\\_v1.4.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906788/NDG_survey_report_v1.4.pdf).

<sup>7</sup> Beckman (2021) *How unlocking health data shaped the Covid-19 vaccine rollout*. [online] Available at: <https://www.hdruk.ac.uk/case-studies/how-unlocking-health-data-shaped-the-covid-19-vaccine-rollout/>.

<sup>8</sup> Rand, L., Dunn, M., Slade, I., Upadhyaya, S. and Sheehan, M. (2019) Understanding and using patient experiences as evidence in healthcare priority setting, *Cost Effectiveness and Resource Allocation*, 17(20). Available online here: <https://resource-allocation.biomedcentral.com/articles/10.1186/s12962-019-0188-1>.

**17.** It would be worthwhile to consider how population health researchers can, with consent, obtain access to the wealth of health data that is collected by technology firms such as Apple, Fit Bit, and Google Fit. The data that is collected through these sources may have the potential to prevent ill health and provide new insights into diseases.<sup>9</sup> However, in doing so, consideration should also be given to groups that are less likely to track their health data, to ensure that they are not underrepresented in medical research.

## Thinking about improving the quality of data that is used by health and social care services

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- *What three things are needed to improve quality and accessibility?*

**18.** Training staff on how to use the systems that are already in place should help to improve skills in data management and improve accessibility. The effective use of digital technologies depends on staff being equipped with the skills in order to actually use them.<sup>10</sup> Data input should be recognised as a valued aspect of a person's job role, but people need the skills to do so.

**19.** The RSE believe that single systems/monolithic sources of data are almost impossible to create, particularly in health data. We recommend the establishment and use of multiple systems that are heterogenous and serve different purposes, whilst having the capability to exchange data between the systems.

**20.** There is a need for ongoing, centralised, routine maintenance and enhancement of quality conducted on data sets. Currently, there is a tendency to leave data accumulating and only assess its quality as and when it is required. A cultural shift is required to move away from spending long periods of time cleaning data towards proactively monitoring datasets before they become out of control. This would require investment but would be worthwhile by improving the overall quality of data.

- *What data, that is generated outside of the health and social care sector, do you think could be made available to health and social care professionals to improve health and social care outcomes in Scotland?*

**21.** As previously mentioned in paragraph 18, the data collected from handheld or wearable devices could offer a wealth of data that could benefit health professionals. For example, access to data from digital wallets and discount apps can reveal grocery shopping and spending habits, potentially providing insight into disease causation (particularly diseases linked to poor diet) and management of health. This data may also reveal spending habits on personal and public transport, potentially giving insight into fitness levels. Additionally, the capabilities of these devices to monitor geographical location including a person's ordinary residence, could help determine those more likely to be exposed to pollutants, or drug usage if linked to local sewage analysis.

- *We have heard that a more consistent approach to data standards will help improve insight and outcomes for individuals:*
  - *To what extent do you agree with the proposal that the Scottish Government should mandate standards for gathering, storing, and accessing data at a national level? What data standards should we introduce?*

**22.** RSE agree that mandating standards for the collection, storing, and access of data is essential, and that this should be prioritised to ensure that health and social care workers adhere to good practices of data management. The introduction of standards may help encourage staff to input the data, by offering clear guidelines that state this is part of their job description.

**23.** Development of data standards should evolve with the science and be a constant process of adjustment, as is common to other areas where standards are established reviewed and updated. There is a risk that if the standards fail to evolve, they may not be relevant to future data sets. Data standards will need to be reviewed on a regular basis.

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<sup>9</sup> Mac Manus, S. (2020) *How can data transform our health and care system?* [online] Available at: <https://www.nesta.org.uk/blog/how-can-data-transform-our-health-and-care-system/>.

<sup>10</sup> OECD (2020) *Empowering the health workforce: Strategies to make the most of the digital revolution* [online] Available at: <https://www.oecd.org/health/health-systems/Empowering-Health-Workforce-Digital-Revolution.pdf>.

- *When considering the sharing of data across Scotland's health and social care system: Do you agree with the idea that greater sharing of an individual's health and social care data between the organisations in the health and social care sector will lead to better quality services?*

**24.** Yes, we believe that sharing data across Scotland's health and social care system will lead to better quality of services. The RSE have previously called for more collaboration between health and social care services in order to ensure improved outcomes for patients. Indeed, the sharing of patient information between health and social care providers can help ensure that patients can be supported more effectively through coordinated care. The sharing of information has the potential to ensure there is continuity between the various teams involved in the person's support.

**25.** Consideration should be given to addressing the potential barriers to sharing data between health and social care services. Barriers such as concerns about sharing information due to legalities, poor training and lack of guidance have been previously cited as barriers to information sharing across services.<sup>11</sup> The government should work to address these issues and encourage a culture of collaboration between health and social care.

## Part 3: Empowering industry, innovators and researchers

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- *When considering the ethics of accessing health and social care data for commercial, development and research purposes: How do you think health and social care data should be used by industry and innovators to improve health and social care outcomes?*

**26.** RSE contends that both industry and innovators should widen the range of health and social care data that are used to improve outcomes. This need is exemplified by how qualitative data from clinical trials, such as patients' feelings, are increasingly being used to help find solutions to scenarios where drugs, such as Tamoxifen, result in ~20% people not completing their 5-year courses due to negative side-effects.<sup>12</sup>

**27.** RSE acknowledges the relative scarcity of public funding for clinical research in the UK, such as clinical trials, in both commercial and public sector research. We suggest that the health and social care sector should work with commercial enterprises, by for example selling data, to enable organisations to target new medicines and develop effective interventions at a faster rate. Public money could also be used to leverage support from elsewhere, as the sums available from public sources in Scotland are relatively small.

**28.** The establishment of a culture of sharing across the health and social care sector, underpinned by the principle of open access, is of paramount importance. There is a need to enrich data sets through enhanced collaboration between multiple stakeholders. This could be achieved by reevaluating the way Government collaborates with industry on medical research, for example by sharing health and social care data across industry, academia, and publicly funded medical research bodies.

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<sup>11</sup> National Data Guardian (2020) *Survey report: Information sharing to support direct care* [online] Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/906788/NDG\\_survey\\_report\\_v1.4.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/906788/NDG_survey_report_v1.4.pdf).

<sup>12</sup> Ford, S. (2016) *Breast cancer patients fail to complete tamoxifen therapy* [online] Available at: <https://www.nursingtimes.net/news/research-and-innovation/breast-cancer-patients-fail-to-complete-tamoxifen-therapy-14-12-2016/>; Meanwhile, in oncology, medicines are determined to be successful if they have a 20% response rate. These crude measures of success should be improved upon.



**29.** RSE advocates more experimental public policy strategies which draw from best practice international data sharing cultures, such as open-source software/code initiatives, to empower individuals to address health and social care issues. Any leveraging of crowdsourcing techniques to accelerate innovation in the development of health and social care solutions would depend on a shift in the Scottish Government's risk appetite when commissioning health and social care research projects.<sup>13</sup> To enable this shift, the Scottish Government could sponsor innovation sandboxes to attract students and hobbyists to collaboratively create solutions to problems that as of yet have not been solved by conventional practices.

**30.** RSE notes the potential of outcome-based reporting on medicines within the health and social care sector to enable open access to data and feedback on medicines, and how they are being received by patients. This could help to guide the way they are prescribed, and how new drugs are developed. For example, this could help to incorporate outcomes-based pricing as a guiding principle for how new drugs are developed. It could also help to introduce an element of transparency. For example, when granting access to drugs, contracts could be used to stipulate that any results are published, to provide a means for industry to enrich data sets through collaboration between multiple stakeholders.

- *How can industry and innovators maintain the trust and confidence of the people of Scotland when using their health and social care data for research purposes?*
- *What do you believe would be unacceptable usage of Scotland's health and social care data by industry, innovators, and researchers?*
- *How should industry, innovators and researchers be transparent about their purposes in accessing, and the benefits of using, health and social care data?*
- *We want to create an infrastructure that supports access to data for research and innovation in a safe, secure, and transparent way: How should the Scottish Government seek to store and share health and social care data for research in order that it can best facilitate easier access that is still safe and secure?*
- *What do you believe are the key data needs and gaps that are faced by industry, innovators, and researchers when it comes to Scotland's health and social care data?*
- *Used appropriately and well, technologies such as Artificial Intelligence can help to improve decision making, empower health workers and delivery higher quality health and social care services to citizens, improving how you receive health and social care services.*
- *What are your views on the benefits of using AI to improve the delivery of health and social care services?*
- *What safeguards do you think need to be applied when using AI?*

**31.** RSE note the immense potential of artificial intelligence, when used appropriately and well, to improve the delivery of health and social care.<sup>14</sup> However, more work needs to be undertaken to ensure the appropriate use of artificial intelligence technologies and techniques, including machine learning, for example, to train against biases and mitigate against misdiagnoses.<sup>15</sup>

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<sup>13</sup> RSE notes that the over-regulation of health and social care data could be a barrier to enabling open-sourced solutions. For more information on leveraging crowdsourced solutions see: Kostkova, P. (2015) Grand Challenges in Digital Health, *Frontiers in Public Health*, 3(134). Available online here: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4419711/>.

<sup>14</sup> .For more information on RSE's views on artificial intelligence, see: Royal Society of Edinburgh (2020) *Developing Scotland's Artificial Intelligence Strategy*. [online] Available at: <https://rse.org.uk/wp-content/uploads/2022/04/RSE-Scotlands-Artificial-Intelligence-Strategy-2020.pdf>.

<sup>15</sup> Davenport, T. and Kalakota, R. (2019) The potential for artificial intelligence in healthcare, *Future healthcare journal*, 6(2).

**32.** RSE note that the potential applications of artificial intelligence are often misunderstood due to the framing and scale of analyses, as exemplified by the complexity of neural networks.<sup>16</sup> In response, RSE call for the development of an ethics charter alongside the development of artificial intelligence to provide a coherent summary of the ethical issues that can arise through its application, as exemplified by issues associated with optimising against costs. This would also help to increase transparency in the development of health and social care solutions, by discouraging trade secrets.

**33.** Artificial intelligence optimises on the basis of data available. This means that if the available data are contaminated by, for example, sexism, racism, or ethnic differentiation, there is a real danger that artificial intelligence can further systemic/algorithmic biases and discrimination.<sup>17</sup> RSE notes that domain knowledge of specific health and social care issues alongside in-depth knowledge of the intricacies of complex clinical data sets is essential when exploring how to most effectively apply artificial intelligence, overcome any potential ethical issues, and remove biases. RSE contends that any application of artificial intelligence should be underpinned by situational ethics which positions AI as both an ethical and a computational issue.

## Additional points

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**34.** RSE suggest that there is a difference between perception and reality of progress on Scotland's Data Strategy, which often positions Scotland as world-leading in capabilities for data management, visualisation, access, and governance, despite shortcomings in capitalising on existing assets.<sup>18</sup> Indeed, whilst Scotland has assets that other countries do not, such as a highly integrated health service that allows individuals to track across the entirety of the system, there is a need to address existing barriers to data usage in Scotland to ensure that the required data can be captured and cleansed, is interoperable (and therefore more easily analysed), and accessible (for example by addressing data access issues that can delay research projects). Nonetheless, RSE commend the important work that is being conducted by bodies such as the Health Informatics Centre at the University of Dundee to tackle data access and confidentiality issues (such as accessing unconsented data for research purposes).<sup>19</sup>

## Additional information

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**35.** Any enquiries about this advice paper should be addressed to Stephanie Webb, Policy Advice Officer, at [swebb@theRSE.org.uk](mailto:swebb@theRSE.org.uk), and Alfie Gaffney, Policy Advice Officer, at [agaffney@theRSE.org.uk](mailto:agaffney@theRSE.org.uk).

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<sup>16</sup> Indeed, the complexity of neural networks is exemplified by the basis for their classification/decision making often being hidden. See for example: Surkan, A.J. and Singleton, J.C. (1990) Neural networks for bond rating improved by multiple hidden layers, 1990 *IJCNN international joint conference on neural networks*, pp. 157-162).

<sup>17</sup> See for example, Chu, C., Leslie, K., Nyrup, R. and Khan, S. (2022) *Artificial intelligence can discriminate on the basis of race and gender, and also age*. [online] Available at: <https://theconversation.com/artificial-intelligence-can-discriminate-on-the-basis-of-race-and-gender-and-also-age-173617>.

<sup>18</sup> See for example, Scottish Government (2021) *A changing nation: how Scotland will thrive in a digital world*. [online] Available at: <https://www.gov.scot/publications/a-changing-nation-how-scotland-will-thrive-in-a-digital-world/pages/no-one-left-behind/>; Scottish Development International (2022) *Why Scotland's the place to do great things with data*. [online] Available at: <https://www.sdi.co.uk/news-features/news-and-feature-articles/why-scotlands-the-place-to-do-great-things-with-data>.

<sup>19</sup> For more information on the Health Informatics Centre at the University of Dundee see: <https://www.dundee.ac.uk/hic>.



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