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Authors

Anderson, Nicholas
Bragg, Caleb
Hartzler, Andrea
et al.

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Participant-centric initiatives: Tools to facilitate engagement in research

Nicholas Anderson [a,b,*], Caleb Bragg [c], Andrea Hartzler [a], Kelly Edwards [a]

[a] Department of Biomedical Informatics and Medical Education, University of Washington, Seattle, WA, USA
[b] Department of Bioethics and Humanities, University of Washington, Seattle, WA, USA
[c] Applied Health Sciences, Wheaton College Wheaton, IL, USA

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ABSTRACT

Clinical genomic research faces increasing challenges in establishing participant privacy and consent processes that facilitate meaningful choice and communication capacity for longitudinal and secondary research uses. There are an evolving range of participant-centric initiatives that combine web-based informatics tools with new models of engagement and research collaboration. These emerging initiatives may become valuable approaches to support large-scale and longitudinal research studies. We highlight and discuss four types of emerging initiatives for engaging and sustaining participation in research.

1. Introduction

Despite increasing capabilities in technology and analytic perspectives, translational researchers still face familiar challenges in generating successful trials and studies (Collins, 2011). Both in the US and internationally, slow recruitment and limited retention of research participants can hinder the research process (Sung et al., 2003; Center for information and study on clinical research participation (CISCRP), 2012; Gottweis et al., 2011). Participation and engagement are further limited within some marginalized socioeconomic or cultural groups (Gottweis et al., 2011; Bowen and Penchaszadeh, 2008; Wynia and Gamble, 2006; James et al., 2008; Bussey-Jones et al., 2010). In parallel, human subjects' research regulations in the U.S. and E.U. pose ethical and public relations challenges (Silverman et al., 2001; Fullerton and Lee, 2011), with many researchers and institutions preferring to use de-identified datasets to limit responsibilities and liabilities. Against these common research challenges are evolving new modes of data sharing and collaboration, including research networks and increasingly coordinated access to large-scale resources such as biobanks or clinical data warehouses. These innovations also increase the complexity of coordination, accountability, preference management, and researcher–participant communication (Fullerton et al., 2010; Heeney et al., 2011; Kaye et al., 2009; Mascalzoni et al., 2008; McGuire et al., 2011; Ludman et al., 2010; Harmon, 2010). The ability to leverage communications technologies such as social media may ameliorate some of the traditional roadblocks to broad patient participation in health care (Trinidad et al., 2011), and similar approaches provide new models for engaging participants in the research process and facilitating researcher–participant collaboration. In clinical settings, decision aids have been evolving to support patients' self-education and decision support as components of their participation in therapeutic paths, and these methods can now also play a part in research (Swan, 2009). As these technologies and challenges intersect, a range of public/private participant-centric initiatives illustrate how information tools can expedite translational research. We highlight four emerging types of initiatives that illustrate evolving approaches of participant engagement and the use of informatics-based tools to expedite translational research.

2. What are patient centric-initiatives?

Participant-centric initiatives (PCI) are tools, programs, and projects that empower participants to engage in the research process and, in many cases, can differentiate between a range of diverse preferences and needs. Although current U.S. and E.U. human subjects' regulations permit secondary research on de-identified data and biosamples without further participant contact or consent (Fullerton and Lee, 2011), cautionary tales demonstrate that people feel that they are marginalized if they are excluded from the research process (Ludman et al., 2010; Harmon, 2010). For example, some research participants are not concerned about what happens to biosamples that have been collected from them for research, yet many participants have concerns about their lack of involvement in data sharing for secondary research use (Trinidad et al., 2011, 2010; Brase, 1998). Diverse preferences need dynamic tools to manage them, and one-size fits all approaches such as waivers of consent or "broad consent" are increasingly under significant critique (Simon et al., 2011; Sheehan, 2011; Hansson et al.,

* Corresponding author at: University of Washington, 850 Republican St, Box 358051, Seattle, WA 98109, USA. Tel.: +1 206 685 0249; fax: +1 206 685 7515.
E-mail address: nicka@uw.edu (N. Anderson).

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2006). PCI facilitate opt-in and opt-out approaches, where participants can make enquiries about their level of engagement in studies.

Given this complex social climate of regulatory challenges, participant desire for greater control, and advancing scientific needs, our current regulations may provide a baseline for research practice, above which methods that support greater connection with participants may be beneficial. PCI offer the potential to communicate with participants and in some instances, mediate participants' active control and choice within diverse research contexts. Conceptually, PCI facilitate a shift from a negative right to privacy, where researchers protect identity by promising anonymity or de-identification, to a positive right to privacy, where participants are given active control over who sees their data and in what contexts (Warren and Brandeis, 1890). Although further research is needed to demonstrate the impact of increased participant control afforded by PCI on recruitment and retention, we can anticipate that the shift to more participant control will address some concerns expressed by privacy advocates about data used for research (Trinidad et al., 2010). Furthermore, where some disenfranchised groups have been historically mistreated at the hands of researchers, the hypothesis is that increased control and enhanced communication opportunities will improve transparency to the point of encouraging participation (Bowen and Penchaszadeh, 2008; Wynia and Gamble, 2006; James et al., 2008; Bussey-Jones et al., 2010).

A growing evidence base of patient-centric health initiatives, decision-support research (Brase, 1998), and participant managed research enterprises provides a range of alternative models from which to learn (Genetic Alliance, 2012; Sharp and Landy, 2010; Kaye et al., 2012; Corradetti and Mascalzoni, 2012; Weitzman et al., 2011; Wicks et al., 2010). In two recent international "state of the science" meetings, emerging tools for participant-centered informatics approaches used in research-based initiatives were discussed (Kaye et al., 2012; Corradetti and Mascalzoni, 2012). In light of these emerging tools, we created a framework to characterize four approaches utilized within the tools with some tools incorporating more than one approach (Fig. 1).

There are many PCI tools that directly contribute to research but which fall outside of the criteria of this paper because they focus primarily on empowering patients in their medical care. Examples include social networking tools like Inspire.com and TuDiabetes (Wicks et al., 2010), and participant-driven survey databases, such as CureTogether.com. These tools contain large amounts of detailed personal data and represent a resource for researchers to discover new research questions, find potential participants, and analyze the effectiveness of treatments. However, these tools aim primarily to empower patients in their medical care rather than the research process. Our review is by no means exhaustive, but rather an analysis of promising initiatives that offer the research community several options for consideration.

2.1. Finding the engaged participant through intermediation: participant–researcher 'matchmaking' tools

A range of potential factors may affect consideration of participation in research, including prior participation in research and existing relationships with researchers, involvement of trusted leaders, and trust in the organization (Gottweis et al., 2011; Bowen and Penchaszadeh, 2008; Wynia and Gamble, 2006; James et al., 2008; Bussey-Jones et al., 2010). Although a majority of US residents (77%) say that they would consider becoming involved in a research trial, only 10% of those eligible to participate do so (Center for information and study on clinical research participation (CISCRP), 2012). Many are not aware of research opportunities (unpublished results, NWABR 2012). European residents vary considerably in consideration of contribution of data or samples to a biorepository for research purposes, with "93% of Icelanders and 82% of Norwegians could imagine providing information to a biobank, but only 25% of Latvians or 35% of Austrians are likely to do so" (Gottweis et al., 2011). Some common barriers to recruitment include lack of participant incentives, privacy concerns, complex and confusing consent forms, differences in cultural norms, and lack of public knowledge about the potential for participation. One possible solution is more active facilitation of connections between willing volunteers and searching researchers, and enhanced communication structures that support these potential relationships. Matchmaking tools do so by acting as intermediators that draw together researchers and participants. For example, participant-driven clinical registries, such as ResearchMatch.org, TrialX.com, and EmergingMed.com enable willing volunteers to enter personal information (e.g., age, sex, conditions) and use this information to find researchers in need as well as clinical trials seeking participants.

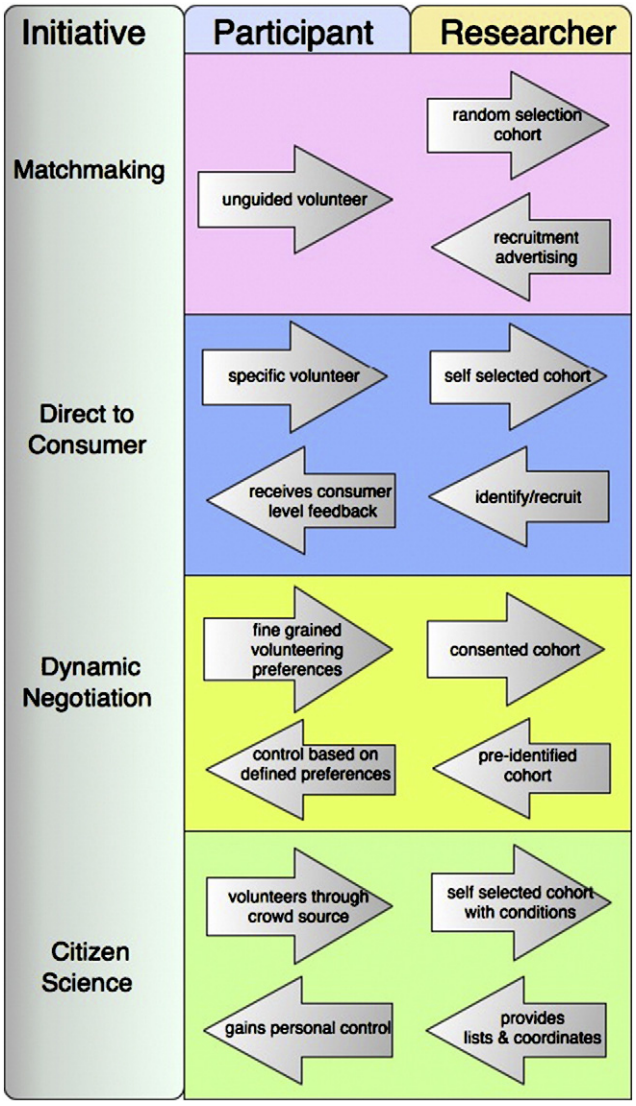

Fig. 1. Example of modes of engagement and communication for patient centric initiatives.

Currently, the effectiveness of such registry approaches depends upon the study type (Weng et al., 2010). Traditional recruitment methods, such as direct use of hospital data warehouses, are still beneficial particularly if the participant inclusion criteria are well defined or the study requires complex exclusion criteria. For example, a study may require participants to be diabetic, with hemoglobin A1C values between 6.5% and 8.0%, have pre-existing ischemic vascular disease, not use insulin therapy, and have a certain requirement for glomerular filtration rate. At present it will be difficult for participant-driven clinical registries to match this level of specificity, though tools like EmergingMed.com, are addressing this problem by offering defined and structured data definition and query options for cancer patients

and researchers. Continued technological advancement and wide-scale adoption by researchers and volunteers alike are contributing to richer data resources, and are demonstrating the potential of such matchmaking tools for overcoming recruitment bottlenecks in limited domains, though a comprehensive evaluation of the effectiveness of these tools across a range of demographic and disease types is still nascent.

2.2. Engagement through direct participant benefits: 'Direct-to-consumer' tools

Direct-to-consumer (DTC) tools offer individuals highly personalized information as a proposed direct benefit of participation. For example, established web-based DTC genetic testing companies, such as 23andMe.com or deCODEme.com seek to empower and promote identity perception for individuals by supplying them with personal genotype and phenotype information that may inform their personal health decisions (Nordgren, 2012). The social interactions between DTC companies and their customers are not without controversy, as the promise of this form of consumer-focused health decision making has to date managed to avoid either the predicted dire consequences of a excessively worried public, or the proposed swell of empowered and activated patients (Nordgren, 2012; Cecile et al., 2010). What the DTC companies have enabled beyond personalized information is the increased ability to facilitate participation in research. The research arm of 23andMe, '23andWe', notifies members of research opportunities enabled through more personalized matching of studies than ResearchMatch through an extensive set of structured surveys about their phenotypic traits. By connecting those self-reports to corresponding genotypes, 23andWe can produce publishable study results, and within days can verify other published results (Tung et al., 2011; Wicks et al., 2011). To help drive their research arm, 23andMe created condition-specific member communities (e.g., Parkinson's, sarcoma, pregnant women). By joining, members receive free genetic testing and involvement in the community forum. For example, the "Roots into the future" community is an up-and-coming community that offers 10,000 African Americans free genetic testing in return for completing surveys. 23andWe's model leverages individuals' willingness to participate in research and rewards their participation with information people value. Given the amount of genetic information that 23andMe can gather through this approach to participant engagement, it is reasonable to assume that they have the potential to produce many more substantial findings.

Like 23andMe, the health social network PatientsLikeMe.com started as an organization that provided a service to people curious about their health and frustrated with the slow progress of traditional research. PatientsLikeMe.com has a substantial research arm and has great potential to conduct studies faster and cheaper than existing models (Tung et al., 2011). For example, analysis of data reported by people with amyotrophic lateral sclerosis (ALS) who experimented with lithium carbonate reached the same conclusion as traditional randomized trials (Wicks et al., 2011), indicating the potential for such communities to conduct valuable studies. PatientsLikeMe.com also offers a comprehensive clinical trial finder and various health tracking tools, making the site a rich source of data. PatientsLikeMe.com asks all researchers to first contact their partnership team before allowing researchers to use the data for research or to use the site to recruit participants in their studies. Once the partnership team gives permission, researchers can specifically search for users who fit their study criteria. The referral rates are high, making PatientsLikeMe.com an attractive and viable option for populating studies.

2.3. Participant control through choices: tools for 'dynamic negotiation' between researchers and participants

DTC companies seek to offer something that many research institutions are unable to provide - a user-friendly interface that gives users of a range of literacy and education levels descriptive, personalized and easily accessible information. However, at present most DTC users pay for the service, and in doing so, fuel research efforts of the parent companies offering these services. Although most researchers cannot individually offer the same usability and customer support amenities as 23andMe.com, they are increasingly able to offer participants greater levels of choice and control, as well as manage a diverse range of participant preferences. The company Private Access (privateaccess.info) is one such platform that seeks to provide participants with substantial control over the uses of their data in research (Terry and Terry, 2011). The platform allows researchers to search for potential study participants with great specificity because participants who use Private Access enter their entire personal health records, and have control over both individual portions of their personal health records as well as the scope of researchers and research groups that the data is visible to. Researchers can use Private Access to recruit participants, access this private data by being granted "private access" by the participants, and use the data in the records of recruited participants in applicable research projects.

Private Access uses this dynamic negotiation approach to moderate patient involvement in research repositories. The traditional practice of entering data into repositories often requires participants' broad consent to authorize secondary use of their anonymized or de-identified data. Although it may be impossible for participants to fully know all potential future studies in which their data could be used, refusal to agree to such broad use thus renders secondary usage of their data an all or nothing decision (Fullerton and Lee, 2011). Private Access arguably overcomes this bottleneck by permitting individual control over privacy and data sharing, much like social sharing tools like Facebook.com. Some participants may choose to set liberal privacy settings, permitting any researcher access to their data in full for screening and eligibility purposes, while others may request to be contacted about study eligibility after giving access permission on a case-by-case basis. By giving participants this dynamic control, Private Access supports broad consent, if that is what an individual prefers, but it also gives participants the opportunity to choose the access level with which they are most comfortable over time. It should be noted that much like Facebook and other social-networking sites, the definition of what is personally and culturally appropriate to share is an evolving discussion and one that is likely to vary from person to person. Tools such as Private Access, or the open-source Indivo (indivohealth.org), can be tailored to provide culturally specific information or utilize trusted community leaders as "guides" through the decisions involved in selecting preferences. Data is emerging now regarding how tools such as these facilitate participant participation.

2.4. Public engagement through citizen science: direct participant involvement tools

Increased public awareness of large volunteer registries, such as the Love/Avon Army of women (armyofwomen.org) or Inspire 2 Live (inspire2live.com) can be considered a minimal form of public engagement in the research process. Towards the other end of the spectrum lies Genomera.com, a company that seeks to empower and engage the public in research by giving them the opportunity to be 'citizen scientists' who can design, conduct, and analyze their own studies (Eolgin, 2010). Members of Genomera.com can develop their own study designs (i.e., study creator), participate in the study themselves, and post procedures for other community members to participate in their study. Study participants then send their results to the study creator for analysis. The openness of this community enables participants to be recruited and studies to be completed much quicker than the traditional research process.

Given the established conventions for peer review and controlled research, the likelihood of the citizen scientists at Genomera.com having their results published in scientific journals is presently slim.

However, with widespread adoption of this approach, validation of methods, the possibility of finding significant results, or creating methods that can be replicated in other studies is possible. Furthermore, such citizen science approaches are challenging existing paradigms about accepted standards in research, finding their own distribution channels outside of traditional dissemination strategies (CES4Health.info, 2012). Efforts, such as Genomera.com, demonstrate the desire for people to play a larger role in research. Whether through educating participants about studies they participate in, returning study results (Beskow and Smolek, 2009), or answering participants' questions, participants can become more involved (Gust and Seifer, 2011). Involving participants could increase the likelihood of future participation, adherence to study protocols, or sharing positive research experiences with others.

3. Conclusion

There are widespread changes occurring internationally in health care, and all face common challenges of effective leverage of information technology, the need for accurate clinical and health data, and the need for privacy protections (Collins, 2011; Meslin and Cho, 2010; U.K. E-Health Records Failure Makes U.S. Plan Shine, 2011). The research enterprise can utilize similar developments in order to keep up with changing socio-cultural context that requires more engaged research participation to be successful. If decisions are made and practices are built without due diligence to public opinion, then the string of inefficiencies and ethical questions will unnecessarily grow. We have observed resources destroyed due to of lack of appropriate public engagement (Root, 2010). We should look not only to public opinion, but also to the empowered public by facilitating their engagement in the research process as key stakeholders. Recruiting participants, protecting their privacy, and ensuring informed consent should not be viewed as burdensome bottlenecks, but rather as opportunities to engage, inform, and benefit the ultimate end-user of all research, the public.

Using PCI in research is one approach to overcome these challenges by leveraging new communication and facilitation modes increasingly available through the on-line economy. From the informatics-based initiatives we have presented, to the great successes of participant-centered organizations like Love's Army of Women and Genetic Alliance, to participant-driven social networking sites, the possibilities of an empowered public are starting to be realized. Data are needed in a variety of settings to test whether and how PCI can facilitate and sustain research participation across populations, particularly those with less access to web-based technologies and who may benefit the most. If we keep lessons learned from community-based research, minority recruitment, decision support, and other innovations, we can meet the goal of an active and invested community of research participants. With the current initiatives already in development and use, we have crossed an important threshold of feasibility testing and can now move into efficacy and effectiveness studies. Research groups and funders can begin to make the choice to utilize these tools and study the process along the way.

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References

Beskow, L.M., Smolek, S., 2009. Prospective biorepository participants' perspectives on access to research results. Journal of Empirical Research on Human Research Ethics 4, 99–111.
Bowen, D.J., Penchaszadeh, V.B., 2008. Special issue: enhancing minority recruitment into genetics research. Community Genetics 11 (4), 189–190.
Brase, T., 1998. Privacy and medical records research. NEJM 338, 1076–1077.
Bussey-Jones, J., Garrett, J., Henderson, G., Moloney, M., Blumenthal, C., Corbie-Smith, G., 2010. The role of race and trust in tissue/blood donation for genetic research. Genetics in Medicine 12 (2), 116–121 (Feb).
Cecile, A., Janssens, J.W., van Duijn, C., 2010. An epidemiological perspective on the future of direct-to-consumer personal genome testing. Investigative Genetics 1, 10.
Center for information and study on clinical research participation (CISCRP), 2012. Professionals: Clinical Trial Facts and Figures. Retrieved June 2 2012 from: http://www.ciscrp.org/professional/facts_pat.html#5.
CES4Health.info, 2012. Retrieved June 1 2012 from: www.ces4health.info.
Collins, S.F., 2011. Reengineering translational science: the time is right. Science Translational Medicine 3, 90cm17.
Corradetti, C., Mascalzoni, D. (Eds.), 2012. Special Issue of "Science law and Technology". Sage. July.
Eolgin, E., 2010. Personalized investigation. Nature Medicine 16, 953–955.
Fullerton, S.M., Lee, S.L., 2011. Secondary uses and the governance of de-identified data: lessons from the human genome diversity panel. BMC Medical Ethics 12, 16.
Fullerton, S.M., Anderson, N.R., Guzauskas, G., Freeman, D., Fryer-Edwards, K., 2010. Meeting the governance challenges of next-generation biorepository research. Science Translational Medicine 2, 15cm3.
Genetic Alliance, 2012. Retrieved June 1 2012 from: geneticalliance.org.
Gottweis, H., Chen, H., Starkbaum, J., 2011. Biobanks and the phantom public. Human Genetics 130, 433–440.
Gust, S., Seifer, S., 2011. The central role of governance in community-based participatory research. Progress in Community Health Partnerships 5, 105–107.
Hansson, M.G., Dillner, J., Bartram, C.R., Carlson, J.A., Helgesson, G., 2006. Should donors be allowed to give broad consent to future biobank research? The Lancet Oncology 7, 266–269.
Harmon, A., 2010. Indian Tribe Wins Fight to Limit Research of Its DNA. New York Times. April 21.
Heeney, C., Hawkins, N., de Vries, J., Boddington, P., Kaye, J., 2011. Assessing the privacy risks of data sharing in genomics. Public Health Genomics 14, 17–25.
James, R.D., Yu, J.H., Henrikson, N.B., Bowen, D.J., Fullerton, S.M., 2008. Strategies and stakeholders: minority recruitment in cancer genetics research, Health Disparities Working Group. Community Genetics 11 (4), 241–249 (Epub 2008 Apr 14. Review).
Kaye, J., Heeney, C., Hawkins, N., de Vries, J., Boddington, P., 2009. Data sharing in genomics—re-shaping scientific practice. Nature Reviews Genetics 10, 331–335.
Kaye, J., Curren, L., Anderson, N., Bradford, T., Edwards, K., Fullerton, S.M., et al., 2012. User-centric initiatives in health and biomedical research. Nature Reviews Genetics 13 (5), 371–376 (April 3) http://dx.doi.org/10.1038/nrg3218.
Ludman, E.J., Fullerton, S., Sprangler, L., Trinidad, S., Fujiii, M., Jarvik, G., Larson, E., Burke, W., 2010. Glad you asked: participants' opinions of re-consent for dbGaP data submission. Journal of Empirical Research on Human Research Ethics 5, 9–16.
Mascalzoni, D., Hicks, A., Pramstaller, P., Wjst, M., 2008. Informed consent in the genomics era. PLoS Medicine 5, e192.
McGuire, A.L., Basford, M., Dressler, L., Fullerton, S., Koenig, B., Li, R., McCarty, C., 2011. Ethical and practical challenges of sharing data from genome-wide association studies: the eMERGE consortium experience. Genome Research 21, 1001–1007.
Meslin, E.M., Cho, M., 2010. Research ethics in the era of personalized medicine: updating science's contract with society. Public Health Genomics 13, 378–384.
Nordgren, A., 2012. Neither as harmful as feared by critics nor as empowering as promised by providers: risk information offered direct to consumer by personal genomics companies. Journal of Community Genetics (Epub ahead of print 22 March).
Root, J., 2010. Texas officials agree to destroy babies blood samples after setting lawsuit. The Associated Press . February 14.
Sharp, R.R., Landy, D., 2010. The financing of clinical genetics research by disease advocacy organizations: a review of funding disclosures in biomedical journals. American Journal of Medical Genetics 152A, 3051–3056.
Sheehan, M., 2011. Can broad consent be informed consent? Public Health Ethics 4 (3), 226–235 (Available online August 2011).
Silverman, H., Hull, S.C., Sugarman, J., 2001. Variability among institutional review boards' decisions within the context of a multicenter trial. Critical Care Medicine 29, 235–241.
Simon, C.M., L'heureux, J., Murray, J.C., Winokur, J., Weiner, G., Newbury, E., Shinkunas, L., Zimmerman, B., 2011. Active choice but not too active: public perspectives on biobank consent models. Genetics in Medicine 13, 821–831.
Sung, N.S., Crowley, W.F., Genel, M., Salber, P., Sandy, L., Sherwood, L.M., et al., 2003. Central challenges facing the national clinical research enterprise. JAMA 289, 1278–1287.
Swan, M., 2009. Emerging patient-driven health care models: an examination of health social networks, consumer personalized medicine and quantified self-tracking. International Journal of Environmental Research and Public Health 6, 492–525.
Terry, S., Terry, P., 2011. Power to the people: participant ownership of clinical trial data. Science Translational Medicine 3.
Trinidad, S.B., Fullerton, S., Barnes, J., Larson, E., Burke, W., 2010. Genomic research and wide data sharing: views of prospective participants. Genetics in Medicine 12, 486–495.
Trinidad, S.B., Fullerton, S.M., Ludman, E.J., Jarvik, G.P., Larson, E.B., Burke, W., 2011. Research ethics. Research practice and participant preferences: the growing gulf. Science 331, 287–288.
Tung, J., Chuong, D., Hinds, D., Kiefer, A., Macpherson, J., Chowdry, A., et al., 2011. Efficient replication of over 180 genetic associations with self-reported medical data. PloS One 6.
U.K. E-Health Records Failure Makes U.S. Plan Shine, 2011. Information Week. Oct 6 http://www.informationweek.com/news/healthcare/leadership/231900143.
Warren, S., Brandeis, L., 1890. The right to privacy. Harvard Law Review 4, 193–220.
Weitzman, E.R., Adida, B., Kelemen, S., Mandl, K.D., 2011. Sharing data for public health research by members of an international online diabetes social network. PLoS One 6, e19256.

Weng, C., Bigger, J., Busacca, L., Wilcox, A., Getaneh, A., 2010. Comparing the effectiveness of a clinical registry and a clinical data warehouse for supporting clinical trial recruitment: a case study. AMIA Annual Symposium Proceedings 867–871.
Wicks, P., Massagli, M., Frost, J., Brownstein, C., Okun, S., Vaughan, T., et al., 2010. Sharing health data for better outcomes on Patientslikeme. JMIR 12, e19 (Jun 14).
Wicks, P., Vaughan, T.E., Massagli, M.P., Heywood, J., 2011. Accelerated clinical discovery using self-reported patient data collected online and a patient-matching algorithm. Nature Biotechnology 29, 411–414.
Wynia, M.K., Gamble, V.N., 2006. Mistrust among minorities and the trustworthiness of medicine. PLoS Medicine 3 (5), e244 (author reply e245. Epub 2006 May 30).