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A survey of public attitudes toward secondary research governance oversight: Evidence from Singapore's TRUST platform

Hui Jin Toh[1,†], Marthe Smedinga[1,2,†], Faisal Feroz[1,3,4,5], Julian Savulescu[1,3,*], and G. Owen Schaefer[1]

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[1] Centre for Biomedical Ethics, Yong Loo Lin School of Medicine, National University Singapore, Singapore
[2] Institute of History and Ethics in Medicine, TUM School of Medicine, Technical University of Munich, Munich, Germany
[3] Uehiro Oxford Institute, University of Oxford, Oxford, UK
[4] Department of Experimental Psychology, University of Oxford, Oxford, UK
[5] Psychology Programme, School of Social Sciences, Nanyang Technological University, Singapore
[†] Joint first author

Abstract

Background
Health data platforms and biobanks worldwide face challenges in maintaining social licence to operate (SLO) while enabling beneficial research. While technical safeguards can mitigate privacy risks, public expectations for governance oversight processes remain unclear. This study examines public attitudes toward health data governance oversight using Singapore's national TRUST platform as a case study.

Methods
We conducted an online survey of 453 respondents from the Health Opinion Panel Singapore (HOPS) panel in Singapore between September and October 2024. Respondents evaluated four hypothetical research scenarios involving different data users (government agencies, overseas private companies, international universities) and indicated whether additional Ministry of Health (MOH) review should be required despite 2-5 weeks procedural delays. We analysed support rates for this additional review, reasons for support or opposition, and responses about privacy-utility trade-offs.

Results
Strong public support for MOH oversight emerged across all scenarios (80-89%), with government accountability as the primary reason (68-76% of supporters). Support was the highest for research involving overseas private companies (89%) and lowest for domestic government research (80%). Respondents demonstrated sophisticated risk-benefit, context-dependent reasoning: 69% accepted privacy risks for direct personal benefits (retaining contact information for cancer risk notification), while 82% endorsed stringent protections for vulnerable populations (CCTV monitoring for rare disease research despite research impediments).

Conclusions
The Singaporean public expects comprehensive ethical oversight extending beyond privacy protection to encompass accountability, scientific validity, and social justice considerations. Consistent acceptance of procedural delays demonstrates that SLO depends on procedural justice rather than operational efficiency. These findings support implementing risk-proportionate governance frameworks that maintain robust baseline oversight while allowing context-sensitive intensification based on research characteristics and stakeholder involvement.

Keywords
health data governance, public attitudes, data oversight, social licence to operate, health data platforms, government accountability, privacy-utility trade-offs, data sharing ethics

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*Corresponding Author:
Email Address: julian.savulescu@uehiro.ox.ac.uk (Julian Savulescu)

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Introduction

Health data platforms worldwide are revolutionising health research by aggregating population-level datasets and facilitating their secondary use across diverse research contexts [1]. These publicly-funded platforms integrate disparate data sources—ranging from electronic health records and genomic databases to administrative registries and lifestyle surveys—creating comprehensive resources with unprecedented potential to advance medical knowledge and inform evidence-based policy. However, their operation involves navigating complex ethical, legal, and social considerations extending beyond traditional data governance frameworks [2].

Unlike traditional research where informed consent is provided for specific studies, data platforms involve secondary use of data initially collected for other purposes. This shift creates a core governance challenge: how to ensure data privacy while enabling the secondary use of data at scale for the public good [1]. Trade-offs often arise between maintaining individual privacy and promoting public good [3–5], such as when broad data sharing without specific consent could produce valuable knowledge to promote public health. These privacy-utility trade-offs (with utility understood as aggregate benefits to the population) are central to many questions in data ethics [3–5].

The sustainability and legitimacy of health data platforms depend on establishing and maintaining the social licence to operate (SLO) [6]— ongoing public and stakeholder acceptance that permits these activities. While technical safeguards such as de-identification, secure computing environments, and access restrictions can mitigate privacy risks, they do not resolve questions about legitimacy of data use decisions. Past failures of large data initiatives, including the UK's care.data program [7] and widespread public resistance to NHS data collection efforts [8], show how inadequate attention to public values can undermine even well-intentioned data sharing efforts. Robust governance frameworks must therefore be not only technically sound but also reflect the values and priorities of the communities whose data makes research possible.

Despite the increasing deployment of health data platforms worldwide and the growing recognition of the importance of public engagement [9, 10], it remains unclear how different publics weigh the safeguarding of privacy (including delays from rigorous oversight processes and privacy risks from data sharing) against the potential benefits of research. Existing research demonstrates considerable variation in public acceptance of privacy risks for health research [11–13]. These preferences appear to depend on research purpose, potential benefits, and data users. However, most studies focus on data sharing decisions rather than governance process preferences. We lack empirical evidence on public support for oversight procedures that platforms actually employ—particularly whether governance delays are viewed as legitimate investments in accountability or unnecessary bureaucratic barriers. We also aim to examine public reasoning on accepting privacy risks for research benefits and implementing protective measures that may impede scientific progress.

Our study addresses this gap by examining public attitudes toward health data governance oversight using Singapore's national TRUST [14] platform as a case study. We operationalise 'public attitudes' as stated support or opposition to Ministry of Health (MOH) review of hypothetical research scenarios, along with self-reported reasons. This approach assesses one key dimension of social licence to operate (SLO): public acceptance of governance oversight procedures. While SLO is a multi-dimensional construct—encompassing trust, legitimacy, benefit-sharing, and ongoing engagement —acceptance of oversight mechanisms is central to platform legitimacy. High support coupled with acceptance of procedural delays indicates possible alignment between governance practices and public expectations and suggests the presence of SLO. Conversely, widespread opposition framed as unnecessary bureaucracy would indicate misalignment that could undermine the platform's SLO.

The Singapore context

Launched in 2022, TRUST [14] is a platform that provides approved researchers with anonymised, linked health and administrative data within protected computing environments. Developed through collaboration among government agencies, TRUST aims to facilitate health research, policy development, and population health initiatives by enabling data sharing across public and private sectors.

Most national data platforms, including TRUST, employ Data Access Committees (DACs) tasked with evaluating research proposals and granting access permissions. These committees often comprise of representatives from research institutions, government bodies, and sometimes patient or public advocates. TRUST follows a tiered review process: all research proposals undergo initial DAC review; however, requests involving sensitive or rare disease data require supplementary approval from the Ministry of Health (MOH). What constitutes as "sensitive data" is determined by data custodians (i.e. the institutes that collected the data). This additional review extends approval timelines by about 2–5 weeks but is intended to ensure rigorous ethical and social oversight, especially for high risk or ethically complex research.

While such governance processes reflect institutional judgements about when enhanced oversight is warranted, their alignment with public expectations remains largely unexplored. To address this, our study employs hypothetical scenarios, adapted from a prior mixed methods study [15], to assess public attitudes toward these oversight procedures.

Our study addresses the following three research questions:

> RQ1: What proportion of the Singapore public supports additional MOH review for different types of health data research, despite procedural delays?
>
> RQ2: What reasons do respondents cite for supporting or opposing such oversight?
>
> RQ3: How do support rates and reasoning vary across research scenarios involving different data users and purposes?

This study contributes to broader international understanding of public expectations for health data platform oversight and informs discussions about governance of research infrastructure in an era of increasing data-driven research.

While our findings emerge from Singapore's context, they address universal challenges in data platform governance relevant across diverse national and institutional settings.

Methods

This study employed a cross-sectional survey design to examine public attitudes toward health data governance oversight using hypothetical research scenarios. The scenarios were designed to reflect TRUST's actual operational context: (1) the 2-5 weeks delay estimate was based on TRUST's timeline for supplementary MOH review, (2) the scenarios varied requester type, research purpose, and data sensitivity to reflect key dimensions that TRUST considers when evaluating data access requests, and (3) the governance question (whether MOH review should be required) directly parallels TRUST's tiered oversight system where certain data requests trigger additional ministerial review.

Power analysis

Sample size was determined through a power analysis conducted prior to data collection. We calculated that 400 respondents would provide sufficient precision to estimate population support rates within ±5% margin of error (assuming 50% proportion for maximum variance). A final sample of 453 respondents was achieved and exceeded our target.

Survey recruitment

This survey was administered via Qualtrics to the Health Opinion Panel Singapore (HOPS) panel from September to October 2024. The HOPS panel is an online survey panel consisting of 2,527 Singaporean citizens and permanent residents hosted at the Centre for Biomedical Ethics, National University of Singapore. The panel's operations are approved by National University of Singapore Institutional Review Board to be used for public health and ethics studies (IRB ref: LH-18-011). Panel participants were recruited using stratified sampling by mailing invitations to randomly selected households from a deidentified address sampling frame supplied by the Singapore Department of Statistics. To ensure representativeness of the Singapore population, sampling was stratified by age, ethnicity and gender. The eligibility criteria for the panel are: Singaporean citizens or permanent residents aged 21 and above; able to read English; have access to an internet-connected device; and have a personal email account.

We invited 1,526 panel members via email—those who had not been invited to the prior survey [15] from which we adapted our scenarios. For that prior survey, invitees were randomly selected from the panel. While initial panel recruitment is probability-based, participation in any specific survey (including ours) is voluntary. Respondents who chose to participate in a survey about health data governance likely differ from non-respondents in unmeasured ways—such as greater interest in health data issues, stronger prior opinions, or higher health literacy. In addition, while the use of email invitations is standard practice for online panels and allows for efficient survey administration, it introduces potential selection biases. Panel members who regularly check email, have time to respond, and are motivated by the topic are more likely to participate. Reminder emails were sent on days 8 and 15 to non-respondents, and the survey closed on day 31. Respondents received an SGD10 supermarket electronic voucher as an incentive. We did not apply post-stratification weights to adjust for demographic differences between our sample and Singapore's population.

Survey instrument

The survey instrument (see Supplementary Material 1) consisted of four hypothetical research projects. While the survey referred to 'a national data platform' instead of TRUST directly to avoid priming effects, the described governance structures and review processes were based on TRUST's actual practices. Table 1 summarise these four scenarios. Projects 1, 2 and 4 were replicated from our prior mixed method study [15] and were designed in a way where the public interest was not immediately obvious, requiring respondents to do nuanced trade-offs. This ambiguity was intended to uncover which data uses might undermine SLO and generate substantive discussions. For example, Project 4 was designed to present a scientifically and ethically problematic research proposal. The potential confounding of genetic associations with systemic discrimination represents a core ethical concern we sought to examine through public opinion. These three research projects were retained as they had demonstrated effectiveness in eliciting nuanced public reasoning about research trade-offs and represented diverse contexts for testing oversight preferences [15].

Project 3, however, was modified to focus on rare disease research to allow for a more targeted examination of utility-privacy trade-offs in governance contexts. This modification was driven by two considerations:

- Urgency: Rare diseases present increased urgency due to their life-threatening nature and lack of existing effective treatments [16, 17]. We sought to examine whether this urgency factor would influence public willingness to accept expedited review processes, potentially bypassing additional MOH oversight.
- Re-identification risk: The small patient population inherent in rare disease research creates elevated re-identification risks. This privacy risk allowed us to test how sample size considerations affect public preferences for enhanced protective measures, such as restricting data access to monitored environments.

We also developed targeted supplementary questions for Projects 2 and 3 to probe deeper privacy-utility reasoning:

- Project 2: Whether contact information should be retained to inform respondents of cancer risk findings, despite potential data breach risks. This scenario tested willingness to accept privacy risks for direct personal health benefits.
- Project 3: Whether overseas researchers should be restricted to CCTV-monitored rooms in Singapore, despite potential impediments to international

Table 1: Four research projects presented to the respondents in the survey

Project no.	Purpose, pros & cons of project	Description of project
1	Purpose	The Ministry of Defence requests access to genomic research data and medical data on heart disease incidents and stroke to link it with the ministry's own data on medical incidents during military training to identify who would be at high risk of heart disease or stroke during military training. This would then feed into the screening programme for military service.
	Pros	• With the aim to ensure that all men can serve in National Service (NS) vocations that best suit their health (including any risks to cardiac health). • To expand the Singapore Armed Forces (SAF) screening programme to prevent injuries during military training.
	Cons	• To prevent any medical risks during NS training, people with certain genetic markers might not be able to acquire an SAF Health Screening Program (HSP) certificate. • People might deem it unfair if they were to be excluded from joining NS because of their genetic risk factors, especially if they feel fit.
2	Purpose	A private overseas company requests access to 6000 images for a breast cancer screening programme and medical data on breast cancer to develop a computer program that can support breast cancer screening using articificial intelligence. The computer program is currently trained on data of other countries that might not be applicable to Singapore.
	Pros	• Develop computer programs to support breast cancer screening. • If the programme works, breast cancer could be detected in earlier stages and fewer doctors may be needed to do the screening. • The current version of the computer program is trained on European data, which could lead to misdiagnosis and/or mistreatment when used in another population in Asia. By including Singaporean data, the computer program could be better adjusted to the Singaporean population. • Doctors in Singapore are interested in using this programme to support their work.
	Cons	• A private company is using the data. • The company is based overseas.
	Supplementary question: Retention of contact information	While the standard platform practice involves deidentifying all data (as described at the survey's outset), we asked respondents to consider whether an exception should be made: if contact details were retained (contrary to standard deidentification), individuals could be notified of their breast cancer risk should the research identify elevated risk. However, retaining such information would increase harm in the event of a data breach, though the risk of such breaches is very small. Respondents were asked whether personal information should be kept despite this risk, and why or why not.
3	Purpose	A New York University requests access to genomic research data, to do research on a rare genetic disease that causes heart issues at a young age. In Singapore, only around 80 people have the disease currently. No personal information is being kept in the dataset.
	Pros	• Linking data on this disease in several countries together, including Singapore, can provide new insights for developing treatments. • The research can stimulate research collaborations between the US and Singapore.
	Cons	• The data is shared with an overseas university. • Even when personal information is not kept in the database, it might be possible to link the data to individuals because the disease is very rare.

Continued

Table 1: Continued

Project no.	Purpose, pros & cons of project	Description of project
	Supplementary question: CCTV monitoring	Given the increased re-identification risk posed by the small patient cohort, an additional safeguard was proposed: restricting data access to a CCTV-monitored room in Singapore. Although this measure would enhance privacy protection, it would be challenging for US-based researchers to access data.
4	Purpose	The Ministry of Education requests access to genomic research data to link it with the ministry's own data on national exam scores, to aim to predict educational attainment based on genomic data.
	Pros	• Predict educational level based on genomic data to better design educational programmes for children. • The prediction levels are not able to predict how far one person goes in education, but they are valuable on an aggregated level. For example, if research shows that certain genes are associated with a lower education level, educational learning programmes could be adjusted to target children who have more difficulty reaching their full academic potential.
	Cons	• Parents and children might start thinking of themselves differently when children are categorised as having more or less educational potential based on genomic information.

All participants were informed that the projects are hypothetical and all the data that is requested would be deidentified.

collaboration. This scenario examined support for enhanced security measures taken by some data platforms when small patient populations increase re-identification risks.

We did not conduct formal pilot testing or calculate reliability measures for this adaptation. To manage respondent fatigue while ensuring adequate sample sizes per scenario, respondents were randomly assigned to evaluate two of the four hypothetical scenarios. Each scenario included information about research purpose and data requirements, requesting organisation characteristics, potential benefits and risks, and data protection context. These scenarios ranged from 1 year (Project 4) to 3 years (Projects 1, 2, and 3) in duration. In each scenario, respondents were told that a supplementary review by MOH will result in a 2-5 week delay.

For each assigned scenario, respondents responded to the primary yes/no question: "Do you think this research should have an extra review by the Ministry of Health? It will delay the research by 2 to 5 weeks." They were then asked to select reasons for their choice and/or to state other reasons. Two open-ended optional follow-up questions asked respondents to name any other organisations that they would like to review the research and to provide comments on the research proposal. Demographic information collected included age, gender, ethnicity, highest education level, monthly household income level, and self-rated health.

Data analysis

We used descriptive statistics to characterise respondent demographics and response patterns for each scenario. For each project, we calculated support and opposition proportions with 95% confidence intervals using the Wilson score method, which performs well for proportions near boundaries. As described in the "survey instrument" subsection, participants were randomly assigned to evaluate two of four scenarios, creating partially overlapping scenario groups with uneven sample sizes (n=221-236). While each participant's response to each scenario can be treated as an independent observation (allowing between-group comparisons), no participant saw all four scenarios. This precludes within-person comparisons of value trade-offs across research projects.

To test whether support rates differed significantly across the four scenarios, we conducted a chi-square test of independence using a 4×2 contingency table (4 scenarios $\times$ 2 response categories: support vs. oppose). If the overall chi-square test was significant ($p < 0.05$), we conducted post-hoc pairwise comparisons using Fisher's exact tests for each of the six possible scenario pairs. To control for multiple comparisons, we applied Bonferroni correction by dividing the significance level by the number of comparisons ($\alpha = 0.05/6 = 0.0083$). Effect size was assessed using Cramér's V, with values of 0.1, 0.3, and 0.5 indicating small, medium, and large effects, respectively.

We initially planned logistic regression analyses to examine associations between stated reasons and support/opposition. However, we determined this approach was inappropriate for several reasons. The between-subjects design with random scenario assignment created different sample compositions per scenario and precluded modelling individual-level variation. More critically, the very high support rates (80-89%) created quasi-complete separation, with some demographic or reason categories having zero or near-zero cases in the opposition group. This produces unstable odds ratios with extremely wide confidence intervals that reflect separation artefacts rather than real associations. Given these constraints, we focus our analysis on descriptive statistics and appropriate between-group comparisons that more accurately represent patterns in our data.

A research team member (blinded for review) who is experienced in qualitative research conducted thematic analysis [18] of the open-text responses. The coding framework combined deductive codes and themes derived from our previous research [15] with inductive themes that emerged from the data itself. We used R programming (R Studio version 4.3.0) for quantitative analyses and NVivo (version 15) for qualitative coding and theme development.

Ethics oversight

This study was deemed exempt from ethics review by the National University of Singapore Institutional Review Board (NUS-IRB) (Reference No. LH-18-011). This study is a survey of members in the existing HOPS panel who had already provided informed consent for participation in public health and ethics studies. The panel's overall operations, including recruitment procedures and data management, had previously received full IRB approval.

Results

Respondent characteristics

A total of 453 respondents completed the survey between September and October 2024. Table 2 presents the respondents' characteristics. The sample was predominantly female (61%), Chinese (81%), and well-educated (54% with bachelor's or postgraduate degrees). Most respondents rated their health as good, very good or excellent (83%). Compared to Singapore's 2020 census [19], our sample was overrepresented by Chinese (81% Chinese vs. 74% in general population), was more highly educated (54% with university degrees vs. 33% nationally), more females (61% vs. 48%) and older (median age 49 vs. national median 42 years).

Table 2: Characteristics of the survey respondents

Respondent characteristics	**No. of respondents (N = 453)**
Gender	
Female	278 (61%)
Male	175 (39%)
Ethnicity	
Chinese	367 (81%)
Indian	53 (12%)
Malay	24 (5%)
Others	9 (2%)
Age group	
21-30	36 (8%)
31-40	107 (24%)
41-50	103 (23%)
51-60	101 (22%)
61-70	77 (20%)
71-80	25 (6%)
81 & above	2 (1%)
Highest education attainment	
No formal education	0 (0%)
Pre-Primary	0 (0%)
Primary	1 (1%)
Secondary	63 (14%)
Post-Secondary	19 (4%)
Polytechnic	60 (13%)
"A" Levels	11 (2%)
Other Diploma	54 (12%)
University - Bachelor's Degree	189 (42%)
University - Postgraduate Degree	56 (12%)
Self-rated health	
Poor	2 (1%)
Fair	74 (16%)
Good	241 (53%)
Very good	113 (25%)
Excellent	23 (5%)

Table 3 summarises the proportions of support and opposition to MOH review and the respective reasons for all projects. Across all four scenarios, 80% and more of the respondents reported that they would like additional MOH review despite being informed it would delay research by 2-5 weeks. Support was highest for Project 2 involving an overseas private company (89%), followed by Project 3 involving a US university (86%), Project 1 involving MINDEF (84%), and Project 4 involving MOE (80%). Government accountability was the most frequently cited reason for supporting MOH review (68-76% depending on the scenario), followed by 'MOH has the public interest in mind' (50-62%) and 'MOH has the right expertise' (44-55%). Among those opposing MOH review (11-20% across scenarios), the most common reason was 'I do not see the added value' (56-64%), followed by concerns about research delays (22-38%) and resource allocation (22-36%). These findings highlight consistent public expectations for oversight and accountability across diverse research contexts.

Comparison of support rates across research projects

Table 4 presents support rates across all four research scenarios. We compared support rates across the four scenarios using chi-square test of independence ($\chi^2(3) = 8.47$, $p = 0.037$, Cramér's $V = 0.10$), indicating small but significant variation across scenarios.

Table 5 presents the post-hoc pairwise comparisons using Fisher's exact tests with Bonferroni correction ($\alpha = 0.0083$). Only one comparison reached statistical significance: support for Project 2 (overseas private company, 89%) was significantly higher than for Project 4 (local government agency, 80%) ($p = 0.007$). All other pairwise comparisons did not reach significance after correction for multiple testing (all $p > 0.0083$). This pattern indicates that while the public applied somewhat higher oversight expectations to research involving overseas private companies compared to domestic government agencies, the more striking finding is the consistency of strong majority support across all research contexts examined.

Reasons for supporting or opposing MOH review

Table 6 presents the frequency and percentage of each reason cited by respondents who supported or opposed MOH

Table 3: Reasons for supporting/opposing MOH review for each research project

Purpose of research project	No. of respondents supporting MOH Review	No. of respondents not supporting MOH Review	Reasons for supporting MOH review	Reasons for opposing MOH review
1.Data use by MINDEF for NS medical risk prediction	185 (84%)	36 (16%)	• There should be government accountability. (69%) • MOH has the right expertise. (55%) • MOH has the public interest in mind. (50%) • Other reason(s) (6%)	• I do not see the added value. (60%) • I would not want the research to be delayed. (31%) • MOH should not spend time or resources on this. (25%) • Other reason(s) (17%)
2. Data use by overseas private company for breast cancer screening AI	211 (89%)	25 (11%)	• There should be government accountability. (76%) • MOH has the public interest in mind. (58%) • MOH has the right expertise. (44%) • Other reason(s) (12%)	• I do not see the added value. (56%) • I would not want the research to be delayed. (36%) • MOH should not spend time or resources on this. (36%) • Other reason(s) (12%)
3. Data use by New York University (US) for rare genetic disease research	195 (86%)	32 (14%)	• There should be government accountability. (68%) • MOH has the public interest in mind. (62%) • MOH has the right expertise. (49%) • Other reason(s) (7%)	• I do not see the added value. (56%) • I would not want the research to be delayed. (38%) • MOH should not spend time or resources on this. (22%) • Other reason(s) (19%)
4. Data use by MOE for education attainment prediction	177 (80%)	45 (20%)	• There should be government accountability. (68%) • MOH has the public interest in mind. (55%) • MOH has the right expertise (46%) • Other reason(s) (8%)	• I do not see the added value. (64%) • MOH should not spend time or resources on this. (29%) • I would not want the research to be delayed. (22%) • Other reason(s) (13%)

Note: Respondents could select multiple reasons for their position. Percentages are calculated among those who supported (or opposed) MOH review, not among the total sample. Therefore, reasons for supporting and reasons for opposing are not complementary and do not sum to 100%. Each project was evaluated by approximately 220-240 respondents (not 453), as each respondent was randomly assigned to only 2 of 4 projects.

Table 4: Support rates for additional Ministry of Health oversight across four research scenarios

Scenario	n	Support	95% CI	Oppose	95% CI
1. Data use by MINDEF for NS medical risk prediction	221	185 (84%)	79-88%	36 (16%)	12-21%
2. Data use by overseas private company for breast cancer screening AI	236	211 (89%)	85-93%	25 (11%)	7-15%
3. Data use by New York University (US) for rare genetic disease research	227	195 (86%)	81-90%	32 (14%)	10-19%
4. Data use by MOE for education attainment prediction	222	177 (80%)	75-85%	45 (20%)	15-25%

review across all four projects. Among supporters, government accountability was endorsed by similar proportions across all scenarios: Project 2 (76%, n = 160), Project 1 (69%, n = 128), Project 3 (68%, n = 132), and Project 4 (68%, n = 121). Among opponents, the pattern was also consistent. Lack of perceived value remained the dominant concern regardless of

Table 5: Post-hoc pairwise comparisons using Fisher's exact test with Bonferroni correction

Comparison	Difference in support	p-value	Significant?*
Project 1 vs 2	5 pp	0.089	No
Project 1 vs 3	2 pp	0.512	No
Project 1 vs 4	4 pp	0.231	No
Project 2 vs 3	3 pp	0.267	No
Project 2 vs 4	**9 pp**	**0.007**	**Yes**
Project 3 vs 4	6 pp	0.062	No

**Bonferroni-corrected $\alpha = 0.0083$ (0.05/6 comparisons). pp = percentage points.*

research context: Project 4 (64%, n = 29), Project 1 (61%, n = 22), Project 2 (56%, n = 14), and Project 3 (56%, n = 18).

For supporters, the other two primary reasons showed more variation by scenario. "MOH has the public interest in mind" ranged from 50% (Project 1, n = 93) to 62% (Project 3, n = 121). "MOH has the right expertise" ranged from 44% (Project 2, n = 92) to 55% (Project 1, n = 102). These patterns may reflect different perceptions about which scenarios most require specialised ethical judgement versus subject-matter expertise. However, because respondents could select multiple reasons, these are not mutually exclusive categories and many endorsed multiple justifications.

For opponents, concerns about delays showed more variation, ranging from 22% (Project 4, n = 10) to 38% (Project 3, n = 12). This variation may reflect different perceptions about urgency across research contexts - for instance, rare disease research (Project 3) might be viewed as more time-sensitive. However, the small numbers of opponents in each scenario (25-45 respondents) mean these percentage differences should be interpreted cautiously and may simply reflect sampling variability rather than meaningful patterns.

Privacy-utility trade-offs: Retention of contact information

Respondents who were assigned to Project 2 were asked whether contact information should be retained to inform individuals of their cancer risk, despite risks of potential data leak. A majority (69%) supported keeping contact information, and of these (Table 7), the primary reason was that individuals might want to be informed about their cancer risk status (83%). This was followed by recognition that respondents explicitly consented to this, knowing all the potential benefits and risks (56%) and that it might lead to health benefits (47%). Only 12% indicated they were not worried about data leaks. Those opposing retention of contact information (Table 7) primarily cited concerns about data leaks (77%), followed by uncertainty about consent (57%) and not seeing added value (30%).

Privacy-utility trade-offs: CCTV monitoring for data access

For Project 3, respondents evaluated whether overseas researchers should only access data in a CCTV-monitored room in Singapore. A strong majority (82%) supported this requirement despite it being a potential impediment to international collaboration. The primary reason for support (Table 8) was patient privacy protection (92%). Additionally, 29% expressed distrust of overseas researchers, while 22% indicated they were not worried about the measure being a research hurdle. Of those opposing CCTV monitoring (Table 8), the main concerns were that it would make research more difficult (59%) and that they did not see added value for data protection (53%).

Insights from the qualitative responses

Analysis of open-text responses revealed context-specific reasoning patterns and expectations for data governance across research scenarios. Key themes for each project are summarised below (full analysis in Supplementary Material 2).

Project 1: Military health screening - Government accountability and scientific rigour

Respondents viewed this research as necessary for service member safety while emphasising the need for government accountability. MOH oversight was supported due to the ministry's dual role as data custodian and health authority, providing "a second layer of credibility." Scientific rigour concerns were prominent, prompting calls for comprehensive datasets beyond genetic markers. However, fairness concerns emerged regarding potential discrimination, with respondents preferring additional health testing over automatic exclusion based on genetic profile.

Project 2: Commercial accountability and national interests

Commercial accountability dominated responses, reflecting awareness of profit-driven data exploitation. Respondents emphasised data sovereignty when foreign entities were involved, viewing international collaboration as requiring enhanced safeguards. AI and technology concerns added complexity. One respondent stated: "Data is the new gold in the future and we should not be giving away any data without understanding the entire purpose." Partnership arrangements and local capacity building were preferred over pure commercial relationships.

Project 3: Privacy risks amplification and international data sharing concerns

The small sample size uniquely amplified privacy concerns, with respondents recognising that rare diseases make individual identification easier. International data sharing

Table 6: Reasons for supporting or opposing MOH review

Position	Reason	Project 1. Data use by MINDEF for NS medical risk prediction	Project 2. Data use by overseas private company for breast cancer screening AI	Project 3. Data use by New York University for rare genetic disease research	Project 4. Data use by MOE for education attainment prediction
Support	There should be government accountability.	128 (69%)	160 (76%)	132 (68%)	121 (68%)
	MOH has the public interest in mind.	102 (55%)	122 (58%)	121 (62%)	98 (55%)
	MOH has the right expertise.	93 (50%)	92 (44%)	96 (49%)	82 (46%)
	Other reason(s)	12 (6%)	25 (12%)	13 (7%)	24 (14%)
Oppose	I do not see the added value.	22 (60%)	14 (56%)	18 (56%)	29 (64%)
	MOH should not spend time or resources on this.	11 (31%)	9 (36%)	12 (38%)	13 (29%)
	I would not want the research to be delayed.	9 (25%)	9 (36%)	7 (22%)	10 (22%)
	Other reason(s)	6 (17%)	3 (12%)	6 (19%)	6 (13%)

Note: N represents the number of respondents who selected each specific reason. Percentages calculated as (N/total supporting or opposing for that project) × 100. Multiple reasons could be selected.

Table 7: Reasons for decision on retaining personal information (Project 2)

Position	Reason	N (%)
Reasons for keeping personal information	Individuals might want to be informed about their cancer risk status.	135 (83%)
	Participants explicitly consented to this, knowing all the potential benefits and risks.	91 (56%)
	It might lead to health benefits.	76 (47%)
	I am not worried about data leaks.	20 (12%)
	Other reason(s)	5 (3%)
Reasons for not keeping personal information	I am worried about data leaks.	57 (77%)
	It is unclear to me whether people have consented to be contacted for this reason.	42 (57%)
	I do not see the added value.	22 (30%)
	Other reason(s)	9 (12%)
	I do not believe this computer program will be helpful for breast cancer screening.	6 (8%)

Note: N represents the number of respondents who selected each specific reason. Total respondents for "keeping" = 164 (69%); for "not keeping" = 74 (31%). Percentages are calculated as: (number who selected this reason)/(number who supported or opposed MOH review for that project) × 100%. As respondents could select multiple reasons, percentages do not sum to 100%. Each project was evaluated by approximately 220-240 respondents (not 453), as each respondent was randomly assigned to only 2 of 4 projects.

triggered significant wariness about overseas access to Singapore data and enforcement challenges across jurisdictions. Despite privacy concerns, life-saving potential was acknowledged, with some advocating expedited processes when lives were at stake. Enhanced security measures, including CCTV monitoring, found strong support despite potential research impediments.

Project 4: Strongest moral objections and social justice concerns

This scenario elicited the strongest moral objections and concerns about social stratification. Core concerns were about labelling children and limiting potential, and some respondents stated that the research should not be conducted at all. Historical parallels to eugenics were drawn, reflecting deep discomfort with genetic-based categorisation. Psychological harm to children emerged as a unique concern, as worries about reduced expectations might affect developmental potential. Even supporters of MOH review emphasised preventing misuse rather than endorsing the research.

Cross-Cutting themes

Acceptance of oversight delays

Across all scenarios, respondents consistently mentioned acceptance of the 2-5 weeks review delay. Rather than viewing

Table 8: Reasons for position on CCTV-monitored room requirement (Project 3)

Position	Reason	N (%)
Reasons for CCTV room requirement	It is important that the privacy of patients is protected.	135 (92%)
	I do not trust researchers from an overseas university.	43 (29%)
	I am not worried about this data protection rule being a hurdle for researchers.	32 (22%)
	Other reason(s)	12 (8%)
Reasons against CCTV room requirement	This would make doing research more difficult.	46 (59%)
	I do not see the added value for data protection.	41 (53%)
	Other reason(s)	17 (22%)
	I am not worried about data leaks.	10 (13%)

Note: N represents the number of respondents who selected each specific reason. Total respondents for “for requirement” = 193 (82%); “against requirement” = 42 (18%). Percentages calculated as (N/column total) × 100.

this as an impediment, many framed it as a reasonable investment in accountability: “A layer of governmental involvement may result in more responsible behaviours from other stakeholders. Delay of 2-5 weeks is a small price to pay for added oversight.”

Data as public property requiring stewardship

Some respondents conceptualised health data as a national resource belonging to Singaporeans that warranted government protection. Statements like “It is our country data, need a watchdog if affects us” and “when using public data, public sector scrutiny is important” reflected the view that MOH has inherent responsibility as custodian of national health data. This was emphasised when private companies were involved: “Any data requested by private organisations/companies should be reviewed by additional ministry as national data is involved. No matter how reputable/established the company is.” This stewardship expectation extended to ensuring reciprocal benefits from data sharing, with respondents questioning why Singapore should share valuable health data without adequate returns.

Discussion

This study demonstrates strong public support (80-89%) for additional MOH oversight of health data use in Singapore, with government accountability emerging as the primary reason. Our findings both align with and extend previous research in Singapore on public attitudes toward health data governance.

Our observation that commercial and foreign entities may trigger heightened scrutiny is consistent with prior Singapore research [11, 12] and international evidence [20, 21]. Our finding that Project 2 (an overseas private company) received the highest support for oversight (89%) appears to corroborate these earlier findings. However, because our study did not include scenarios involving local universities or companies, we cannot definitively attribute this scrutiny to foreignness alone. The nature of the entity, its commercial status, or the research purpose may also have contributed to the observed support levels.

Our study provides novel evidence about procedural costs of governance. While previous studies examined willingness to share data with different entities, few studies directly measured whether oversight delays are viewed as legitimate accountability investments or bureaucratic barriers. The acceptance of 2-5 weeks delays across all scenarios suggests that social licence depends more on procedural justice than operational efficiency.

Finally, our findings on contextual sensitivity extend previous work showing that data sharing attitudes vary by research purpose, user type, and benefits [20, 21]. The contrast between Project 2’s cancer notification scenario (69% accepting privacy risks for direct benefit) and Project 3’s CCTV monitoring (82% supporting despite research impediments) illustrates context-sensitive reasoning that has been theorised but less documented empirically.

Strong public interest mandate for government accountability

Government accountability was the most frequently endorsed reason for supporting MOH oversight, cited by 68-76% of supporters depending on scenario. This consistency indicates an underlying expectation rather than a scenario-specific concern. Respondents framed the 2-5 weeks review delay as a reasonable investment in accountability rather than bureaucratic impediment, with comments emphasising that “a layer of governmental involvement may result in more responsible behaviours from other stakeholders.”

The consistent acceptance of oversight delays demonstrates that SLO operates through procedural justice. Governance legitimacy derives from fair, accountable processes rather than merely favourable outcomes. This validates Singapore’s current TRUST governance requiring additional review for sensitive data, suggesting the process aligns with public expectations. However, support for oversight should not be interpreted as blanket research endorsement. Qualitative responses show that MOH review was viewed as a mechanism for substantive ethical evaluation that could halt or modify problematic research, not merely procedural oversight. In Project 4, strong moral objections to genetic-based educational categorisation coexisted with support for oversight—respondents wanted MOH review precisely because they hoped it would prevent harmful research.

Singapore's high trust in government [11, 22] potentially explains these consistently high support levels. Unlike contexts where government oversight faces suspicion, MOH involvement was viewed as protective rather than obstructive. This contrasts with international evidence showing variable trust in government oversight, where research demonstrates that willingness decreased with higher distrust of the government as an oversight body.[23] Singapore's context creates opportunities for governance approaches that might face greater resistance in lower-trust environments, while also suggesting these findings may not directly transfer to all national contexts.

Contextual sensitivity in data governance preferences

While oversight support was consistently high, qualitative data showed substantial variation in reasoning and concerns. Respondents have applied a consistent threshold for requiring oversight while varying considerably in their underlying rationale across contexts. Three key considerations emerged: (1) foreign and private sector involvement, (2) sensitive population groups and social justice concerns, and (3) directness of personal benefit.

Foreign and private sector involvement

Project 2 garnered the highest support for MOH review, with concerns about commercial exploitation, data sovereignty, and the need for benefit-sharing agreements. The expected increased scrutiny of foreign commercial entities suggests the public applies a risk-calibrated approach to data governance, demanding stricter oversight when profit motives and international data transfers are involved. Commercial entities and foreign institutions triggered demands for stronger safeguards, while domestic government agencies received relatively more trust, though still requiring oversight. This heightened scrutiny aligns with well-documented concerns from past empirical studies both in Singapore [11] and international studies [23, 24] identifying the commercial and profit-driven data use as viewed with greater suspicion.

This differentiation reasonably recognises the distinctive aims of such entities. Companies primarily aim for corporate profit rather than public good. In contrast, foreign non-profit entities may have public good aims such as combatting disease or improving global health but are unlikely to be tailored to Singapore's specific interests. In considering privacy-utility trade-offs, stakeholders are cognizant of which populations may benefit from particular interventions.

Sensitive population groups and social justice concerns

Projects involving potentially vulnerable populations (military personnel, children) or rare diseases prompted concerns beyond data security. Respondents worried about discrimination, stigmatisation, and psychological harm—demonstrating awareness that data misuse extends beyond privacy breaches to broader social justice issues.

For Project 4, respondents questioned not just data protection but the fundamental premise and potential social consequences of the research. They explicitly connected these vulnerability concerns to the need for enhanced oversight, with comments like "Any study that tends to predict/estimate a person's capability should go through layers of reviews before it is given the approval to commence" and "Ethical reasons should be reviewed by government agencies as it has potentially long-lasting impact to the subject participants." Respondents demonstrated sophisticated ethical reasoning in recognising that genetic associations with educational attainment likely reflect complex interactions of genetic, environmental, and social factors rather than direct genetic causation: "Gene sequence did not guarantee academic result. It will also depend on many factors such as social support system, grit, determination, etc."

For Project 3, mathematical privacy risk justified delays: "Because it might be possible to link the data to the individuals since the disease is very rare... 2-5 weeks delay for review by MOH is a small consideration for this sensitivity." This demonstrates that support for risk-proportionate governance stems from identifying specific vulnerabilities and inferring appropriate protective responses, rather than merely abstract preferences for oversight.

Directness of personal benefit

The case study of research offering immediate, individual health benefits (e.g. Project 2 involving cancer screening) generated greater willingness to accept privacy risks than research promising abstract, population-level benefits. Our supplementary questions revealed nuanced public reasoning about risk-utility trade-offs:

- In Project 2's breast cancer screening scenario, 69% supported retaining contact information despite data leak risks, primarily so individuals could be informed about their cancer risk. This demonstrates acceptance of calculated privacy risks when clear personal health benefits exist.

- For Project 3, 82% supported CCTV monitoring despite major research impediments, driven by the sensitive nature of rare disease data and high re-identification risks from small patient population.

- This contrast reflects direct versus indirect benefits. Project 2 offered direct, immediate health benefits through cancer risk notification, while Project 3 promised more abstract, future-oriented benefits. However, qualitative data revealed scepticism about whether such "security theatre" provides meaningful protection, with some respondents suggesting more sophisticated technical solutions.

Such nuanced reasoning challenges binary privacy-versus-utility framings and suggests that one-size-fits-all data protection measures may not align with public expectations for proportional, context-sensitive governance. Our findings suggest that data governance must move beyond privacy-centric models to address comprehensive ethical review. Respondents expected oversight bodies to ensure not just data protection but also scientific validity, social justice, and long-term societal benefit. Comments about preventing "misuse or misrepresentation of data that might be misleading" and ensuring research serves public benefit demonstrated understanding that governance must address the full lifecycle and impact of research.

Implications for data governance policy

In the below, we survey some practical implications of our findings. Here, we return to the concept of the SLO and show how the results suggest certain oversight practices will indeed have a SLO in Singapore. This means that, roughly, such practices would be in line with public expectations and would be deemed acceptable to most stakeholders. Minimally, there would not be much risk of a public backlash to implementing such practices; more substantively, there is some ethical reason to implement these policies in order to respect the values and priorities of the public whose data is being used and whose interests are affected directly by those uses.

At the same time, the existence of an SLO for a given policy does not mean that policy should necessarily be implemented. Even if it is publicly supported, there may be countervailing considerations such as cost, legal ramifications, or impacts on public health that outweigh public opinion. So, for instance, even though there was substantial support for CCTV monitoring of sharing of data with overseas researchers, such an onerous requirement may de facto make many international collaborations infeasible. Further research is needed to explore these trade-offs in more depth in order to translate them to firmer policy recommendations, including methods that enable more nuance and careful considerations such as focus groups or citizens' juries.

Accountability focused governance

The support for government oversight with accountability as the primary driver indicates the Singaporean public expects substantive accountability mechanisms beyond procedural requirements such as technical compliance and privacy protection. This translates to governance systems with visible, enforceable accountability, mandatory public reporting on data access decisions (including approval rationales and rejections), ongoing monitoring of research outcomes, and clear consequences when research violates approved parameters. Such emphasis on accountability in the data domain is in line with broader Singaporean governance norms.[24] Although Singapore has high levels of trust in government, this trust cannot be taken for granted as it is predicated on continued adherence to expectations such as accountability.

The acceptance of 2–5 weeks delays across all scenarios suggests the public values comprehensive review over speed. As respondents may not fully grasp how such delays impact the research ecosystem, this finding should be taken as indicative of public value trade-offs rather than determinative of best practices. Nevertheless, this finding supports the existence of a SLO for implementing clauses for data access permissions that require periodic re-justification of ongoing research value, alongside regular public consultation on governance framework evolution rather than limiting public input to individual research approvals. That is to say, relatively stringent oversight will not risk public backlash due to perceived inefficiencies.

Risk-proportionate oversight systems

The public's willingness to accept research delays for accountability, combined with their nuanced risk assessment, suggests that properly designed tiered oversight systems [25] could maintain legitimacy while balancing both protection and research advancement. For genomic research specifically, proportionate governance policies could promote safe, socially acceptable use that addresses the lifetime persistence of genetic information and potential impacts on relatives [25].

The highest support for oversight in Project 2(commercial overseas entity) indicates SLO for enhanced scrutiny for research involving profit-driven entities: requiring demonstration of public benefit, benefit-sharing agreements, and stronger data use restrictions. International data sharing warrants additional sovereignty protections, enforcement mechanisms across jurisdictions, and clear limitations on secondary use, while commercial-academic partnerships require careful assessment of competing interests and robust conflict management procedures.

Heightened concern for rare disease patients and children indicates support for specialised review addressing re-identification risks through enhanced protection when small sample sizes create elevated privacy risks. Such policies could mandate community engagement and consultation with affected communities [26], particularly for rare disease research [27], while implementing enhanced consent processes for populations with limited capacity or heightened vulnerability to discrimination. Governance bodies must conduct long-term impact assessments for research risking stigmatisation or limiting people's future opportunities, to evaluate consequences that extend far beyond the immediate research goals [28].

However, even "lower-risk" scenarios generated majority oversight support. This indicates that proportionality operates within bounds of minimum acceptable protection rather than eliminating review entirely. Even trusted institutions need to operate with substantial oversight. Arguably, it is those existing oversight mechanisms that helped establish (and earn) high trust [29] in the first place. Relaxing oversight due to high trust risks becoming self-undermining. Instead, effective governance requires maintaining consistent ethical review as a baseline while allowing for risk-proportionate intensification based on contextual factors such as commercial involvement, vulnerable populations, or sensitive data types.

Comprehensive ethical review processes

Our results align with wider recognition that ethical reviews must expand beyond privacy protection to encompass broader ethical evaluation, particularly for research with potential societal impacts [28, 30, 31]. This could include methodological review to ensure research designs can answer proposed questions, assessment of sample size and statistical power to prevent fishing expeditions or underpowered studies, and data necessity assessment requiring justification of specific data elements requested. Outcome measurement plans should establish clear metrics for research success and public benefit demonstration.

Strong concerns about discrimination in Project 4 suggest the existence of an SLO in Singapore to evaluate potential for harmful discrimination against individuals or groups while considering equity implications to ensure research benefits are accessible to communities providing data. Historical context consideration is essential for maintaining sensitivity to past research harms or exploitation [32, 33], while community benefit requirements should ensure research serves interests of data-providing communities rather than external entities alone. Such comprehensive review processes require governance bodies to assess downstream use potential—how findings might be misused or misinterpreted —alongside policy implication review that examines how findings could influence discriminatory policies.

Commercial exploitation prevention mechanisms could establish limits on how findings can be commercialised, while public communication plans ensure responsible reporting to prevent misrepresentation. This expanded scope considers the full lifecycle and societal impact of research, requiring governance bodies to develop expertise across ethics, social justice, and public policy implications. Incorporating these mechanisms may be demanding from a policy perspective but is crucial to protect SLO.

Transparent risk-benefit communication and public participation

Real-time public reporting on approved research, associated risks, and emerging benefits would provide transparency through risk-benefit dashboards offering plain language explanations and outcome tracking mechanisms publicly reporting whether approved research achieved promised benefits. Risk materialization monitoring would provide transparent reporting when privacy or other risks move from theoretical to actual.

Participatory governance mechanisms could include citizens' juries for complex or controversial research proposals and regular public surveys to track evolving attitudes and expectations. Community representation on oversight bodies is important for research affecting specific populations, to ensure that governance decisions reflect the perspectives of those most directly impacted by research.

Limitations

Several limitations should be considered when interpreting our findings. Our results are specific to Singapore's population, which has notably high levels of trust in government compared with European or North American populations [34]. Therefore, the very same activity (such as government review of data access request) which may receive an SLO in Singapore might not be accepted elsewhere. Nevertheless, our analysis may be of interest to those outside Singapore in illustrating the connection between data oversight mechanisms and the SLO; ultimately, meeting public expectations in data oversight will need to be context-sensitive.

Projects 2 and 3 involved only foreign entities, preventing us from definitively separating concerns about foreign access from concerns about entity type or research purpose. Our design was informed by prior Singapore research showing lower public trust in overseas users [11, 12]. We deliberately focused on foreign entities because these represent contexts where oversight is most contentious and critical. Understanding support for governance in these challenging cases is more policy-relevant than examining scenarios already known to have higher public acceptance. Resource constraints also limited the total number of scenarios we could include.

While our results are indicative of good practices, on their own they cannot establish firm policy recommendations. More comprehensive approaches would integrate empirical findings like these with normative frameworks. One such integrative approach to policy is Collective Reflective Equilibrium in Practice (CREP) [35]. CREP draws on the philosophical method of reflective equilibrium, bringing coherence between particular judgements and theoretical commitments, with the key difference of using public intuition or judgement rather than those of the philosopher in the armchair. Public judgements like the results from this study would be an input into the CREP process but subjected to scrutiny including filtering and mapping to more well-established comprehensive frameworks; with the result of policy recommendations that are both publicly acceptable and normatively defensible. A full engagement with an approach like CREP, though, is outside the scope of this paper.

Further, the HOPS panel, while diverse, was relatively well-educated and may not fully represent perspectives across all demographic groups in Singapore, especially those with lower educational attainment. Compared to Singapore's 2020 census [19] where 33% of residents aged 25 and over held university degrees, 54% of our respondents held bachelor's or postgraduate degrees. These demographic differences were not adjusted through weighting in our analyses, meaning our results reflect the characteristics and views of our actual respondents. The overrepresentation of more highly educated and older respondents, along with voluntary survey participation, may limit generalizability to Singapore's broader population.

Hypothetical scenarios may not capture all complexities of actual research proposals, and stated preferences may differ from actual behaviour when faced with real world trade-offs. Our qualitative analysis relies primarily on written comments, which may not fully capture the depth and nuance of respondents' ethical reasoning. Focus groups or interviews might reveal additional layers of concern. In addition, qualitative coding was conducted by a single experienced researcher. While this ensured consistency in coding approach, having more than one independent coders with inter-rater reliability assessment would have strengthened confidence in the thematic analysis. The themes we report should therefore be understood as one interpretation of the open-text data.

Social desirability bias may have influenced responses, especially around support for government accountability and oversight. In Singapore's high trust context, respondents may have felt normative pressure to express support for government review. The consistently high support rates (80-89%), while potentially reflecting genuine attitudes, may partly reflect such bias. We note, however, that the variation we observed across scenarios and the substantive concerns in open-text responses suggest respondents were engaging critically rather than merely providing socially desirable answers.

Stated reasons for support or opposition, while informative about public values, were selected from predetermined response options after participants had already formed positions. We cannot determine which considerations actually drove their decisions versus which justifications they found most compelling post-hoc. More in-depth qualitative methods such as deliberative forums would be needed to understand actual decision-making process.

The between-subjects design prevented examining how individuals trade off values across contexts. High support rates produced small effect sizes, suggesting meaningful differences may exist but were not detected. Within-subjects designs might reveal more nuanced patterns. Additionally, small numbers of opponents per scenario limited our ability to detect meaningful patterns in reasons for opposition across research contexts. These differences in percentages may reflect sampling variability rather than true population differences.

Lastly, respondents were not asked to take into account other costs of government oversight for secondary data use on a case-by-case basis (e.g. financial costs and staff requirements) even though these are likely considerations when deciding whether or not to adopt this form of oversight. Financial costs of additional government oversight were not introduced in the survey questions because they would be difficult to interpret without providing an overview of the overall platform costs. Moreover, while respondents typically accepted 2-5 weeks delays to ensure accountability, these delays were not explicitly associated with other disutilities such as delay in diagnosis or treatment of conditions.

Conclusion

This study demonstrates strong public support for MOH governance oversight of health data research. Government accountability emerged as the primary stated reason for supporting additional review across all scenarios. Respondents' open-text comments revealed concerns extending to scientific validity and social justice, although these were not explicitly asked about in the survey. The consistent acceptance of 2-5 weeks delays demonstrates that SLO operates through procedural justice, with respondents viewing delays as reasonable investments in accountability rather than bureaucratic barriers.

The findings validate Singapore's TRUST governance practices while supporting risk-proportionate frameworks that maintain robust baseline oversight with context-sensitive intensification. As data platforms become critical research infrastructure globally, effective governance must address the full spectrum of ethical concerns identified by an informed public, ensuring oversight serves genuine accountability and social justice rather than merely technical compliance.

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Statement of conflicts of interest

JS is an adviser of AminoChain, Inc., a Bioethics Committee consultant for Bayer and a Bioethics Adviser to the Hevolution Foundation.

Ethics statement

This survey was administered to the Health Opinion Panel Singapore (HOPS). The panel's operations are approved by National University of Singapore Institutional Review Board to be used for public health and ethics studies (IRB ref: LH-18-011). All respondents gave written informed consent before joining the panel.

Data availability statement

Data are available directly from the authors upon request. Please contact the corresponding author, JS.

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