From Consent to Institutions: Designing Adaptive Governance for Genomic Biobanks

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Abstract

Biobanks are increasingly hailed as powerful tools to advance health research. The social and ethical challenges associated with the implementation and operation of biobanks are equally well documented. One of the proposed solutions to these challenges involves trading off a reduction in the specificity of informed consent protocols with an increased emphasis on governance. However, little work has gone into formulating what such governance might look like. In this paper, we suggest four general principles that should inform biobank governance and illustrate the enactment of these principles in a proposed governance model for a particular population-scale biobank, the British Columbia (BC) Generations Project. We begin by outlining four principles that we see as necessary for informing sustainable and effective governance of biobanks: (1) recognition of research participants and publics as a collective body, (2) trustworthiness, (3) adaptive management, and (4) fit between the nature of a particular biobank and the specific structural elements of governance adopted. Using the BC Generations Project as a case study, we then offer as a working model for further discussion the outlines of a proposed governance structure enacting these principles. Ultimately, our goal is to design an adaptive governance approach that can protect participant interests as well as promote effective translational health sciences.

Introduction

In spite of much that has been written on the topic, existing ethical conventions remain inadequate to guide the collection and storage of samples and information held in biobanks (Caulfield et al., 2008; McGuire & Burke, 2008). Existing protections, such as review by research ethics committees, anonymization, and upfront consent, may fail to protect important participant interests, impede the operation of biobanks, and ultimately limit their societal value (Cambon-Thomsen, 2004). We currently have several failures: we cannot promise privacy, nor can we offer a meaningful consent process (Ohm, 2009; Swede et al., 2007; Cambon-Thomsen et al., 2007).

With regard to privacy, current regulations focussed on the protection of the individual can undermine the scientific value of biobanks as donor anonymity forecloses longitudinal data collection. Studies focusing on the relationship between genotype and environmental factors necessarily entail a higher risk of privacy infringement (Asslaber & Zatloukal 2007; Oosterhuis et al., 2003). Moreover, DNA is, by its very nature, a unique identifier of individuals (Lowrance & Collins, 2007; Bjorn, 2008; Homer et al., 2008). The inadequacy of current privacy protections will only increase with advances in genomics and bioinformatics and increasing linkages with health databases around the world (Riegman et al., 2008).

On the issue of informed consent, individuals' consent to participate in biobanks cannot be fully informed because the very nature of biobanks is to collect samples for future research uses that may not yet be formulated (Hansson et al., 2006). Strict adherence to bioethical protocols would thus require that research participants be re-consented for every individual use of their tissue sample or personal data, a process which has been argued to be prohibitive owing to financial and logistical reasons in many circumstances. While proposals to address this problem vary, one common point of agreement is that traditional informed consent requirements need to be loosened for recruiting research participants in biobanks. Lunshof et al. (2008), for instance, propose an 'open consent' model whereby research participants consent to the unrestricted use and disclosure of their health and genetic information, and where researchers make no promises of anonymity, privacy, or confidentiality. They argue that veracity ("telling the truth")

should be the guiding principle in biobanking, preceding autonomy (Lunshof et al., 2008, p. 409).

However, there are problems with proposed measures to broaden traditional informed consent requirements (Hofmann et al., 2009). Veracity is an obvious value that should prevail in any kind of human research but, as the corner stone of ethics in biobanking, it accomplishes too little. Without additional measures, open consent neither ensures congruence between donors' values and the use of their samples, nor does it provide accountability to donors. Other commentators thus stress the need for a more fine-tuned approach to meeting the expectations of participants. In a tiered consent approach, for instance, participants could be offered a menu of options pertaining to future research uses, request to re-consent, interest in returning results, or data sharing options (McGuire & Beskow, 2010; Mello & Wolf, 2010). The extent to which participants understand these options, or the researchers are able to uphold the promises made by diverse participant selections (both from a financial and data management perspective), remains to be seen (Ormond et al., 2009; Lemke et al., 2010).

While these are stimulating proposals to explore, we argue that fine-tuning consent is unlikely to resolve the ethical conundrums surrounding biobanking. Rather, more robust promise lies in institutional arrangements and qualities that can adapt to changing needs and circumstances in ways that are acceptable to multiple stakeholders. Indeed, there has been increasing attention to identifying solutions to the ethical, legal, and social challenges posed by biobanks on a level of governance (Kaye & Stranger, 2009).

However, little scholarly literature has explored the common theoretical foundations upon which such governance mechanisms should rest. Our purpose in this paper is to provide a starting point for this debate. We propose a series of four normative principles that might form a foundation for the development of governance structures for particular biobanks. We ground our discussion of governance by considering how these principles might be operationalized in a particular example of a Canadian longitudinal cohort study: the British Columbia (BC) Generations Project.

Principles of Biobank Governance

Several recent contributions raise alternative conceptions of participant involvement in biobanking (Trinidad et al., 2011; Ludman et al., 2010; Solbakk et al., 2009). Significantly, Caulfield et al. (2008) state that the key to resolving the ethical problems inherent in biobanking lies in appropriate governance. But what should such governance look like? What should the guiding principles be, and how should they be incorporated into institutional structures? Here, we propose four ideas (or "principles") to guide the implementation of biobanking governance structures: (1) recognition of participants as a collective body, (2) trustworthiness, (3) adaptivity, and (4) fit between the nature of a biobank and the specific structural governance elements. The four principles clearly overlap, and work in concert to help produce what we call *adaptive governance.* While we maintain that recognition of these four principles is necessary for achieving ethical and effective operation of biobanks, they are not sufficient. There are issues such as intellectual property and community specific needs (for instance, involving identifiable communities or those with particular views of biospecimens), that may require additional components of governance, but are beyond the scope of this paper.

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Principle 1: Recognition of research participants and publics as a collective body

Biobanks pose significant challenges to laws, policies and practices intended to protect the individual. Captured under the notion of research ethics, these conventions are necessary to protect individual participants from personal risk incurred in the pursuit of more general benefit (Emanuel et al., 2000). This individualist orientation reflects an interest in protecting individual liberty from impositions of the common good in liberal societies (Kass, 2004). However, with biobanks, the pivotal role of individual research protections has come into question: collectives of different kinds must now be considered (Winickoff, 2007).

The moral standing of biobanks as collectives emerged with force around genetics research on so-called "identifiable communities" and "genetically distinct groups," and helped give birth to the ideas of group consent and community consultation. In the course of the well-documented failures of the Human Genome Diversity Project, community participation in governance of population genetics projects emerged as a central concern (Reardon, 2005). While the mechanisms for community consultation ultimately failed to satisfy many indigenous groups within the Human Genome Diversity Project, "community consultation" has survived as an important norm in population genetic research projects (Foster et al. 1999; International HapMap Consortium, 2004). The notion still struggles, however, to solve ethical and legal problems of providing legitimate group representation (Burgess & Brunger, 2000; Juengst, 2000).

More recent work on biobanking governance has argued that the collective of research participants—whether an "identifiable community" or not—deserves benefit-sharing and power-sharing as a matter of fairness and operational management (HUGO Ethics Committee, 2002; Winickoff, 2009). This argument can be further extended: participants in many biobanks will vary in terms of group identity and unity of voice, but whether participants as a group have moral standing or deserve group benefits cannot depend on this cohesiveness. The biospecimens and associated data sourced from donors constitute a form of informational and biological capital, which collectively constitutes the major resource of the biobank. As a result of this collective constitution of the material of the biobank, they are entitled to be involved in decisions regarding allocation of biobank resources. The interest of participant collectives in decisions is most apparent in the case of disease group biobanks, where members have retained legal control of biobanks in order to drive research goals of the resource (Terry, 2003).

When large-scale and publicly funded biobanks are at issue, the relevant public extends beyond the participant group to include the broader society. Biobanking research is not like other state-supported biomedical research for which informed consent and local review board consideration might adequately protect the interests in play. Large state projects take on a civic character. They are not simply research on humans, but represent significant public investment and interests. For this reason large state projects such as UK Biobank and the US National Children's Study initiated public dialogues on these projects.

It is worth noting, though, that initiating public engagement does not in and of itself constitute meaningful incorporation of relevant values or interests in biobank governance (Castle & Culver, 2006). Public engagement can take many forms, varying in the degree to which publics are empowered, and ranging from simply informing to full power-sharing (Rowe & Frewer, 2005). In the context of biobanks even projects that have arguably implemented very comprehensive public dialogues (e.g., UK Biobank, where part of the mandate of the Ethics and Governance Council is to advise on the interests of UK Biobank's research participants and the general public), there are not always clear institutional mechanisms whereby the collective interests of participants and/or publics are represented in an ongoing manner.

"Community representatives" are often involved on scientific review boards, data review boards, and ethics review boards. However, typical community advisories and members often: (i) are chosen arbitrarily; (ii) are restricted to particular roles (e.g., lawyer, consumer advocate, etc.); (iii) lack independence or are subservient to expert management; (iv) are insufficiently transparent and accountable to a larger public; and (v) ultimately, fail to enhance trust from donors or the public. Adaptive governance would thus need to consider a model for recognizing the moral standing of biobank participants in a manner that protected against these known challenges, including developing a strategy for clear decision-making authority.

Principle 2: Trustworthiness

As outlined above, previous informed consent requirements and guarantees of privacy protection can often not be met in research involving biobanks. If previously more stringent requirements for consent and privacy are to be replaced with an increased emphasis on governance, then effective biobank governance requires that strong relationships of trust exist between the biobank owners/implementers and donors and the wider public (Hansson, 2009; Hawkins & O'Doherty, 2010). As has been demonstrated, lack of public trust leads to a lack of support and participation, which may translate into activities being stopped or abandoned (Luhmann, 2000).

Such relationships of trust do not occur spontaneously, but require active management (Yarborough et al., 2009). Critically, we are not suggesting that biobank owners or managers seek to manufacture trust in individuals or communities, but rather that they seek to implement governance mechanisms such that the biobank is deserving of the public's trust. In other words, a sustainable ethical framework for biobanking that relies on governance as well as consent must be supported by institutional structures that are *worthy of trust*.

We can draw on several lessons from stewardship and principles of good governance to infer characteristics of trustworthy governance (Graham et al., 2003). Commonly mentioned conditions are listed in Table 1. As discussed below (in "Fit"), how each of these characteristics is operationalized depends on the specific circumstances of the particular biobank.

TABLE 1

Commercial aspects of biobanks are probably one of the most contentious issues for participants and publics (O'Doherty & Burgess, 2009). Poorly managed, there is a high probability of loss of public trust and support in biobanks if there is a perceived disconnect between priorities (public health benefits versus profit motives) (Haddow et al., 2007; Anderlik, 2003). The utility of biobanks depends on their longevity and productivity; it is inevitable that public biobanks will consider commercial involvement. The form and extent of these arrangements are likely to develop and change over time, but given the contentiousness of the issue, the particular commercial arrangements of any given biobank should adhere to the trustworthy governance conditions set out above. By corollary, any public policies for biobank governance will apply to private enterprises; arguably, to build trustworthy governance, these organizations should incorporate representation of research participants and/or publics, not just those with a stake in potential profits, into governance decisions.

Principle 3: Adaptivity

Existing research ethics and regulatory review most often occurs at the beginning of the research endeavor. However, this one-time review model is no longer optimal for biobanks, which are highly dynamic. "Game-changing" developments have already occurred in (a) technologies enabling genomics including information technologies, genetic and genomic scans, and statistical and searching tools that render genome-wide

data identifiable; (b) institutional configurations, including the constellation of for-profit and non-profit entities; (c) regulations and research norms, and (d) public climate. Accordingly, it has been suggested that regulations of biobanks should not be approached as a once-off implementation, but as an ongoing process (Rynning 2009). In addition to the range of recognized and well documented problems inherent in biobank governance (e.g., intellectual property, consent for secondary use, withdrawal of consent, return of results, data sharing, harmonization with other biobanks), further issues will inevitably arise that may or may not be anticipated. Effective governance of biobanks must respond to emerging issues while maintaining trustworthiness.

Effective biobank governance must thus be *adaptive* in this dynamic environment. This requires an integrated framework allowing governance to evolve in ways that are fair and respectful of participants and their interests, as well as broader constituencies, while facilitating the effective working of the biobank as a valuable resource. Ethical issues unanticipated at the time of consent and establishment will require policy solutions, which will test governance structures. Governance structures constituted at the outset of the biobanks may thus need to contain an element of reflexivity, and employ engagement strategies to get further participant input if the original intent or scope of consent has changed meaningfully (Hunter & Laurie, 2009). Innovative governance and engagement strategies are needed to assure the collective value of the resource is not held captive by a contractual interpretation of informed consent documents.

Principle 4: Fit: Making governance appropriate to the particular biobank

Biobanks are diverse. For example, a collection based on a single Aboriginal tribe is fundamentally different from a national cohort study of 500,000 or a proposed set of research uses for newborn screening bloodspots (Kaiser, 2002; Maschke, 2005). These differences may have important implications for designing appropriate governance. We suggest that particular attention should be given to several factors:

1. Who initiated a particular biobank, and how was this achieved? A biobank composed of biospecimens from hospital pathology departments collected for clinical purposes without consent for research purposes is different from a biobank that was initiated by a patient group to facilitate research into a particular disease.
2. What is the intended purpose of the biobank? Different governance structures may be required for biobanks intended to facilitate research into particular diseases versus population-based biobanks intended to facilitate research on a much broader level.
3. What kinds of data or specimens will be included in the biobank? Different kinds of data have different implications with regards to identifiability and potential privacy infringement.
4. Are samples linked prospectively or retrospectively? This has implications for both informed consent and privacy. Public engagement studies suggest that people are less likely to insist on requiring consent for the use of de-identified or anonymized specimens for research when they are derived from retrospectively linked biobanks. In contrast, however, research participants are likely to insist on appropriate consent and governance protocols for prospectively linking samples in biobanks. (O'Doherty et al., Unpublished results)
5. What populations are included in the biobank? In cases where biobanks are focused on specific ethnic communities, particular patient groups, or other easily identifiable groups, governance structures may need to take this into account. Certain historically disadvantaged groups may require different levels of participatory governance and oversight (Pullman & Arbour, 2009).
6. How is the biobank funded? Although commercial involvement in health research is common, the way in which this is managed may have important implications for biobank participants and the public. Second, if researchers are charged access fees for biobank resources (whether for cost recovery or profit), consideration needs to be given to benefit sharing, particularly if biospecimens have been donated by an identifiable collective. A third issue to consider is the planned funding longevity of the biobank and how to manage samples and data once funding for the biobank ends.

7. What is the size of the biobank or cohort? Smaller, local, disease based or longitudinal studies may more readily re-contact individual participants for consent to subsequent studies or further data collection.
8. What is the degree of social cohesion/political identity among the research participants? If this is high, finding participants who can represent the collective may be relatively easy. If cohesion is low, such a representative group may still be constructed, but it would require additional planning (Burgess & Brunger, 2000).
9. What is the reach of the biobank (e.g., is it hospital based, national or international)? Whatever governance structure is established for a biobank, it will need to conform to local laws. If the biobank crosses legal jurisdictions, consideration must be given to how such issues as privacy protection, commercialization, etc., are managed in a way that conforms to all relevant requirements.
10. Finally, what is the anticipated access for research that will be granted? Will the biobank be 'private' with access granted only to individuals within the institution, or will it be 'open access'? If it is a publicly funded biobank, will access be given to industry? How might these statuses change? For example, a biobank that started as an investigator initiated resource may become linked to national and international resources in unanticipated ways (Hofmann, 2009; Asslaber & Zatloukal, 2007).

Setting up appropriate governance for a biobank is thus very dependent on the nature of the biobank in question, and a "one-size-fits-all" governance approach should be avoided. It is also important to note that the principle of "fit" intersects with the other principles outlined above. In association with adaptivity, for instance, the particular nature and purpose of a biobank may change over time. The points for consideration listed here may thus need to be revisited periodically as part of adaptive governance.

Enacting the Principles of Adaptive Governance: Institutional Structures and Mechanisms

While the development of accepted principles underlying sustainable governance of biobanks is important, equally important is the design of specific mechanisms that allow their enactment in practice. Given our discussion of the final principle of fit, it is evident that stipulating one particular model of governance for all types of biobanks is neither feasible nor desirable. Nevertheless, it is important to bring a level of specificity to this discussion. The aim of this section is therefore to specify the context of a particular biobank that allows for consideration of relevant factors outlined in 'Fit', above, and to develop a set of institutional mechanisms and structures that allow for the enactment of the other three principles of adaptive governance. We offer this not so much as a normative stipulation for good governance, but rather as a working model, open to critique, further reflection and refinement.

BC Generations Background

We focus our discussion of a working model of adaptive governance on the parameters of a particular biobank that is in the process of being established in British Columbia, Canada. Our proposed governance model is formative and has not been implemented at this point in time. The *BC Generations Project* aims to investigate how lifestyle, environmental and genetic factors contribute to cancer and other serious diseases in B.C. The project intends to recruit 40,000 individuals and is part of a larger national study (Canadian Partnership for Tomorrow) to enroll approximately 300,000 individuals from

across Canada (Borugian et al., 2010). The longitudinal cohort study will track participants for 25 years, periodically assessing a variety of health measures including collection of biospecimens, physical measurements and lifestyle questionnaires. Participants' health outcomes will also be followed through provincial and federal health registries. The project will become a major resource for clinical, epidemiological and basic health research, providing the basis for developing better prevention and screening programs in Canada, and ultimately reducing morbidity and mortality (www.bcgenerations project.ca).

In brief, our case study thus involves a biobank for which samples are collected prospectively from a longitudinal cohort. Access to the biobank and data will be available to multiple research projects and agencies. The biobank will initially be started at a provincial (state) level, with the anticipation of linking it to:

a) health records and other (disease based) biobanks on a provincial (state) level
b) other longitudinal cohort studies in other provinces to form one large nation-wide collection.

Institutional Structures and Mechanisms for Adaptive Governance

We propose a tiered approach to governance in which different social and practical issues can be addressed at different levels of the governance structure. Figure 1 illustrates the different levels at which research participant input or public engagement can occur, with the idea that a decision could engage different participatory levels, depending on the complexity, interests, and potential controversy. The overall governance structure would

require several component elements and processes, the most important of which we outline here.

FIGURE 1

A Board of Directors and Management Team

Biobanks often have dual status as research studies in themselves, as well as platforms or even institutions that support ongoing research. Thus, terminology and concepts traditionally employed in research settings (Investigator) need to be supplemented with those relevant to the management of institutions (Manager). Without going into detail, we presume there will be a management committee, and recommend that this committee reports to a Board who develops and maintains a mandate for the biobank. Board membership is likely to be constituted by leaders of the scientific project, but may be supplemented by relevant stakeholders or members of the health community or relevant government agencies (e.g., Health Canada, Office of the Privacy Commissioner, etc.). The main issue we want to emphasize is that there to be direct participant representation at this Board level.

Participant Bodies

Management of the biobank is very likely to benefit from the input of the research participants. However, the way in which such input is garnered is not simple or even self-evident. Patient or community representatives are often recruited from personal contacts of those involved in the enterprise, reflecting a bias toward people likely to support

decisions of the management group. Further, community or "lay" representatives are typically without resources to engage the broader community, leaving them to personal opinion informed by the experts, media and others they happen to encounter. We thus suggest there be a *Participant Association*, which will elect a *Participant Board*. While both the Participant Board and the larger Participant Association have the potential to contribute to governance in various ways, it is principally members of the elected Participant Board that contribute to governance in an ongoing and routine manner.

The Participant Association should include all biobank participants who choose to be involved, with funding provided by the biobank to support participant meetings. Project websites and occasional electronic newsletters can help to keep members informed and motivate the community of participants. Members of this Participant Association would select a Participant Board, a group of representatives who are interested in governance and willing to act as a channel between biobank governors and participants. This body of elected representatives would meet as needed and supply members to serve on other biobank committees, such as ethics advisory boards, scientific advisory boards, data access committees, and the Board of Directors.

To ensure participation on the Board of Directors, one or two members should be elected as executives of the Participant Association and as regular members of the Board with a term of 2-3 years. These elected representatives should be paid honoraria to recognize the commitment of time to attending meetings, reading background materials and engaging the Participant Association as well attracting participants to represent the Association.

The elected representatives will be supported by the biobank staff to organize small regional meetings, in which participants and members of the public can comment on specific issues. Although brief reports can be made at these meetings, more detailed background materials can be provided online and also sent to those donors who request them. Regional meetings should involve management or technical advisory people who can answer questions, be publicly advertised, and include an external observer from either an ethics review board or the Provincial government to act as a link to ongoing regulatory review.

Consent process

Participants would be asked to consent to a governance process as part of the consent to participate in the biobank. The consent process would include explicit invitations to participate actively in governance and follow biobank activities in newsletters/web forums. The adaptive mechanisms would be made clear, including an explanation that the Board of Directors, which includes participant-members, has the authority to change existing policies and procedures. The entire participatory governance process would be characterized in an Appendix to Consent that could be kept for future reference.

Periodic Review

Withdrawals from the biobank or particular projects would be tracked by the management committee and reported to the Board. Withdrawals will be reviewed by the Participant Board to determine whether the Participant Association should be informed of concerns or whether changes need to be made to address underlying issues.

The governance of the biobank and the activities of the Participant Association should be reviewed (possibly two years after initiation, and periodically thereafter). The activities, contributions to policy decisions, budget and satisfaction level of participants, management and researchers accessing the biobank should be assessed, and the Participant Association given an opportunity to make suggestions about how their activities could be improved or modified.

Broader Public Engagement

In order to assess and enact the entitlements of donors and publics, two questions need to be answered: first, which collectives need to be considered; second, how should consideration be implemented. Regarding the former, it seems that broad participation from biobank collectives should be encouraged, and in different forms. Regarding the latter, the theory and practice of deliberative democracy has given rise to models for involving collectives (Collins et al., 2003; Irwin, 2001), which has been implemented in some instances (Avard et al., 2009; Tutton & Corrigan, 2004; Burgess, et al., 2008; O'Doherty & Hawkins, 2010).

Though they may coincide or overlap in certain instances, there is a difference between the interests of research participants in a biobank and broader social interests. Considering these in the context of a particular biobank should inform whether and what kind of public representation or engagement is required. Our brief consideration here is driven by two questions: (1) What public interests are not captured by the participant association? (2) Where does accountability lie for these interests? An example of a

perspective that a participant organization may not be able to represent is when commercial involvement might enhance one kind of research over others. The partnership between the biobank management and the Participant Association might constitute too narrow a perspective to represent public interests about systemic effects of commercialization on the nature of the biobank and its ability to sustain public trust.

Broader public representation or engagement may also be important when some participants disagree with the direction or decisions of a biobank. It is important to note that individual withdrawal or refusal to consent only protects from some direct personal risks or registers individual objections as a kind of conscientious objection. Such individual actions are unlikely to have much of an effect in voicing objections about the social effects of the biobank or particular research (i.e. the withdrawal of individual samples will not prevent the research from continuing or the formation of the biobank). It thus seems that these kinds of issues may require input from publics beyond those individuals already involved in the biobank as participants.

This raises the issue of locating accountability for assessing public interests, investment and lost opportunity costs related to biobanks. Since funders routinely manage opportunities across different types of research, they seem a more appropriate location for accountability related to merit and opportunity costs than particular biobanks or ethics committees. However, funders are typically focused on a particular range of research (e.g., public health research, social science research, cancer research), and are unlikely to assess across social priorities. Most funders also can reasonably be expected to have a

very favourable attitude toward facilitating research, thus creating a conflict of interest when attempting to evaluate spending on research versus other social priorities. Similarly, research ethics committees may be appropriate in assessing the ethical acceptability of particular studies or research platforms, but are less appropriate in assessing the merit of large scale funding for certain biobanks versus other social priorities. Indeed, the most difficult accountability to achieve is related to wider social priorities.

Some empirical work in deliberative democracy has directly confronted the issue of whether a deliberative forum of informed citizens from diverse backgrounds can produce meaningful assessments of the social implications of biobanks. Participants in these events consistently produce strong support for the existence of biobanks, despite being presented with strong arguments against them (Burgess et al., 2008; O'Doherty & Burgess, 2009). Informed, deliberative engagement distinguishes participants from the population from which they are drawn and may be less representative of the populations' non-deliberative views. Policy makers must decide whether they want to give preference to informed deliberative assessments or popular opinion. At this time it seems that opposition to biobanks is well represented through various stakeholder groups (e.g., privacy advocacy groups). The question of social priorities, however, is not so easily addressed. Representation of broader public interests within biobank governance will provide greater transparency and accountability, thus enhancing trustworthiness and may, in exceptional circumstances, be necessary to consider competing social priorities.

Adaptive Governance

The institutional structures and mechanisms outlined above are intended to satisfy the four principles of biobanking governance described previously. In brief, the structural incorporation of participant interests into governance in the form of the participant bodies would constitute formal recognition of the collective status of participants (first principle). Second, by holding management accountable through existing mechanisms such as research ethics boards (institutional review boards), a scientific oversight committee, and privacy laws, but also through the additional mechanisms of elected community and/or participant representation at the Board level, the foundation for *trustworthy governance* can be laid. Third, by having mechanisms that allow for continuing communication between management and the donor collective as a whole, a reflexive element is added to the governance structure to allow it to *adapt* both to changing material and societal circumstances, as well as providing for collective participant sentiment to influence the operation of the biobank mechanism (third principle). Finally, the particular structural mechanisms of the governance model outlined above potentially *fit* the parameters of the type of biobank exemplified by the BC Generations Project (fourth principle). Some points are worth noting: given the size and provincial/national scope of the project the stakes are sufficiently high to warrant resources to support participant bodies and ongoing public engagement; as sample collection is prospective for research purposes there is scope to engage participants in the research endeavour from the start if they so choose; and low political or community cohesion among participants (given that they are recruited from across an entire province)

suggests that new structural mechanisms need to be constructed to recognise the collective capital of the donor body.

While we are cautious in claiming broad applicability of the model of institutional structures and mechanisms presented above to all kinds of biobanks, aspects of the model may be useful to a range of biobanks other than the BC Generations Project. In particular, versions of our tiered approach to governance may be useful in promoting collective standing, trust, and adaptivity in a variety of contexts. The tiered approach also has the practical advantage in that various issues may be dealt with at a higher level of management and only escalated to broader levels of participation if warranted by the degree of controversy or the degree to which a proposed activity diverges from the original mandate of the biobank. For instance, whereas traditional studies might require the re-contacting and re-consenting of samples for a new study, this tiered approach would allow the management committee to make the data access decision for studies that are well within the original mandate; in cases where there is a minor deviation, the Participant Board could be consulted; only in unusual cases or data access requests that involved major deviations from the original research mandate might the full Participant Association be involved (e.g., via a special meeting); finally, in very exceptional circumstances a deliberative public engagement might be conducted to add input from the general public into a decision. We thus see our proposed model of biobank governance as providing not only more protections for individual and collective interests, but also being more efficient in implementing ethically sustainable decisions. Significantly, if it is

considered as an alternative to re-consenting tissues for use in every new research project, this approach may also be associated with substantial cost savings.

Although the Participant Association cannot replace the informed consent requirement, it can provide an intermediate mechanism for supporting decisions about which biobank activities require new informed consent from individuals, and providing donor and public input without the costs and work associated with re-consenting. Further, some group decisions made by participants will be based on listening to concerns and expectations of many participants and the management team. This promotes the recognition that biobanks are intended to promote collective interests. Assuming this orientation and process are not manipulated, the collective focus of a participant association and public representatives is consistent with the collective interest emphasis that supports the creation of biobanks.

There is the risk that a participant association and public representatives could be superficially engaged without any real effect on the management of a biobank, yet the biobank management gains some legitimacy from the participants having genuine decision-making power (Buchanan et al., 2008). There are several possible sources of power for a donor board ranging from a formal legal basis (such as a corporate constitution) and representation on the Board of a biobank, or recourse to more informal power such as communication with participants or with institutional ethics review committees. If a biobank has a board with stewardship responsibilities, the Participant Association could have voting members on the board as suggested above. Alternatively,

the board could be structured to report to the Participant Association who could be assigned custodianship of the biobank (this might be appropriate in "grass roots" or community initiated biobanks). The biobank could have a constitution that ensures compliance with a mandate that would provide the Participant Association with a platform for assessment. Less directly, the Participant Board may exercise power by advising members of the Participant Association to withdraw as individuals from the biobank, or by advising Research Ethics Boards that they need to review the biobank. Where the scale of the biobanks justifies the investment, a website with participant and public webpages for information and discussions could serve to widen the base of information and transparency related to participant and public concerns.

Conclusion

We have constructed a set of normative arguments beginning with the observation that biobanks constitute an attempt to structure a research resource or platform with the objective of multiple and sometimes population based benefits. This is different from recruiting to an individual research project in which reasonable risk is assessed against a single research objective and the analysis then described for participants' informed consent. The unspecified nature of research that could be based on the biobank means that the risk-benefit assessment is open-ended and participants cannot therefore provide informed consent. Both the principles of governance and the specific governance model outlined here suggest that biobank participants agree to donate based on a proposed means of making decisions about when the biobank can be used for research, and a

process for identifying when it is important to provide the donors with an opportunity to re-assess. Further, because biobanks require large public investment and enable research that will shape the future of health care and notions of health, broader society may have a strong interest. And, given the shifting nature of the associate technology and knowledge, and the difficulty in engaging diverse publics when their interests are not obvious, the governance of a biobank should also ensure that as wide as possible a range of public interests are considered.

There are no perfect responses to the complex issues and evolving nature of the science and technology associated with biobanks. Standards of privacy, secrecy or consent will continue to be challenged by the evolution of biobanks and related research. While there are clearly matters of significant legal and ethical substance, it seems evident that dynamic, adaptive governance is required. In this context, careful assessment of experiments with different forms of governance holds the most hope for balancing protection of participants with the development and distribution of benefits derived from research using biobanks. While some individual biobanks are already enacting interesting and progressive forms of governance, we hope that our discussion of the principles of adaptive governance contributes to further engagement with the issue, and will ultimately lead to the establishment of best practice guidelines across the broad spectrum of research endeavours supported by biobanks.

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Tables and Figures

Characteristic	Example
Representativeness	Consideration of the full range of donor and public interests.
Accountability	Ability to audit data use and management within biobank; repercussions when violations occur.
Transparency	Overview of operations and decision making are open to scrutiny.
Reflective Practice	Regular review of policies and biobank use including assessment of fit with original intent, approvals and consents.
Sustainability	Consideration of the long term financing and management.

Table 1: Necessary conditions for trustworthy biobank governance

Figure 1: Tiered Approach to Participation to Address Escalating Decisions of Increasing Complexity or Disagreement

1. Participant and Public Representatives on Executive or Management Group
2. Participant Board
3. Participant Association
4. Deliberative Public Engagement