Ethical issues regarding the acquisition and control of genetic information*

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ABSTRACT

Genetic tests for cancer predisposition involve complex issues, not only in terms of expertise and medical potential but also in terms of their moral import on patients or examinees and their families. This paper explores a model of ethical analysis, which aims at the construction of a normative framework within which ethical considerations regarding genetic clinical research, including cancer genetics, can be adequately framed and addressed. It reconsiders and critically assesses the role of fundamental principles in bioethical reasoning, particularly those of respect for personal autonomy, justice, beneficence and nonmaleficence, regarding the acquisition, access and control of genetic information. It investigates their modal structure, on the basis of which it defends an order of priority in cases of conflict between them in actual cases. Reliance on fundamental principles, as the barebones of an adequate moral framework for decision-making, meets hard ethical issues regarding intra-familial dynamics and professional duties, while it also facilitates choices in research settings.

Key words: bioethics; genetic information; data protection; genetic privacy; patient autonomy; informed consent; justice; beneficence; nonmaleficence.

Rapid advances in genetics have led to the development of new diagnostic tools, which make it possible to predict the future occurrence of monogenetic diseases or to detect increased susceptibilities to the future development of more complex diseases, such as breast cancer. Genetic tests can be employed to establish probabilities of the occurrence and course of a disease, while the predictive and diagnostic value of the information they provide has been substantially increasing for a number of diseases. Apart from questions regarding their medical potential, the collection and management of genetic data raise a number of ethical, legal, social and public policy issues. The latter require normative analysis, which aims at the clarification and justification of evaluative criteria forming a framework for practical decision-making. Normative inquiry is complex and involves, firstly, an analysis of the diverse ways in which a genetic approach to disease may affect people individually; within their families; and in their social and working spheres. Secondly, it involves the development of a framework of ethical norms for decision-making, which brings out the ethical and professional responsibilities of clinicians as well as those of other agents who may be directly or indirectly interested in sharing it (other potentially concerned individuals, private or public sector employers, insurance companies, the police, etc). In normative analysis, we must always bear in mind that biology or genetics alone do not determine the social outcome.

A preliminary distinction needs to be made: Genetic knowledge, considered in the abstract, may be taken to refer to claims about the nature and effects of genetic variation, about the respective contributions of genes and the environment to specific outcomes and about the clinical effects of specific genetic variations. What is of particular ethical concern is not genetic knowledge in the abstract, but genetic knowledge *individuated*, associated with genetic data pertaining to particular identifiable *persons*, what is usually described as "genetic information". While genetic knowledge is impersonal, genetic information about individuals is commonly viewed as personal and, in addition, as medical information. This characterization, however, needs to be further qualified. Genetic information is a rather atypical kind of medical information. Unlike the latter, which is normally thought of as intimate rather than publicly available, as cur-

rent than predictive and as individual rather than shared by a group, a good deal of genetic information is public rather than intimate and not at all medical (e.g. one's skin colour) [1].

As genetic data possess certain idiosyncratic features and characteristically distinguish the data subject from other individuals, there are growing concerns that the information they furnish could become a new tool of discrimination. Concerns are often expressed that gene tests and genetic profiling could be used to keep data subjects deemed at genetic risk of certain diseases banned from getting jobs or health insurance. Additional concerns arise regarding storage of genetic material in biobanks for research. As this kind of research flourishes on the sharing of samples and information, it poses prominent ethical questions: Are there ethical barriers to the sharing of biological resources? How does the advent of large-scale biobanking alter the ways in which ethical issues about genetic data are addressed?

In the light of increasing complexities, it is imperative to approach genetic research and its clinical aspects from a robust ethical perspective, in order to identify core ethical issues emerging, and to draw conclusions regarding the construction of a normative framework, which may also provide directions for certain policy decisions. Moral analysis is part of formulating appropriate policies.

THE CHARACTER OF GENETIC INFORMATION. GENETIC IDENTITY AND "EXCEPTIONALISM"

Inherited genetic traits are part of a person's biological constitution and persist for life. Are they part of one's personal identity and should they, therefore, be treated in a special way? Should genetic information, obtained through genetic testing or genetic screening, be viewed as unique and exceptional, quite unlike other medical or personal information?

Genetic information is commonly seen as sensitive, intimate and strictly personal. However, in the light of an increasing understanding of our genetic make-up, the danger is to fail to recognise the scope and limitation of genetic information as regards the shape of one's identity. While geneticists and medical practitioners clearly state that genes are not the complete story of a human being, the increasing advances in genetic knowledge have given birth to an erroneous social stereotype. The threatening moral hazard in this context is that persons may be categorised on the basis of their genes, and suffer various forms of discrimination. The danger is that increasing reliance on genetics may lead to all sorts of convictions regarding things that are completely out of our control (our genes) to the exclusion of what is within our control, namely, the capacity to adopt and overcome limitations which have been placed upon us by biology.

If the claim is that genes are somehow distinctively the basis of one's identity, this is clearly false. Genetic constitution is not sufficient to specify one's identity, as the case of identical twins indicates. The same genetic make-up does not result in the same personality. The phrase "genetic identity" is misleading, as it suggests that information about one's lineage and origins will of itself contribute to one's identity or sense of personal identity [2]. This claim does not stand to critical scrutiny. It is imperative that we address society's tendency to oversimplify and exaggerate complex scientific information and adopt analogous unjustified attitudes towards it. Together with robust ethical thinking, what is needed is rigorous public debate and education about the meaning and scope of genetics.

"Genetic exceptionalism" is an over-exaggeration, loaded with unargued metaphysical assumptions. As a general claim about the distinctiveness of genetic information, it is based on controversial, reductive and essentialist, conceptions of genetic identity ("we are our genes", "our genes are us") and presupposes a false methodological claim -that of genetic determinism- which may unjustifiably undermine and distort our very appreciation of moral agency.

Yet, even though genetic exceptionalism is untenable as a general hypothesis, genetic data provide a particularly rich and challenging example of the real ethical challenges that emerge as a result of vital biomedical advances. In the light of immense biotechnological developments regarding the management of genetic information, most profoundly the complex ways in which such information may be collected, used or disclosed, stored or disseminated, its handling offers a paradigm case for a re-examination of, and reflection on, the very character and future of health care ethics and biomedical ethics. Genetic information does seem to raise some issues of special ethical significance.

PROPER USE AND MISUSE - THE NORMATIVE FRAMEWORK

Questions regarding the acquisition, use and control of diagnostic or predictive health information concern the medical potential of such information (in predicting and managing risk predispositions), its ethical evaluation, as well as the legal and regulatory limitations of its use. Arriving at an adequate and sustainable clinical decision requires taking into account diverse considerations, including scientific and medical background, a constantly renewed call for evidence, clinical validity (how well the tests results detect or predict the associated disorder), clinical utility (whether there are preventive measures or therapies that can be adopted to eliminate, reduce or defer the risk of associated disease), psychological and social impact. The mixture of prospective benefits and harms associated with acquiring and using genetic information, both for the individual concerned and family members, calls for robust ethical reasoning as an indispensable parameter in decision-making. A framework needs to be explored for distinguishing morally permissible use from misuse.

Ethical debates concerning the distinction of proper from improper use of medical data, as well as the participation of

individuals in clinical tests, have a long history. Among the ethical principles invoked are the protection of autonomy, justice, beneficence ("doing good") and nonmaleficence ("not doing harm", the no-harm principle) [3]. Respect for autonomy has been treated as the cardinal ethical principle of health care ethics. In its minimal version, it amounts to the claim that it is ethically unacceptable to impose medical decisions on patients or test subjects. As soon as the relevant facts have been presented, it is the patient or the examinee who carries out the decision for a medical act. The practice of medicine should be non-directive and non-paternalistic. The subject concerned should make a rational decision in the light of information concerning medical facts, which health professionals have a duty to provide. The principle of individual autonomy supports the more specific principle of informed consent. The latter has been most widely acknowledged in bioethics discourse applying to clinical research and health care.

However, obtaining data about the presence or absence of specific genetic variations and genetic risks for disease may raise distinctive ethical problems. They characteristically relate to the dual nature of genetic information. On the one hand, it is intensely personal, relating to a person's very biological endowment as an individual. It ought, therefore, to be treated with the greatest respect and sensitivity as private and confidential, not to be disseminated or transmitted to others without the subject's consent. On the other hand, genetic information, by its very nature, pertains to more than one individual; it is familiar. All subjects share their genes with members of their biological family, so that in discovering something about an individual, one may discover something about her relatives, too, and possibly something they do not know about themselves. When subjects taking genetic tests are revealed genetic risks, such as the risk for inheriting mutations in BRCA1 or BRCA2, they can infer that these risks may concern some of their relatives, too. Disclosing information may be ethically problematic just as not disclosing it may be.

If a subject obtains crucial genetic information that is also important for, say, her brother, does she have an obligation to share it with him? Or, conversely, a right not to share it? As it pertains to him too, does he have a right to insist that she seeks his prior consent, or that his refusal to consent should have to restrict or compromise her right to seek this genetic information about herself? Do relatives have a right to limit each others' personal rights to privacy? Discussions turn on the criteria according to which it could be right to disclose information and those of choice in relation to having the tests.

Morally permissible predictive, diagnostic or therapeutic uses of genetic information may be direct, involving the data subject herself, or, in carefully spelt out circumstances, her relatives, but also indirect, in that they may be involved in medical education or clinical research. Particularly, with the establishment of clinical-genomic and biobank research, with increasing capability of assemblage, storage and use of genetic data at a mass scale, further issues arise. They raise ethical dilemmas, which challenge currently accepted individualistic conceptions of personal autonomy, privacy and informed consent as the ethical milestones in reasoning about action in genetic research and its clinical applications. They have, thus, led to a continuous reviewing and reassessment of the applicability of existing ethical provisions and guidelines and the concomitant legislative responses.

The construction of an appropriate moral framework for decision-making needs to start with an analysis and understanding of constitutive features of the structure of moral agency. Moral requirements are directed towards agents, aim at shaping action and require justification by reasons. Moral ascription presupposes that we are separate beings, whose actions and interactions are mediated by a process of practical reasoning. If such beings are to act at all, each must have some space of action. The conditions of each other's agency must be respected. The fundamental moral insight, in normative analysis, is that the relationship between agents is determined by the reciprocal recognition of each other *as a person* -that is as an autonomous subject capable of self-determining action, who thereby requires respect for the conditions of such action. The core moral axiom is the universal respect for each other's agency, conceptualised as a person's unconditional worth or human dignity. We, thereby, start practical moral deliberation by rejecting those principles that cannot guide the action of all agents, that is, that cannot be principles for all. Fundamental principles follow from the above insight, which ground moral obligations and counterpart rights. The indispensable methodological move, therefore, in developing the appropriate moral framework regarding the use of genetic information, is to determine how it fits within the broader ethical perspective of respect for personality and the fundamental principles derived from it.

THE GROUNDING PRINCIPLES

Fundamental rights of personality. Respect of autonomy, informed consent

Respect for human dignity forms the milestone of our ethical and legal obligations and the starting point of our reasoning for the justification of any particular moral and legal judgements and practices. It is undergirded by the inviolable "intrinsic value" of human beings, it presupposes their freedom (autonomy) and it includes the equality of all human beings, as a matter of principle. The moral obligation of treating a human being as an "end-in-itself" [4] follows necessarily. This means that under no circumstances should a human being be treated as a mere means or instrument for the achievement of any other ends. Human beings, *qua* persons, deserve respect in their individuality. Their physical and psychological integrity ought to be protected by all means. What follows from this is that human subjects cannot be merely reduced to their genetic

traits, nor can they be submitted to discrimination on the basis of their genetic endowment. Fundamental rights of personality constrain every kind of biomedical research and its clinical applications, involving human subjects. The principle of respect for human dignity rules out, *ab initio*, any and every form of exploitation, deception or coercion of a human being, in all contexts. For instance, requesting the consent of a test-subject, after she has been deceived or coerced, violates her autonomy as a person. It constitutes a case of heteronomy and is ethically (and legally) absolutely impermissible.

The core of the fundamental principle of respect for human dignity is the self-determination of a human being. The principle of self-determination (autonomy) forms the inviolable normative point of reference regarding the moral (and legal) assessment of new medical technologies and their use in medical genetics. Autonomy implies that an individual should decide for herself whether to consent to, or dissent from, actions which affect her body, or concern matters which affect her personal sphere of life. It encompasses one's right to decide on the use that one's personal data will be subjected to. Personal autonomy shapes the right of an individual to raise questions about her genetic endowment, including her risk factors, but also to keep confidential sensitive information derived from it, like, for instance, the fact that she carries a mutation that poses high probability of cancerogenesis.

Crucial normative issues pertain to the protection of examinees and patient-subjects from unrestricted and uncontrolled use of their genetic data, as the latter bear information which could touch on the very core of their moral personality in particularly sensitive ways. To the extent that diagnosis, therapy, medical research or education are based on personal data and samples, such practices affect the very core of human autonomy and fundamental rights of personality. The principle of autonomy requires that genetic data should not be collected or used without the prior consent of the data subject, which in turn presupposes her complete information (informed consent).

Furthermore, the knowledge that someone is at risk of developing a serious illness in the future may be psychologically burdensome, generate immense stress and become a source of social stigmatisation and discrimination. Therefore, no one should have such information forced upon oneself against one's will. Protection of the right to self-determination, in this case, entails a right to remain ignorant of one's genetic status (a right to not know). Any claim of a right to not know is, however, complex, in a context where information does not merely pertain to the individual but has implications for other family members as well.

The principle of justice requires informing relatives who are at risk of inheriting the same predisposing factor. A woman with a strong personal and family history of breast or ovarian cancer faces an obligation to provide useful information to her daughter or sister or other relative at risk of inheriting the same predisposing mutation, as a matter of beneficence and justice. But the latter requirement follows derivatively from the individual's autonomy and right to self-determination. When a person, who has learned of a mutation, expresses disinclination to advise siblings or other relatives who are clearly at risk, subtle moral dilemmas arise. The tension between the rights and interests of the individual, in claiming control of her genetic information, and those of others at-risk, in requiring access to it, may be severe. However, there must be sufficiently compelling reasons to justify the demand of the individual's responsibility to share it [5]. The right to self-determination is overriding and any restriction on it requires robust moral justification.

Overall, it is morally important to ensure that information is not obtained or handled without appropriate consent. The performance of all medical examinations must always be subject to the examinee's consent. Respect for autonomy through informed consent, the examinee's right to informational self-determination, should be safeguarded as far as possible, even in relation to future and currently not clearly defined uses.

But the principle of informed consent cannot be treated as the ultimate or sole principle in decision-making. By itself, it furnishes limited justification for ethical choice, and may furnish even less as new information technologies are used, on an increasing scale, to store and handle genetic data. The central weakness of relying exclusively or primarily on formalized informed consent procedures for ethical justification of certain medical acts is that consent is "referentially opaque" [6]. That is, it is given to specific propositions describing limited aspects of a given situation and does not transfer even to closely related propositions regarding future consequences. Informed consent requirements play their part adequately within a wider net of ethical requirements that determine obligations and rights in scientific and clinical practice. It is important not to lay too much stress on exaggerated, idealised, notions of "fully" informed consent and to take into account the vulnerabilities and specificities of those required to provide their consent, given the complexity of the testing itself, as well as the delicate nature of communicating to them results which are technically complex and anxiety-provoking.

Gathering genetic data in databases creates additional challenges for ethical justification that relies primarily or exclusively on informed consent procedures. This is not because genetic information is somewhat intrinsically exceptional, but because advances in genetic information technologies make it feasible to gather, store and disseminate massive quantities of subtle information in ways which exceed individuals' best efforts and abilities to understand what is at stake, or to give genuinely informed consent or dissent. Regarding future use for scientific research purposes, primarily, the anonymity of data-subjects should be preserved, and the transfer of information in ways which could reveal the subject's personal data, which she

has a right to keep private or to make public when she decides as appropriate, should be strictly forbidden.

Put in a nutshell, the practices of informed consent, however important, may not suffice to secure protection, and they should be constantly scrutinised and revised [7]. In the light of increasing complexities regarding storage and dissemination of massive amounts of information, other ways of safeguarding full protection of patients, data-subjects and relatives than individualised formal consent procedures need to be, additionally, sought. Particularly regarding future use, prior consent is difficult to be obtained, while, on the other hand, seeking case-by-case consent procedures in any future use may be extremely unrealistic. Onora O'Neill [8] has argued convincingly that informed consent needs itself to be analysed as including two distinct stages: i.e. public consent to *systems* for collecting, storing, using and disclosing genetic data, such as biobanks; and individual consent to *particular acts* of collecting, storing, using and disclosing genetic data about individuals. The establishment of background institutions that secure moral standards in medical and scientific practice can provide a safeguard for the particular procedures for which individual consent is sought. Trustworthy institutions are of vast importance.

Confidentiality and genetic privacy

Norms of professional confidentiality and personal privacy stem from the principle of respect for personal autonomy. They are significant since genetic results are directly related to one's characteristic biological endowment and may generate information which touches on the very nature of one's moral personality, in particularly sensitive ways. They are important in health care, medical research but also in contexts of employment or insurance coverage so as to prevent discrimination. These rules require that an individual's genetic information should not be disclosed to third parties. Respecting the privacy of information and securing confidentiality instantiate the ethical principles of respect for persons, their autonomy and their fundamental rights.

At the same time, implications for family members should be taken into account: Genetic information concerns the individual and her future health, but is also significant to family members. A genetic diagnosis/prediction never has implications solely for the examinee, but reflects disease probability and risk factors in other biological relatives. The results of gene testing, including molecular testing in search for mutations, may lead to different reactions among different family members, and some may not wish to have such information. Significantly, genetic testing of clinically healthy relatives may disclose predisposition to disease which may lead to changes in quality of life. Medical professionals, thus, have to cope with further responsibilities if the rights and interests of others, especially biological relatives, are at stake.

In some rare situations, in which the protection of other persons is at stake, a "duty to warn" is also in force. This has been interpreted as a duty to act in prevention of foreseeable harm or injury. But this is a fuzzy area of ethical decision-making. Disclosure against the examinee's will may violate confidentiality rules and discourage individuals from taking the tests. Above all, individuals should be responsible for the dissemination of their own medical information and should be encouraged to do so by the medical staff, on the basis of principles of beneficence, justice and solidarity. However, in cases where individuals resist sharing important information for the health and welfare of others, the physician may be liable to warn the at-risk individuals in specified circumstances -e.g. when serious foreseeable harm is highly likely to occur or disease is preventable or treatable. But the harm due to failure of disclosure should outweigh the harm that may be caused by disclosure.

It must be emphasised that the obligation to warn should be applied with extreme caution, however, for breach of medical confidentiality may have a detrimental effect on the trust placed on genetic counsellors and health care professionals by the individuals concerned. The latter may refuse to seek referral to genetics services altogether, if they deem them untrustworthy, or might provide misleading information about their family history that would obscure the interpretation of their genetic situation.

Deciding what to do in relation to genetic predispositions made available through genetic tests requires close examination of the true as opposed to the feared likelihood that symptoms will develop as well as the subtle weighing of the interests of the individual concerned, other family members and concerned third parties. In such contexts, it is of vital importance for clinicians to discuss with prospective examinees the potential adverse psychological and social consequences of testing, so that they can reach adequately informed decisions whether or not to proceed with testing.

Due to the complexities involved, including the far-reaching implications of test results for both the applicant and her family, genetic counselling is imperative and an integral part of the genetic testing process (pre-test as well as post-test counselling). Particularly, this should be the case as predictive genetic testing, such as that for cancer predisposition genes presents an important psychological challenge. Some people use the information to become proactive, others find the risk revealed frightening, and serious psychological consequences may result, such as anxiety or depression. The importance of pre-test counselling can hardly be exaggerated.

Justice, non-discrimination, non-stigmatisation

Principles of justice are associated with considerations as to whether an individual is treated fairly and equitably. They are vindicated by appealing to a demand of rejecting principles which undermine the exercise of agency and of

causing injury or harm, that cannot be universally adhered to, i.e. that cannot be principles for all. They stem from the equal worth of all human beings *qua* persons.

Justice requires that there should be equality of access to genetic testing, without discrimination. Particularly in cases where there is no universal health care coverage, the cost of genetic testing in search of mutations that put their carriers at high risk of malignancy is considerable. So, given that in many cases reliable insurance coverage is absent or inadequate, the significant economic barriers to seeking useful information are a source of moral concern. Such barriers constitute a violation of the fundamental principle of justice, since they prevent access of the poor to benefits of biotechnology enjoyed by the privileged and the wealthy. These problems are not specific to medical genetics but are detected in every aspect of health care. Questions of distributive justice exist where individuals or groups face disadvantages in enjoying scientific advances and the recourses made available. Justice requirements demand that benefits (e.g. access to health care services) and burdens (e.g. taxation) are allocated fairly and equitably. Conversely, we cannot accept inequalities in access (e.g. of diagnosis and treatment) and burdens (allotment of expensive care or of research) for granted and, then, expect to reach ethically justifiable conclusions about genetic testing.

Furthermore, genetic data can be handled in such ways that imply unjustifiably unequal treatment of subjects outside the medical sphere, e.g. when applying for a job or insurance coverage, on the basis of genetic traits. The prohibition of discrimination, whether on grounds of genetic or non-genetic information, follows from the principle of the equal value of all human beings, as conscious self-determining agents, who, therefore, demand respect of their capacity for self-determination, irrespective of medical status and, hence, of their genetic predisposition to health or illness. Discrimination exists where unequal treatment is ethically unjustified. For this reason, it is always indispensible to sound ethical reasoning to seek grounding criteria which justify unequal treatment of persons.

Since accurate foreknowledge is at present unavailable, and may in principle be unattainable, given the complexity of human bodily systems and the effects of their interaction with their environment, a note of caution should be sounded regarding willingness to rely on genetic tests for social purposes. It may become possible to assess individuals' susceptibilities to some common diseases, such as breast cancer or heart disease, stroke and Alzheimer's. Even a crude risk stratification applied to large numbers of individuals could have serious adverse social consequences in limiting the availability of health care resources to some groups as opposed to others. Injustice, stigmatisation and marginalisation may be among the moral hazards provoked.

An issue of vital ethical significance is the protection of data-subjects and their genetic relatives from genetic stigmatisation, which may well be based on irrational overestimation and inadequate understanding of genetic factors. It ought to be rectified with appropriate public discussion and education, rather than with regulation which restricts scientific research. The moral demand for protection against genetic stigmatisation may concern not only individuals but also groups of population as their data are collected and stored and are related to personal information.

Moreover, the issue of commercial use of research has moral import and demands normative assessment and regulation. The possible commercial utilisation of medical findings and genetic research outcomes is a substantial motive for private investment. This is only permissible to the extent that all necessary precautions are provided for the protection of the participants' personal self-determination and fundamental rights.

Regarding use in employment, it should be noted that, when considering whether to employ a candidate, it is legitimate to consider whether at the time of engagement the applicant possesses the physical, mental and health-related fitness required by the relevant activity. Medical examinations are permissible provided that they are necessary to establish that the applicant is fit for the proposed job *at the time of engagement*. More thorough medical examinations for currently symptom-free or predictable conditions may be permissible, if and only if they are necessary, having regard to the principle of proportionality, in order to preclude specific third-party risks inherent in the nature of the activity. Tests of genetic susceptibility to future illness should not be imposed, or genetic information should not be used, except when public safety depends on the good heath of the employee and it is needed in order to assess it.

Nonmaleficence, beneficence, solidarity, benefit-sharing

The principle of nonmaleficence *(primum non nocere)* prescribes the avoidance of harm or injury, imposed accidentally and/or systematically, thereby causing adverse effects on someone's rights or interests. Obligations of nonmaleficence (doing no harm) include those of not inflicting actual harm but also of not imposing risks of harm, at least in ways disproportionate to the benefit expected. In cases of risk disposition, it is morally acceptable that a standard of due care determines whether the agent who is causally responsible for the risk is also morally responsible for it. One might counter-argue, at this point, that medical practitioners commonly injure, in order to achieve the greater good of the patient, i.e. with a therapeutic intent. So the rejection of injury cannot be an unconditional principle. However, injury in therapeutic contexts is not gratuitous but intended to limit injury. Likewise, some uses of genetic data may legitimately injure, provided that the injury is not unjustified but only deemed necessary for therapeutic purposes. Unnecessary injury is one that may destroy, damage or degrade a human subject, or, more narrowly, her body and its characteristics. This would be a case of failure to acknowledge respect for human beings and their

moral worth (dignity), and should, therefore, be unconditionally rejected. The principle of nonmaleficence supports more specific moral rules, such as not to kill, not to cause systematic and gratuitous pain or suffering, not to cause offence and not to deprive others of goods contributing to their quality of life [9].

An adequate moral framework for decision-making needs to incorporate normative considerations regarding the well-being of others. These are requirements to support and assist others, particularly those at risk (beneficence). Vulnerable agents (and we are all vulnerable and needy and finite beings) cannot will indifference to others as a universal principle valid for all, because they invariably have plans and life projects which they cannot reasonably hope to achieve without the support of others. In willing indifference as a universal principle, agents would will to put at risk help that may be indispensible for others' activities or projects, including their own. Willing a principle of indifference as a universal principle is incompatible with a commitment to seek effective means for whatever project and life plans agents wish to achieve.

The duty to assist others may be interpreted in clinical genetics (including cancer genetics) as a duty to provide information which may be significant in facilitating the empowerment of individuals to think for themselves and take charge of their lives. It, thus, makes their autonomy possible. The positive obligations of beneficence (to do good) complement in this way the negative moral obligation not to harm others (the no harm principle).

Genetic research and its clinical applications, particularly the use of stored genetic data, may lead to the improvement of diagnostic tools for the prediction and diagnosis of diseases, the development of techniques for prevention and cure, individualised medicine, and so on. In this sense, research based on genetic material is of interest to society at large, as health is a public good, the protection of which is of universal value. Therefore, the improvement of health needs to be protected, from the perspective of public interest. From the perspective of individual data-subjects, the use of genetic data has to be assessed morally, not only on the basis of avoiding harm and the protection of their fundamental rights, but also on the basis of responsibility and a moral claim for social solidarity (an obligation to assist those in need).

The use of genetic information in medical research and education may substantially contribute to the improvement of public heath, by facilitating the establishment of the right health policies for large samples of the population. In this context, the voluntary and informed consent for the participation of individuals constitutes an act of social solidarity and ought to be promoted. "Because of shared vulnerabilities, people have common interests and moral responsibilities to each other. Willingness to share information and to participate in research is a praiseworthy contribution to society" [10].

In moral analysis, there is a growing emphasis on the significance of information *sharing* rather than the protection strictly of individual "genetic" rights. The claims of rights to know and to not know have to be constantly renegotiated in the light of such considerations.

Put in a nutshell, binding normative requirements should be in place in order to safeguard the protection of patients or data subjects' personal autonomy and fundamental rights. The principles of respect for autonomy, justice, beneficence and nonmaleficence, particularly in the form of the protection of the life and health of individuals, form the "ethical minimum" of any normative evaluation of the uses of genetic information. In addition, there are other norms that are relevant in decision-making, which include those of promoting collective goods, such as scientific knowledge and public health. There is a responsibility to promote the genetic health of the population and to help those at risk, whereas the protection of freedom of research (and its quality), related to public interest, is also to be promoted. But these requirements are structured in an order of priority, such that the latter require adherence on the condition that the former are not violated: That is, however important the purpose of the use of genetic data may be, no such use can legitimise or justify, the violation of the fundamental rights of patients or individual data-subjects or the generation of harm to them. The protection of human subjects is overriding and no genetics research, however useful to society, can be morally permitted to interfere with or postpone the appropriate therapeutic interventions for individual patients.

Freedom from injury or harm, and from disrespect as well as respect for personal autonomy are overriding principles. Proper use ought not to inflict systematic or gratuitous harm or injury, and it ought not to override the consent of those whose data are being used.

CONCLUSION

Advances in genetic research lead to improvements in knowledge of the factors related to predisposition to various diseases as well to associations between genes, way of life and the environment. This new knowledge carries with it a powerful potential for combating disease, promoting health and improving the quality of life. Its utilisation, however, should not be exaggerated or idealised. Providing genetic analysis for susceptibility to diseases should take into account, minimally, test limitations (particularly for multifactorial ones), including the fact that they are probabilistic and based on current research results, which may be revised. Test results should not be used by themselves for medical decision-making, given their bounded and qualified clinical validity and utility. In addition, integrating genetic information into medical practice raises a distinct set of ethical challenges. Ethical questions may take the form of issues related to the care of individuals or families, but may also take the form of societal and public health concerns, such as those related to biobank research, which may

include policy making from the point of view of public interest and society at large.

To address such issues, it is essential to start moral reflection with fundamental ethical principles, for which sound normative justification can be provided. However, bioethical analysis is not merely a matter of identifying and grounding the appropriate moral principles. It is also concerned with their practical application; it is equally policy-oriented. Emphasis on ethical principles can hardly be sufficient without their contextualisation. One of the aims of bioethical debate is to ensure that fundamental ethical principles can be assimilated by professional and regulatory practices, and where required, by governmental policy. The role of medical education is of special significance. Organisations responsible for the education of healthcare professionals are required to train the latter with sensitivity to ethical principles and norms of best practice in the areas of giving advice about personal genetic testing or profiling.

A bioethical policy-oriented approach on issues as complex and as rapidly changing as the scientific and clinical uses of genetic information will be an ongoing and delicate process. This paper's methodological strategy has been to identify robust ethical principles, for which sound justificatory arguments can be given. After establishing the framework of principles, we may begin to argue for guidelines, which can be of practical interest to medical practitioners, professional, educational and regulatory bodies and research ethics committees, which will make decisions concerning specific uses of genetic data.

There is no simple way of applying moral principles, either algorithmically or mechanistically. Particularly in the field of cancer genetics, the complexity and delicacy of handling genetic information, including practices of seeking to control health risks, require continuous assessment of cases and possibilities, in the light of the best available scientific evidence and in combination with rigorous ethical arguments.

Conflict of interest statement

The author declares no conflict of interest.

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