

Title: 'Fault' genes and false needs? A critical review on the direct-to-consumer marketing of genetic tests.

The paper has been accepted by the Marketing Review journal for publication in July 2017.

Dr Georgios Patsiaouras, Lecturer in Marketing and Consumption, School of Business, University of Leicester.

Address: School of Business, Ken Edwards Building, University of Leicester, University Road, Leicester, LE1 7RH. **Tel:** +44 (0) 116 223 1473 **Email:** gp83@le.ac.uk

Abstract

Since the completion of the Human Genome Project in 2003, the field of personalized medicine based on genetic data has been growing at a phenomenal pace. However, very limited research exists about the marketing practices of companies which promote and sell DNA ancestry and health-related genetic tests directly to the public. Based on a thorough analysis from a variety of online and offline secondary data - such as the content of commercial websites and interdisciplinary studies - this paper seeks to critically examine, discuss and highlight some key issues arising from the process of commercializing genetic tests. Firstly, the study indicates the emergence of a growing consumer marketplace for genetic data that provides to customers a digital space for interaction, construction of biological consumer identities and a sense of belonging. Secondly, the paper critically discusses how advertising messages of genetic tests employ the concepts of 'consumer empowerment' and 'consumer choice.' Finally, the author offers recommendations on ethical issues stemming from the marketing of genetic material related to consumers' genetic literacy and understanding of basic genetic information.

Keywords

Genetics, empowerment, marketing, consumer choice, health

Short Bio: Georgios Patsiaouras is a Lecturer in Marketing and Consumption at the School of Business, University of Leicester. His research interests include conspicuous consumption phenomena, sustainability and marketing theory. His research has been published in journals such as Marketing Theory, Journal of Marketing Management and Journal of Macromarketing amongst others.

Introduction

In May 2013, the actress Angelina Jolie widely publicized her decision to undergo a protective double mastectomy based on the presence of the “faulty” BRCA1 gene which increases the risk of developing breast and ovarian cancer (New York Times, 2013). In general, she encouraged every woman, and especially those with a history of family cancer, to consult medical experts and get access to gene testing and preventive treatment. Miss Jolie’s high-profile contribution has been the most famous and enthusiastic statement about the complex and often misunderstood concepts of personalized medicine, diagnostic and treatments. Since the discovery of DNA’s double helix structure (Watson and Crick, 1953), the field of genetics has probably progressed more than any other scientific field. For example, the modification of DNA material has led to a large number of genetically engineered products such as diabetic insulin and vaccines, gene therapies and genetically modified crops and food, creating new markets for the application of agricultural biotechnology and genomic healthcare (Collins, 2010; Evenson, 2006; Ulo, 2015). From the successful yet controversial cloning process of Dolly the sheep in 1997 up to contemporary uses of nervous systems for the control of bionic legs, the application of biotechnology has expanded to medicine, pharmacy, food and beverage industries and agriculture along with other fields. Amongst these fields, as expected, the biggest impact has been upon the healthcare industry and the growth of medical genetics in particular, an area that has been developing at an unparalleled pace together with increased scepticism regarding its commercial use (Pritchard, 2013; Sheldrake, 2014). For this study, the author seeks to shed some light and examine from a marketing perspective the online marketplace for genetic tests so as to enhance both marketers’ and customers’ understanding regarding the

opportunities and limitations stemming from this emerging industry. Taking into account the noticeable lack of research in this area - especially in the field of customer behaviour - firstly I embark below upon a brief semi-historical account so as to outline how the evolution of medical genetic tests led to its contemporary unlimited commercialization.

The emerging market for genetic tests

The completion of the Human Genome project in 2003 accomplished the mapping, complete sequence and understanding of every human gene - approximately 20,000 thousands coding genes can be found in every chromosome - and paved the way for a future of genetic testing and personalized medicine (Collins & McKusick, 2001; Osakwe & Syed, 2016; Teichler-Zallen, 2008). Nonetheless, the method and an emerging marketplace of genetic testing have been around for some decades now. Newborn screening for rare genetic diseases, such as mental diseases, chromosomal disorders and Galactosemia, occurred in the United States as early as the 1960s (Brosco, 2006; Wilson & Junger, 1968;). In the 1970s, medical researchers focused on prenatal tests assessing the risk of a genetic disease before a baby was born, based on whether the parents had a genetic proclivity towards a certain illness such as Down Syndrome, thalassemia and cystic fibrosis (Patterson & Costa, 2005). Nowadays, prenatal testing for genetic diseases constitutes a routine and since the 1990s medical researchers can identify genes disclosing one's proclivity to develop colon or breast cancer (Collins, 2010).

From the early 2000s onwards, the use of computer science has facilitated the collection of huge amounts of information regarding individuals' genes, a process called genetic profiling (Aronson, 2007). The captivation and stretch of collective imagination after the completion of

the Human Genome Project (HGO henceforth) has led in attributing a genetic dimension to several spheres of cultural and public life interrelating areas such as family characteristics, ancestry, ethics, privacy and individual behaviour amongst others (Prainsack, Schicktanz & Werner-Felmayer, 2014). Amongst these areas, increased media attention has been paid to the development and marketization of genetic tests. Failure rates in drug use (especially for cancer) and increased treatment costs for various diseases have been providing a strong incentive for the implementation of personalized medicine (Spear , Heath-Chiozzi & Huff 2001). Personalized medicine enthusiasts argue that a more in-depth understanding of how genetics interrelate with a disease will diminish the impact of the illness by more effective targeting on prevention or treatment. On the one hand, the promise that each individual can obtain detailed and accurate personal genomic information introduces a spirit of optimism for the provision of tailored and effective therapies for several diseases or the assessment of disease risks. On the other hand, personalized medicine brings forward ethical challenges regarding the ownership and use of personal information, consumer literacy and privacy amongst others. Inevitably, the development and evolution of a contemporary marketplace for genetic tests constitutes a rather complex process and additional research from a marketing perspective can inform how the discovery of the structure of DNA has been transubstantiated – amongst others – into a global market which is expected to reach US\$7.4 billion by 2020 (Global Industry Analysis, 2016). Simultaneously, very few studies have discussed so far the impact of personalized medicine and the marketing of genetic tests towards customers' identities, perceptions and actions as I argue by reviewing the existing literature below.

Genetics and marketing research

The popularity and the legal environment of direct-to-consumer (DTC, henceforth) marketing of genetic tests were discussed by Liu-Thompkins and Pearson (2008). Conducting a content analysis of web-sites that market genetic tests, the authors probed into issues around consumer ignorance, the presence/absence of regulations and how the current selling practices and frameworks can affect potential customers and public health in general. The authors concluded that existing business practices are problematic, taking into account how the lack of a strong regulatory framework around the promotion of preventive medical genetic tests increases consumers' vulnerability since their knowledge of these highly sophisticated products/services is limited. In a similar vein, Williams-Jones and Ozderim (2008) argued that the growing consumer marketplace for genetic tests introduces a diversity of ethical challenges and questions such as the provision of misleading and inaccurate advertising for disease susceptibility. The authors elaborated on the infusion of pre-existing fears about a disease by reductionist marketing strategies which could increase consumers' anxiety towards the potential presence and development of a 'genetic' illness, and consequently, individuals' desire to buy and use genetic tests so as to reduce the risk. Accordingly, Berg and Fryer-Edwards (2007) suggested that increased emotional distress can stem from disclosing information regarding the risk of a future disease, especially taking into account that several diseases can be the outcome of both environmental factors and genetic predispositions. Thereupon, they argued that the promotion of genetic tests by DTC advertising could possibly encourage the cultivation of genetic determinism since it can take advantage of consumers' lack of genetic knowledge. Examining consumers' genetic literacy and calibration through an online survey, Pearson and Liu-Thompkins (2012) suggested that in general low levels of genetic knowledge were identified within their sample. Consequently, the authors expressed their skepticism whether the average consumer of genetic tests acquires the information, knowledge and background so as to make well-informed decisions as regards the use of these products and

services. Almost a decade ago, Ratcliff (2003) indicated that the processes of advertising, supply and access to genetic tests were lacking the establishment of an appropriate framework so as to support consumers' protection. Elaborating on consumer's entitlement to privacy and confidentiality regarding the tests, the author highlighted the need for safe storage and protection of personal genetic information since third parties might be interested - in the future - for the potential application of these data in the areas of insurance and other commercial realms. Ratcliff (2003) suggested that the rigorous evaluation of existing medical tests by screening programmes and public education campaigns can ensure transparency and clarity to potential customers and patients. Such process can stimulate more discussions around the commercialization of genetics and inform individuals so as to make more sophisticated choices. Overall, we notice that since the turn of the century there is a growing (but limited) research interest regarding the ethical provision of genetic services along with the increased development of the marketplace for genetic tests.

Simultaneously, the promises, possibilities and limitations of genetic testing and their intersection with consumer behavior, choices and preferences have also received very limited attention. Davies (2012) employed 'genetic algorithms' - a term superficially described by the author as a vehicle of solving data analysis problems based on the premises of natural selection - so as to create actionable consumer segments for particular products and services. In methodological terms, the genetic algorithm tool was employed by Zwilling and Fruchter (2013) in order to examine the interrelationships between celebrity endorsement, advertising practices and product design. Drawing research tools and insights from the field of artificial intelligence, both studies aimed to scrutinize and assess consumers' perceptions, preferences and thoughts via an advanced statistical analysis which is based upon the biological principles of inheritance, natural selection and crossover. As Bagozzi et al (2012) suggested, the

employment of biological mechanisms for a deeper understanding of consumer orientation and selling methods have remained under-examined. Elaborating on science literature - both from genetics and neuroscience - the authors examined how and to what extent salespeople's consumer orientation is influenced by genes which affect their dopamine system in the brain so as to form managerial decisions and actions. In particular, they focused on the DRD4 gene whose possessors, according to biological research results, develop and display greater proclivity towards potential business opportunities and novelty seeking activities in general. Conducting a DNA analysis with a sample of 65 salespeople, the researchers verified their assumption - regarding the link between the behavior and action - without elucidating with explicit references on how socio-cultural and environmental variables (such as ethnicity, social class, gender and education for example) come into the play and influence salespeople's decisions. Apart from the use of biomarkers in market and sales research, the influence of genetic inheritance to consumers' judgments and choices was recently discussed by Simonson and Sela (2010). Aiming to amalgamate insights from the fields of behavioral genetics and consumer decision making, the authors compared consumption habits between monozygotic and dizygotic twins discussing how their common genes construct preferences for certain products and utilitarian options amongst others. In conclusion, the authors proposed that that close research cooperation between decision-making scholars and geneticists can disclose and bring into the surface how heritable characteristics influence consumers' decisions and actions.

From the analysis and discussion above, we notice that overall there is very limited – both from empirical and theoretical perspectives - research on the intersection between genetic proclivities, marketing and consumption studies. Gradually marketing and consumer behavior theorists immerse themselves in the nature vs. nurture debate so as to examine to what extent and which aspects of our daily actions and behaviors are influenced by inheritance or learning

and environmental factors. Simultaneously the emerging process of marketing genetic tests continues to grow since the advancement of high-tech biological methods and techniques together with private sector interest foster the introduction and marketization of consumer-friendly genetic products.

The introduction of genetic ‘products’

The term personal genome testing doesn't refer to a particular test for the diagnosis of a specific disease or condition but it can be employed in various situations and for several different medical reasons (Evans, Skrzynia & Burke, 2001). Whilst with the turn of the 21st century health-related genetic tests were limited primarily to new-born screening and single-gene diseases related to cardiovascular and obesity, the number and diversity of the offered genetic products over the last ten years divulges a plethora of existing predictive tests oscillating from breast cancer to infertility due to caffeine and wine consumption and from Alzheimer disease to the chances of developing melanoma. In summary, predictive or pre-symptomatic genetic tests can identify genes which enhance one's probability to develop specific diseases; diagnostic tests seek to verify and validate whether a suspected illness stems from the presence of a particular gene; carrier testing aims to trace family members who 'carry' some transformations in their genes which might lead to a disease and finally susceptibility or 'lifestyle' tests can measure and assess individual's risk to develop a disease based on genetic and non-genetic factors (Jorde, Carey & Bamshad 2015; Sharpe & Carter, 2006). Apart from these newly introduced genetic applications, prenatal diagnosis has been used for decades and I also identify the presence of non-diagnostic, but extremely useful tests, such as parental, forensic and also lately genealogical DNA testing.

The popularity and dynamic growth of genetic testing, which involves the introduction and commercial use of almost ten new tests annually, reinforces and substantiates the argument that genetic tests might substitute antibiotics in the 21st century (Klitzman, 2012). Despite several sensitive and ethical issues - - which emerge from the employment of predictive and diagnostic genetic tests, its commercial use via 'direct-to-consumer' practices significantly increases in various countries around the world (Berg & Fry-Edwards, 2008; Gollust, Hull & Wilfond, 2002; Liu & Pearson, 2008; Williams-Jones & Ozderim, 2008). Such increase regarding the popularity of DNA ancestral and health-related genetic testing has created a global marketplace whose main characteristics can be summarized to online services, imaginative promotion and product diversification. Considering that the majority of the readers will not be familiar either with genetic information or genetic products, I present below an overview of DNA ancestry and health-related genetic tests offered directly to the public emphasizing on issues around pricing and product diversification together with criticism that they have received.

Who am I? Ancestral origins and personalized analysis of DNA

Apart from health-related genetic tests, the industry for DNA tests of ancestry tracing findings has boosted over the last 10 years (Bettinger, 2016; Bolnick et al, 2007). Almost 30 online companies (Royal et al, 2010; Su, 2013) over the last decade offer a wide range of ancestry testing and their services return to their customer results which oscillate from family histories and ties that can cover a centenarian period, up to genetic links with populations that lived in different continents centuries ago. More breadth, sophistication and product diversification is offered by particular companies. For example '23andMe' - perhaps the most famous company of personalized DNA services - differentiates its services under the umbrella of 'Ancestral

origins' into: ancestry composition, DNA relatives, family tree tool, maternal and paternal lineages' and surprisingly a test which provides Neanderthal percentage (23andMe, 2015). Since a small percent (approximately 5 per cent) of the Neanderthal genome can be identified within modern humans (Green, Krause & Briggs 2010), potential customers for these genetic services can trace their biological sequence and correlation with this extinct species affording to pay 125 British pounds for a personalized analysis of their DNA. Companies like DNA tribe and iGenea offer commercial and online DNA tests which compete amongst them in terms of affordable pricing (between 100 and 200 US dollars for basic tests), quick turn-around times, customer feedback (expert data analysis) and industry standard markers for more accuracy and reliability. Additionally, we observe that product diversification and price differentiation has been employed by these companies which offer and price differently their DNA ancestry tests. For example, iGenea basic test costs 199 Euros, which draws upon a small database of reference populations, whilst the price of the premium test is 499 Euros so as to assess data from a larger pool of reference populations (iGenea, 2016). Most companies present the final 'product' to their clients via a customer-friendly and personalized map which visualizes and explicates the origins of DNA formation from the amalgamation of moving populations that form a genetic line which eventually results to the consumer. In terms of product offerings and competitive advantage, several companies highlight the employment of advanced technological software (GPS for example) and the ongoing growth of their genetic database which might include up to 1000 national and ethnic groups from every continent. Particular companies, like 23andMe, can provide not only ancestry information regarding spatial and ethnic groups but they can also utilize their database so as to identify costumers' potential relatives (based on members' database) who have the option to message each other and compare their genes and the evolution of their family histories (Jaroslovsky, 2010). As

expected, the direct to consumer employment of DNA ancestry tests has raised increased enthusiasm together with controversy and skepticism.

Following Duster (2010) since the introduction of DNA ancestral matches several Afro-Americans in the United States of America were fascinated with the idea of tracing their roots and antecedents in areas of Sub-Saharan Africa or surprisingly for some of them their genetic connections with Asian or central European ethnicities. Nevertheless, investigations and comparison of inconsistent results from different companies have raised questions regarding the accuracy of these tests, since for the majority of individuals the biological investigation of six generations can provide a lineage of almost 70 direct genetic ancestors (Nixon, 2007). On the other hand, as Balaesque et al (2015) have recently argued through a DNA analysis of large data, millions of contemporary Asians are biologically connected and descended from almost 10 dynastic leaders, including Genghis Khan, who lived thousands of years ago. Although DNA testing can be extremely useful to offer forensic evidence in order to identify and reunite missing members of families (see the case of Argentina's Dirty War - from 1976 to 1983 - for example) its ability to provide a very accurate prediction as regards a customer's link with his/her ancestors from the fifteenth century has been questioned. As it has been scientifically argued the ancestral informative markers shared amongst continental populations can be very subjective and non-specific, thereupon the ancestry percentages returned to customers by some companies (for example 33 % Asian result) might not reflect a scientifically valid sample and biological link (Duster, 2006; Shriver et al, 1997).

The importance of consumption for the construction of individuals' identities has been highlighted by several authors (Belk 1988; Elliott & Wattanasuwan, 1998; Hogg & Mitchell,

1996;; Shankar, Elliott & Fitchett, 2009) and it has been related to a plethora of socio-cultural variables such as ethnicity (Sobh, Belk & Gressel, 2014; Takhar, MacLaren & Parsons, 2010), religion (McAlexander, 2014) and social class (Ustuner & Holt, 2007; Ulver & Ostberg, 2014) amongst others. Perhaps, the increasing popularity of DNA ancestry tests represents an era wherein results related to unknown relatives, geographical and ethnic origins might influence or even alter the attitudes of some consumers regarding their identities and perceptions of their selves in general. DNA ancestry results can be presented and eventually marketed in different forms, informing customers that their descendant had been a historical and well-known figure or by providing evidence which suggests ancestry levels and an exotic ethnic lineage from another continent or an unsuspected ethnic group. There is an over-plethora of reports lately in the media regarding surprising DNA findings which could reshape the identity of nations, ethnic groups or individuals (Guardian, 2015). Test takers might rethink or reconsider their personal identities and they might start building an association or connection with the consumption practices, customs and lifestyles of new ethnic groups or they even might combine leisure and tourism activities with a spiritual quest to visit a ‘homeland’ which was disclosed via their hidden DNA profile. Publishing a guideline book on how customers should interpret Ancestry DNA tests, Hart (2004, p. 90) goes so far as to argue that the results can provide the links “to understanding how to tailor your food, lifestyle, exercises, medicines, supplements and skin-care products to your genetic expression.” Such a powerful and controversial statement implies that existing or potential customers of ancestry testing can or should reconsider, via the interpretation of the results, the use of a variety of products, services and practices oscillating from diet food and alcohol consumption to cosmetics and sports-related activities. On the other hand, growing scientific evidence (ASHG, 2008; Bolnick, 2007) highlights the need for stronger regulatory and quality control frameworks together with greater

responsibility and exploratory clarity within the DNA ancestry testing industry for the provision of accurate information to consumers.

Health-related Genetic Tests

Predictive and diagnostic genetic tests for medical purposes continue to expand within the healthcare industry and simultaneously several companies enter this promising sector so as to offer their web-based DTC services to potential customers (Acton, 2013; Fraker & Maza, 2010). Online consumers of these services, from all over the world, can send samples of their saliva aiming to assess and examine both their risk of developing certain diseases (diabetes, heart disease and Parkinson amongst others) and their sensitivity to particular substances (alcohol or caffeine for example) (Bunton & Petersen, 2005; Teichler-Zallen, 1997). Genetic testing has become so popular to the extent that the University of California (Berkeley) decided few years ago to provide free tests to all fresher undergraduate students in the first semester of 2010 (Colliver, 2010; Pearson & Liu-Thompkins, 2012) seeking to captivate their imagination and interest as regards advances in genomic technologies.

In terms of available health-related 'products' in genetic testing, there seems to be whole gamut of inherited diseases whose predisposition can be identified in customers' genes. The most common example, widely popularized by Angelina Jolie's surgery as preventive measure for breast cancer, can be found in BRCA1 and BRCA2 genes whose presence has been strongly linked with high risk of developing ovarian or breast cancer (Chow, 2003). In general, prices for DTC genetic tests oscillate between 100 and 300 US Dollars (usually shipping included), depending on the complexity of the test, and the range of turnaround is usually between two

and five weeks (Burton, 2015). Harris, Kelly and Wyatt (2014) recently employed a narrative analysis of YouTube videos uploaded by consumers who bought and used, on camera, DTC health-related genetic tests and some of them commented upon their interpretation of the results. The authors analyzed and discussed individuals' narratives as 'stories of consumption' characterized by playfulness, display of imagination, sharing and self-expression, arguing that the use of commercial genetic testing is bound to a kind of emerging consumerism which uses as platforms both biological experimentation and friendly healthcare technologies. One of the participants received the genetic test as a family gift and the online customers elaborated on their consumption experience which amalgamated references to family history, illness narratives and fascination with science. Similar to other commercial goods, the 'genetic product' includes a sheet of instructions, a plastic biohazard bag and a user-friendly sample collection tube. Consumers unboxed online the technologically advanced product and as the authors (Harris et al, 2014) suggested the consumption of the commodity creates economic value since the submission of the saliva sample enhances existing biological databases and the advancement of genomic goods together with the online promotion and branding of the company that sold the product (23andMe).

Focusing on the experiential aspects of consumption (Clarkson, Janiszewski & Cinelli, 2013; Holbrook & Hirschman 1982), the customers of health-related genetic tests can be characterized as novelty-seeking consumers who aim to enhance their experience of how scientific knowledge about their genes can deepen the understanding of their selves, identity, health and relatives. Jantzen, Fitchett, Ostergaard & Vetner (2012, p. 6) elaborated on the emotional aspects of experiential consumption and the marketization of experiences suggesting that apart from seeking hedonism for example, modern consumers employ experiential consumption so as to "enhance self-conception, further a sense of belonging, feeling accepted

or partaking in a collective fate or contribute to the construction of identity.” Similarly, the interpretation of genetic test results - for example a high percentage of risk for future disease, genetic predisposition or a condition like obesity - might enhance consumers’ sense of belonging and collective fate with family members who developed such symptoms or other groups of individuals who share the same genes. However, we should rethink how the commercialization and promotion of health-related genetic products to an online market could also cause potential unintended consequences to unaware consumers.

Several ethical issues can be raised regarding the popularization and marketing of DTC genetic tests and their impact on consumers’ identity, perception and feelings. Consumers might respond in a variety of ways since their genetic literacy and knowledge around biology and illnesses can be very limited (Christensen et al, 2010; Condit, 2010; Pearson & Liu-Thompkins, 2012). For example, the reception of positive results as regards predisposition to an inherited disease might trigger negative feelings related to distress, guilt and emotional burden (Berg & Fryer-Edwards, 2008; Sober & Cowan, 2003). Approaching guilt from an interdisciplinary perspective, Katchadourian (2010) discussed the concept of ‘survivor’s guilt’ which can also occur when the consumer of a predisposition genetic test for a family disease will receive a negative result, developing psychological distress and carrying conscious or unconscious guilt (Chatzidakis, 2015). Apart from the increased cost stemming from the online purchase of DTC genetic tests - insurances do not always cover the cost - the positive or negative outcome of the test might have a positive or even negative health impact. For example, a negative result for the presence of a cancer-related gene might prompt the consumer to omit the future monitoring of his/her health progress or to change their consumption habits assuming that environmental factors and the consumption of particular substances will never lead to the development of the disease (Alba & Hutchinson, 2000; Sanderson & Wardle, 2008). Finally, the disclosure of

consumer's results about increased risk of an inherited disease might have a negative impact on family relationships and family members as regards their decision whether they should know the outcome of the test or not.

In general, the commercial use of health-related genetic products can definitely benefit many customers by increasing their awareness of particular diseases along with their right to access genetic information. However, some consumers might misunderstand or misinterpret the complex information revealed by those tests, an outcome which could affect family dynamics, cause distress, needless of medicines or overconfidence about the chances of developing a disease amongst others. After the presentation and critical examination of existing marketable genetic products, the following section focuses on the employment of advertising strategies and techniques of health-related genetic tests from companies directly to the public.

The Advertising and promotion of genetic tests

Since the beginning of the century a plethora of healthcare enterprises began to advertise and promote their products and services online, using digital marketing strategies (Chaffey & Smith, 2008). Following such trends and avoiding traditional media channels, corporate websites constitute the main means of advertising for companies which offer health-related genetic tests to the public (Berg & Fryer-Edwards, 2008; Liu & Pearson, 2008; Sewak et al, 2005). The number of websites has almost tripled within five years (Liu & Pearson 2008), a fact that reflects the rather dynamic and volatile nature of the marketplace for genetic testing. As McGuire, Diaz, Wang and Hilsenbeck (2009) argued customers of health-related genetic tests usually understand and perceive the online results as helpful, diagnostic and instructive

for decision-making related to their body and health, whilst several companies advertise and highlight that their services have primarily informative and recreational character. However, scepticism has been expressed on how existing or potential customers of these services interpret the information stemming from the advertising of complex medical information related to the risk-assessment for several diseases and health conditions.

It has been argued in social science literature that the majority of these companies upload online mission statements and employ a marketing rhetoric which primarily aims to offer a sense of *empowerment* to viewers and customers (Harvey, 2010; Prainsack et al. 2014). The concept of empowerment has been methodically employed by companies which provide personalized and diagnostic genetic tests (Harvey, 2010; Heath et al, 2004; Williams, Annandale & Tritter, 1998). Encapsulating and communicating its essential values, 23andMe states and informs customers that the company was founded in order to “empower individuals” and “the more you know about DNA, the more you know about yourself” and “to access one’s genetic information is good” (23andMe, 2015). Genetic Health’s website suggests that by knowing your genetic profile “you can control your life and your health” (Genetic Health, 2015) whilst ‘DNA direct’ informs its potential consumers that “you have the right information available to you to make informed healthcare decisions” (DNA direct, 2015). In a similar manner, Myriad Genetics state to their prospective customers that their services provide the information they “need about your cancer risk” so as to “help improve health and quality of life” (Myriad Genetics, 2015). Actually, the most popular companies offering genomic healthcare accentuate and highlight via their promotional messages an amalgamation of individual responsibility, personal care and consumer empowerment as regards risk-related issues from the inheritance and presence of particular genes. Drawing upon Foucault’s work on governmentality and the construction of the self, Rose (2006) argues that advances in the field of biology and genetics introduced a

biomedical governmentality in everyday life which penetrates local, national or cultural boundaries. Subsequently, the formation of 'biological citizens' relies upon consumerism principles which direct and prompt individuals/consumers to be responsible, proactive and energetic so as to empower their control over their own health and bodies. Similarly, the advertising practices of companies in the field of genetic testing cultivate a consumer ethos of responsible and well-informed decisions so as to develop the ability to build and monitor their own personal fitness, healthy lifestyles and well-being. We can draw similarities here on how communication strategies of DTC companies of health-related genetic tests utilize the concept of 'consumer empowerment' via their online mission statements and promotional messages. A traditional view of consumer empowerment acknowledges and proposes customer's gradual access to more control, awareness and information compared to mass producers and sellers (Broniarczyk & Griffin, 2014; Hodgson, 2001; Samli, 2001). Similarly, the analyzed content from genetic companies' websites discloses that one of their key messages for potential customers can be encapsulated to the promise of taking control over their lives since the purchase and use of the 'genetic product' will grant them more access to valuable health-related information, control over their consumption habits together with increased knowledge and awareness about the presence and inheritance of genes within their family tree. Being knowledgeable about genetic risks might enhance consumer's capability to 'act' and modify their consumption habits accordingly, forming a picture of a healthcare marketplace where rewards will be attributed to the more rational, calculus and proactive consumers. Such perspective regarding the benefits of consumer choice and empowerment seems to be embedded within the spirit and framework of a liberal and one-dimensional economic rationality (Shankar, Cherrier & Canniford, 2006) which encourages consumers to embrace the interrelationships between information stemming from a saleable genetic test, the development of healthy lifestyles and eventually their own happiness.

At the same time, websites promoting genetic testing services and products highlight and accentuate the concept of ‘consumer choice’ and how customers can exercise their choices wisely, a concept which has been widely discussed both in healthcare (Bryan, Gill, Greenfield, Guttridge & Marshall, 2006; Fotaki et al, 2008) and marketing literatures (McEachern 2015; Schwartz, 2004). For example, the website of 23andMe (23andMe, 2015) suggests to customers that learning more about their DNA can help them to make “better lifestyle choices” and similarly Gene by Gene (GenebyGene, 2015) promises to provide “unparalleled insights” to their customers for well-informed decision-making. As Zwart (2009) argues the unlimited information and promise to more ‘choice’ and ‘freedom’ stemming from the field of behavioural genomics and bio-information prompts consumers to view their self-images via the lens of genetic information which exhorts both an adaptation of their everyday (consumption) practices and changing behaviors. Thereupon, the promotional rhetoric employed by DTC companies presents the choice of accessing genetic information as an act which can help the consumer to embrace the emergence of a new genetic identity and self who is better informed regarding lifestyle decisions and the risks related to the future. However ethical concerns have been raised as regards the advertising of predictive genetic tests and the interpretation of the results by the consumers without medical mediation.

It can be argued that one of the main motives for purchasing online a genetic test is related to the fear and uncertainty for future diseases. The concept of fear and fear appeal techniques has been employed in marketing and advertising strategies of both pharmaceutical companies (Auton, 2004; Kim & Lee, 2012; Patino, 2005) and DTC genetic testing websites (Liu-Thompkins & Pearson, 2008). As Liu-Thompkins and Pearson (2008) highlight some

companies amalgamate through their advertising messages the concepts of fear and regret portraying negative situations and scenarios related to a future diagnosis of particular preventable disease which could be identified by purchasing a genetic test. Especially, the threat stemming via family history of a particular disease seeks to stimulate customers' coping mechanisms and shape their perceptions towards the existing genetic commodities. Despite the extremely complex factors which should come into consideration for the development of particular diseases, such as cancer for example, DTC genetic testing websites encapsulate and summarize their promotional messages related to fear within a couple of sentences which can lead to incomplete information. As Gollust et al (2002) argue a low level of public understanding around the interrelationship between genes and diseases together the limited scientific explanation provided in the advertisements can easily affect consumers' insecurities about their well-being. It is evident in consumer behavior literature, that the presence of fear and anxiety renders consumers more risk averse and willing to purchase and use new products and brands (Block & Keller, 1996; Dunn and Hoegg, 2014; Rogers, 1983). In the context of the embryonic genetic testing industry, the promotion and communication of fear seeks to attract more customers and via the lack of consumers' medical knowledge on genetic information, it can also enlarge and expand the market. For example, contrary to several types of cancer which might potentially affect millions of individuals, some websites of DTC genetic companies present and promote tests for uncommon hereditary diseases such as Tay-Sachs which will probably affect very fewer individuals compared to potential customers who will be encouraged to purchase the test so as to alleviate their anxieties and worries. In conclusion, several ethical questions can be raised regarding the accuracy and promotion of online genetic testing and its impact on consumers who possess very low levels of genetic literacy and knowledge around biology. In the following section, the discussion focuses around the

consequences from the popularity of direct to the public marketing of genetic tests together with directions and recommendations for future research.

Healthy consumption lifestyles and the emergence of the genetic consumer

The geneticist and entrepreneur Craig Venter is perhaps the most famous advocate of genomic research. In his autobiography titled “A Life Decoded”, he proposed that genetic data not only interpret the risk of hereditary diseases but can also indicate and explicate the presence of behavioural and social features related to tobacco and alcohol consumption, socialization, decision-making and stress levels amongst others. As Prainsack et al (2014, p. 47) suggest such understanding of genomic information as a modern technological and scientific tool brings forward and indicates the merging of individual’s “principle identity which comprises the biological, the autobiographical, and the social self.” This assumption together with the commercialization and supply of genetic tests to the marketplace also brings forward an ontological question regarding how consumers’ identity and sense of being is shaped and determined by their genetic structure. DNA ancestry results could inform or update consumer’s beliefs and attitudes towards his/her cultural and historical background whilst diagnostic genetic results might prompt consumers to rethink dispositions, traits and behavioural characteristics which inform several choices related to purchasing behaviour and consumption of particular substances. However, the assumption that genetic data constitutes the platform for a holistic and accurate understanding of consumer’s identities and actions can be misleading for the potential users of genetic tests.

Actually, a variety of diseases associated with particular genes – such as cystic fibrosis, heart disease or ovarian cancer – are to a great extent influenced by environmental factors, a fact which is not emphasized or explicated in some of the aforementioned websites. Inadequate explanation about the role of diet, smoking, working conditions and socialization, amongst other external factors, and their impact on consumer's health can lead to the false assumption that one's future is totally depended upon his/her genetic background. The overshadowing of environmental factors together with the absence of medical involvement might encourage some consumers to adopt a deterministic understanding as regards the interrelationships between genes and a disease which can inform their everyday consumption practices. As Ratcliff (2003) suggested regarding the presentation of messages in DTC online genetic tests, the line between advertisements and accurate medical information is blurred and creates a confusion which can lead to unnecessary consumer demand for drugs, creation of false needs and the emergence of a genetic consumer marketplace fostered by medicalization and genetic susceptibility. As mentioned above few diseases, such Huntington's disease for example, have been scientifically proved to be definitely inherited by genetic mutation, thereupon consumer's interpretation of a risk of a disease should be accompanied by a medical diagnosis and a careful consideration of environmental interaction, habits and lifestyle in general.

We can assume that in the long run and following the enthusiasm from the completion of the Human Genome Project, the field of personal genomic testing will be defined and shaped by the creation of massive genetic databases which can be used for as platforms for scientific research (Harris et al, 2013) but also as resources for life-style related characteristics of customers. On the one hand the formation of large pools of genetic data can certainly contribute to the development of helpful treatments and therapies but on the other hand more emphasis should be placed on issues around confidentiality and entitlement to privacy. There is the

danger that third parties might be interested in accessing those databases so as to use personal genomic information regarding employability or provision of insurances for example, thereupon, further research should be conducted on issues around consumer protection and informed consent.

In general, and focusing on the realm of media we notice the increased popularity of biomedical research via continuous production of scientific news, public media coverage and press releases related to DNA ancestry, new therapies and public debates regarding the legacy of the Human Genome Project (Marshall, 2011). Billions of individuals without any background in biological science are engaged through the press and media news stemming from the realm of genetic progress and its potential for the 21st century. The usefulness and revolutionary aspects of the human genome has been presented and communicated in the media as a landmark in the history of scientific research which enables us to comprehend the 'book of life' (Kay, 2000). Undoubtedly, the completion of the Human Genome Project has induced tremendous progress in our understanding of life and the commercialization of sequencing services paves the way for the development of new therapies and personalized medicine that will benefit millions of individuals. However, one of the most prominent features of genetic research is increased complexity stemming from data-driven technologies and such complexity can have an impact upon the interpretation of DTC tests taken by thousands of customers on a daily basis. Perhaps, DTC companies of genetic services and products could offer both pre and post-testing counselling so as to assist customers to make more informed decisions about their lifestyles and consumption habits. Cultivating and effectively communicating a basic understanding about the influence of genes on personal health will enhance the quality of existing information and it will improve consumers' decision making and choices. The public's scientific education and knowledge around the role of genes and genetic testing are very limited (McInerney, 2002),

therefore perhaps medical professionals should be involved in the promotion of genetic testing via educational intervention and personalized counselling services. Ideally, marketing-managers of DTC online genetic tests could infuse and imbue their statements and online messages with more scientific reports and valid information regarding the limitations and opportunities stemming from the use of these tests. Of course, such process could weaken and affect some of the most successful characteristics of the existing advertising strategies and messages (playfulness, simplicity, entertainment for example) and therefore it might have a negative impact on their sales. More public funding for development of genetic education, establishment of websites which include useful and comprehensible information around the understanding of genetics and cooperation amongst academic researchers, the government and the private sector could strengthen both the accessibility and usefulness stemming from the employment of genetic tests to consumers.

Conclusions

From the legendary search for the Holy Grail up to the tragic fates of Faust, Dorian Grey and Frankenstein human imagination has always sought to comprehend the ability or condition to avoid death, bodily pain or suffering. Somehow, modern science and medicine have undertaken such task and the popularity of genetics in public media coverage and discourse suggests that more individuals display a growing interest in employing the advancement in genetic research so as to alleviate their anxieties, change lifestyles and to be informed in general about their genetic heritage. Focusing on marketing practices of genomic data online, via DNA ancestry and health-related tests, this study sought to present and critically discuss issues around pricing, product differentiation and advertising from companies which offer genetic products and services. Overall, it can be argued that limited attention has been paid by the discipline of

marketing to the growing industry of genetic testing and the promotion of its products and services to existing or potential customers. Thereupon, this study identifies and highlights the development and growth of an online consumer marketplace for genetic tests whose main characteristics can be summarized to playfulness, sense of belonging, entertainment and from a communicative perspective increased emphasis on the concepts of ‘consumer empowerment’ and ‘consumer choice’ via the use of available products and services. Such interactive environment prompts existing and potential customers to embrace and construct the emergence of their genetic identity which can reveal helpful facts so as to avoid risks and make better decisions regarding their lifestyle and consumption actions in the future. Although the commercialization of consumer-friendly genetic products can assist consumers to better understand their genetic make-up and health risks, the complexity of genetic tests and science in general raises some questions whether customers acquire the conceptual skills and knowledge so as to change their consumption habits and actions based on the results. This paper suggests that the existing promotional strategies should place more emphasis on the role of environmental factors towards developing a disease and ideally medical counselling could be accompanied together with the purchase of a health-related genetic test so as to assist the customer to make better-informed decisions. More research should be conducted in the area with emphasis on the presence of regulatory frameworks, consumers’ levels of genetic literacy and understanding of basic genetic information together with the impact of genetic results to consumer’s actions, emotions and attitudes. The growth and popularity of genetic research in the 21st century is expected to have a massive influence not only upon the healthcare industry but also on social and cultural dimensions of everyday life, thereupon the marketing practices of genetic tests and its impact on the construction of consumption identities requires further research.

References

Acton, Q. (2013) *Issues in Genetic Medicine*. Atlanta Georgia: Scholarly Edition.

Alba, J. & Hutchinson, W. (2000) Knowledge calibration: what consumers know and what they think they know. *Journal of Consumer Research*, 27(2), 123-156.
<http://dx.doi.org/10.1086/314317>

American Society of Human Genetics (2008, November 13) *Ancestry Testing Statement*. Retrieved from <http://www.ashg.org/>

Aronson, J. (2007) *Genetic witness science, law, and controversy in the making of DNA profiling*. New Brunswick NY: Rutgers University Press.

Auton, F. (2004) The advertising of pharmaceuticals direct to consumers: a critical review of the literature and debate. *International Journal of Advertising*, 23(1), 5-52.
doi:10.1080/02650487.2004.11072871

Bagozzi, P. Verbeke, W. van den Berg, W. Rietdijk, W. Dietvorst, R. & Worm, L. (2012) Genetic and neurological foundations of customer orientation: field and experimental evidence.

Journal of the Academy of Marketing Science. 40(5), 639 – 658. doi:10.1007/s11747-011-0271-4

Belaresque, P., Poulet, N., Cussat-Blanc, S., Gerard, P., Quintana, L., Heyer, E., and Jobling, M., (2015) Y-chromosome descent clusters and male differential reproductive success: young lineage expansions dominate Asian pastoral nomadic populations. *European Journal of Human Genetics*. 23, 1413–1422; doi:10.1038/ejhg.2014.285.

Belk, R. (1988). Possessions and the Extended Self. *Journal of Consumer Research*, 15(2), 139-168. Retrieved from <http://www.jstor.org/stable/2489522>

Berg, C. & Fryer-Edwards, K. (2008) The ethical challenges of direct-to-consumer genetic testing. *Journal of Business Ethics*, 77(1), 17-31. doi:10.1007/s10551-006-9298-8

Bettinger, B. (2016) *The Family Tree: Guide to DNA testing and Genetic Genealogy*. New York (NY): Family Tree Books.

Block, L. & Keller, P. (1998) Beyond protection motivation: an integrative theory of health appeals. *Journal of Applied Social Psychology*, 28(17), 1584-1608. doi:10.1111/j.1559-1816.1998.tb01691.x

Bolnick, D. Fullwiley, D. Duster, T. Cooper, R. Fujimura, J. Kahn, J. et al. (2007) The science and business of genetic ancestry testing. *Science*, 18(5849), 399-400. DOI: 10.1126/science.1150098

Brosco, J. (2006) Early History of Universal Screening for PKU and Galactosemia in the US. Mailman Center for Child Development, Department of Pediatrics, University of Miami, *Quarterly Narrative Report*, January-March 2006.

Broniarczyk, S. & Griffin, J. (2014) Decision difficulty in the age of consumer empowerment. *Journal of Consumer Psychology*, 24(4), 608-625. doi:10.1016/j.jcps.2014.05.003.

Bryan, S. Gill, P. Greenfield, S. Gutridge, K. & Marshall, T. (2006) The myth of agency and patient choice in health care? The case of drug treatments to prevent coronary disease. *Social Science and Medicine*, 63(10), 2698-2701. doi:10.1016/j.socscimed.2006.07.008

Bunton, R. & Petersen, A. (2005) *Genetic governance: health, risk and ethics in biotech age*. New York (NY): Routledge.

Burton, A. (2015) Are we ready for direct-to-consumer genetic testing? *The Lancet Neurology*, 14(2), 138-139. DOI: [http://dx.doi.org/10.1016/S1474-4422\(15\)70003-7](http://dx.doi.org/10.1016/S1474-4422(15)70003-7).

Chaffey, D. and Smith, P. (2008) *E-Marketing excellence: planning and optimizing your digital marketing*. London: Butterworth: Heinemann.

Chatzidakis, A. (2015) Guilt and ethical choice in consumption: a psychoanalytic perspective. *Marketing Theory*, 15(1), 79-93. doi: 10.1177/1470593114558533.

Chow, L. (2003) The new challenges of personalized medicine. *Medical Marketing & Media*, March (1), 69-72.

Christensen, K., Jayarante, T., Roberts, J., Kardia, S., and Petty, E., (2010) Understandings of basic genetics in the United States: results from a national survey of Black and White Men and Women. *Public Health Genomics*, 13(7/8), 468-476. doi: 10.1159/000293287.

Clarkson, J. Janiszewski, C. & Cinelli, M. (2013) The desire for consumption knowledge. *Journal of Consumer Research*, 39(6), 1313-1329. <http://dx.doi.org/10.1086/668535>

Collins, F. (2010) *The language of life: DNA and the revolution in Personalized Medicine*. New York: Harper Collins.

Collins, F. & McKusick, V. (2001) Implications of the Human Genome Project for Medical Science. *JAMA*, 285, 540-544.

Colliver, V. (2010 May 21st) Ethics of UC Berkeley's gene testing questioned. *San Francisco Chronicle*, retrieved at <http://www.sfgate.com/education/article/Ethics-of-UC-Berkeley-s-gene-testing-questioned-3188224.php>].

Condit, C. (2010) Public understandings of genetics and health. *Clinical Genetics*, 77(1), 1-9. doi: 10.1111/j.1399-0004.2009.01316.x.

Covolo, L. Rubinelli, S. Ceretti, E. & Gellati, U. (2015) Internet-Based Direct-to-Consumer Genetic Testing: A Systematic Review. *J Med Internet Res.* 17(12): e279 doi: 10.2196/jmir.4378.

Davies, S. (2013) Choosing the right basket for your eggs: Deriving actionable customer segments using supervised genetic algorithms. *International Journal of Market Research*, 54(5), 689 – 706.

DNA direct (2015) Personalized Medicine: Putting Your Genes in Context. Retrieved at 15th of March 2015 from: [<http://www.dnadirect.com/dnaweb/consumers/consumers.html>]

Dunn, L. and Hoegg, J. (2014) The impact of fear on emotional brand attachment. *Journal of Consumer Research*, 41(1), 152-168. <http://dx.doi.org/10.1086/675377>

Duster, T. (2006) The molecular reinscription of race: Unanticipated issues in biotechnology and forensic science. *Patterns of Prejudice*, 40(4/5), 427-441. DOI: 10.1080/00313220601020148

Duster, T. (2010) Ancestry Testing and DNA: Uses, Limits, and Caveat Emptor. In Krimsky, S., and Sloan, K., *Race and the Genetic Revolution: Science, Myth, and Culture*. New York: Columbia University Press.

Economist Intelligence Unit (2009) *Breakaway: The global burden of cancer – challenges and opportunities*. London: United Kingdom.

Elliott, R. & Wattanasuwan, K. (1998) Brand as symbolic resources for the construction of identity. *International Journal of Advertising*, 17(2), pp. 131-144.

Evans, J. Skrzynia, C., & Burke, W. (2001) The complexities of predictive genetic testing. *British Medical Journal*, 322(7293), 1052 – 1056.

Evenson, R. (2006) *International trade and policies for genetically modified products*. Wallingford: United Kingdom.

Fotaki, M. Roland, M. Boyd, A. McDonald, R. Scheaff, R. & Smith, L., (2008) What benefits will choice bring to patients? Literature review and assessment of implications. *Journal of Health Service Research and Policy*, 13(3), 178-184. doi: 10.1258/jhsrp.2008.007163.

Fraker, M. & Mazza, A. (2010) *Direct-to-Consumer Genetic Testing*. Washington, DC, USA: National Academies Press.

GenebyGene (2015) The Gene by Gene story. (accessed 10th of March 2015).retrieved from: [<https://www.genebygene.com/pages/company#>].

Genetic Health (2015) Genetic Testing Services. (accessed 15th of March 2015). Available from: [<http://www.genetic-health.co.uk/dna-test-services.htm>]

Global Industry Analysts (2012) Future of Direct-to-Consumer (DTC) Genetic testing market remains fraught. (accessed 10 December 2014) Retrieved from: http://www.prweb.com/releases/DTC_genetic_testing/direct_to_consumer_tests/prweb9780295.htm

Global Industry Analysis (2016) Genetic Testing – a Global Strategic Business Report. (accessed 2nd of January 2016) retrieved from: <http://www.strategyr.com/pressMCP-1392.asp>

Gollust, S. Hull, S., & Wilfond, B. (2002) Limitations of Direct-to-Consumer Advertising for Clinical Genetic Testing. *Journal of the American Medical Association*, 288(14), 1762-1767.

Green RE, Krause J, Briggs AW, et al. (2010). A draft sequence of the Neandertal genome. *Science*. 328 (5979): 710–22. [doi:10.1126/science.1188021](https://doi.org/10.1126/science.1188021).

Guardian (2013) To claim someone has 'Viking ancestors' is no better than astrology. (accessed 15 December 2013) retrieved from: <http://www.theguardian.com/science/blog/2013/feb/25/viking-ancestors-astrology>

Harris, A. Wyatt, S. & Kelly, S. (2013) The gift of spit (and the obligation to return it): how consumers of online genetic testing services participate in research. *Information Communication and Society*, 16(2), 236-257. **DOI:**10.1080/1369118X.2012.701656

Hart, A. (2004) *How to interpret family history & Ancestry DNA test results for beginners*. Lincoln (FL): ASJA Press.

Harvey, A. (2010) Genetic risks and healthy choices: creating citizen-consumers of genetic services through empowerment and facilitation. *Sociology of Health and Illness*, 32(3), 365-381. doi: 10.1111/j.1467-9566.2009.01202.x.

Heath, D. Rapp, R. & Taussig, K. (2004) *Genetic citizenship*, in A Companion to the Anthropology of Politics, edited by Nugent, G., and Vincent, J., Malden, MA: Blackwell Publishing, pp. 152-167.

Hodgson, D. (2001) “*Empowering customers through education or governing without government.*” in Sturdy, A., Grugulis, I. and Willmott, H. (eds), *Customer Service: Empowerment and Entrapment*, Palgrave:Basingstoke, pp. 117-34.

Hogg, M. & Mitchell, P. (1996) Identity, Self and Consumption: A conceptual framework. *Journal of Marketing Management*, 12(7), 629-644. **DOI:**10.1080/0267257X.1996.9964441

Holbrook, M., & Hirschman, E. (1982). The Experiential Aspects of Consumption: Consumer Fantasies, Feelings, and Fun. *Journal of Consumer Research*, 9(2), 132-140. Retrieved from <http://www.jstor.org/stable/2489122>.

iGenea (2016) iGenea: Discover your History. (Accessed 10th of December 2015) retrieved from [<https://www.igenea.com/en/order/premium>].

Jantzen, C. Fitchett, J. Ostergaard, P. & Vetner, M. (2012) Just for fun? The emotional regime of experiential consumption. *Marketing Theory*, 12(2), 137-154. doi: 10.1177/1470593112441565

Jaroslovsky, R. (2010) Self-absorbed? It must be in my genes. *Bloomberg Businessweek*, 18, 79-80.

Jolie, A. (2013, May 14) "My Medical Choice" *New York Times*, pp. 24, viewed 17 January 2014. Retrieved from http://www.nytimes.com/2013/05/14/opinion/my-medical-choice.html?_r=0

Jorde, L. Carey, J. & Bamshad, M. (2015) *Medical Genetics*. 5th edition. Philadelphia: Elsevier.

Katchadourian, A. (2010) *Guilt: A Bite of Conscience*. Stanford: Stanford University Press.

Kay, L. (2000) *Who wrote the book of life? A History of the Genetic Code*. Stanford: Stanford University Press.

Kim, H. & Lee, C. (2012) Presumed influence of endorser and fear appeal in DTC prescription drug advertising: are they overpowering consumers' judgments? *Journal of Medical Marketing*, 12(4), 247-258. doi: 10.1177/1745790412459878

Klitzman, R. (2012) *Am I my genes? Confronting fate and family secrets in the age of genetic testing*. Oxford: Oxford University Press.

Life Science Foresight Institute (2013) *Personalized medicine: a new era for healthcare and industry*. University of Lund: Sweden.

Liu, Y. and Pearson, Y. (2008) Direct-to-Consumer Marketing of Predictive Medical Genetic Tests: Assessment of Current Practices and Policy Recommendations. *Journal of Public Policy & Marketing*, 27(2), 131-148. doi: <http://dx.doi.org/10.1509/jppm.27.2.131>

McInerny, J. (2002) Education in a Genomic World. *Journal of Medicine and Philosophy*, 27(3), 369-390. DOI:[10.1076/jmep.27.3.369.2977](https://doi.org/10.1076/jmep.27.3.369.2977)

Marshall, E. (2011) Humane genome 10th anniversary. Waiting for the revolution. *Science*, 331(6017), 526-9. DOI:[10.1126/science.331.6017.526](https://doi.org/10.1126/science.331.6017.526)

McAlexander, J. Leavenworth, B. Martin, D., & Schouten, J. (2014) The Marketization of Religion: Field, Capital, and Consumer Identity. *Journal of Consumer Research*, 41(3), 858-875. DOI: 10.1086/677894.

McEachern, G. (2015) Corporate citizenship and its impact upon consumer moralization, decision-making and choice. *Journal of Marketing Management*, 31(3/4), 430-452.
<http://dx.doi.org/10.1080/0267257X.2014.974658>

McGuire, L. Diaz, M. Wang, T. & Hilsenbeck, G. (2009) Social networkers' attitudes toward direct-to-consumer personal genome testing. *The American Journal of Bioethics*, 8(6), 18-20.

Molinger, C. Aaker, J. & Kamvar, S. (2014) How happiness affects choice. *Journal of Consumer Research*, 15(5), 312-326.

Myriad Genetics, (2015) What is my risk? (accessed on 15th of March 2015) retrieved from:
[\[https://www.myriad.com/patients-families/your-questions-about-disease/whats-my-risk/\]](https://www.myriad.com/patients-families/your-questions-about-disease/whats-my-risk/)

Nixon, R., (2007, 25th of November) DNA tests find branches but few roots. Accessed 20th of May 2015 retrieved from:
http://www.nytimes.com/2007/11/25/business/25dna.html?pagewanted=all&_r=0

Osakwe, O, & Syed. R., (2016) *Social aspects of drug discovery, development and commercialization*. London: Elsevier.

Patino, A. (2005) Male body image and fear appeal. *Advances in Consumer Research*, 32(1), 260-263.

Patterson, D. & Costa, A., (2005) History of genetic disease: Down syndrome and genetics – a case of linked histories. *Nature Review Genetics*, 6, 137-147. doi:10.1038/nrg1525.

Pearson, Y. & Liu-Thompkins, Y. (2012) Consuming Direct-to-Consumer Genetic Tests: the role of genetic literacy and knowledge calibration. *Journal of Public Policy and Marketing*, 31(1), 42-57. doi: <http://dx.doi.org/10.1509/jppm.10.066>

Prainsack, B. Schicktanz, S. & Werner-Felmayer, G. (2014) *Genetics as social practice: transdisciplinary views on science and culture*. Burlington, VT: Ashgate Publishing.

PricewaterhouseCoopers (2009) *The Science of Personalized Medicine: Translating the Promise into Practice*. London: United Kingdom.

Pritchard, D. (2013) *Medical genetics at a glance*. Chichester: Wiley.

Rogers, R. (1983) Cognitive and Physiological Processes in Fear Appeals and Attitude Change: A Revised Theory of Protection Motivation. in *Social Psychophysiology*, ed. John T. Cacioppo and Richard E. Petty, New York: Guilford, 153–76.

Rose, N. (2006) *Politics of life itself: biomedicine, power and subjectivity in the twenty-first century*. Princeton: Princeton University Press.

Royal, D. Novembre, J. Fullerton, M. Goldstein, B., & Long C., et al (2010) Inferring genetic ancestry: opportunities, challenges and implications. *American Journal of Human Genetics*, 86(5), 661-673. doi: 10.1016/j.ajhg.2010.03.011.

Samli, A. (2001) *Empowering the American Consumer: Corporate Responsiveness and Market Profitability*. QuorumBooks: Westport, CT.

Sanderson, S. & Wardle, J. (2008) Associations between anticipated reactions to genetic test results and interest in genetic testing: will self-selection reduce the potential harm. *Genetic Testing*, 12(1), 59-66. doi: 10.1089/gte.2007.0047

Schwartz, B. (2004) *The Paradox of Choice*. New York: Ecco.

Sewak, S. Wilkin, N. Bentley, J. & Smith, M. (2005) Direct-to-Consumer Advertising via the Internet: the role of web-site design. *Research in Social and Administrative Pharmacy*, 1(2), pp. 289-309. DOI:[10.1016/j.sapharm.2005.03.012](https://doi.org/10.1016/j.sapharm.2005.03.012)

Sheldrake, J. (2014) *Technology, Business and the Market: from R. and D. to Desirable products*. London: Ashgate Publishing Ltd.

Shankar, A. Cherrier, H. & Canniford, R. (2006) Consumer empowerment: a Foucauldian perspective. *European Journal of Marketing*, 40(9/10), 1013-1030. <http://dx.doi.org/10.1108/03090560610680989>

Shankar, A. Elliott, R. & Fitchett, J. (2009) Identity, consumption and narratives of socialization. *Marketing Theory*, 9(1), 75-94. doi: 10.1177/1470593108100062

Sharpe, N. & Carter, R. (2006) *Genetic testing: care, consent and liability*. Hoboken, N.J.: Wiley-Liss.

Shriver, D. Smith, W. Jin, L. Marcini, A., & Akey, M. et al (1997) Ethnic-affiliation estimation by use of population-specific DNA markers. *American Journal of Human Genetics*, 60(4), 957-964.

Simonson, I. & Sela, A. (2010) On the Heritability of Consumer Decision Making: An Exploratory Approach for Studying Genetic Effects on Judgment and Choice. *Journal of Consumer Research*, 37(6), 951-966. DOI: 10.1086/657022

Sobel, S. & Cowan, C. (2003) Ambiguous loss and disenfranchised grief: the impact of DNA predictive testing on the family as a system. *Family Process*, 42(1), 47-57.

Sobh, R. Belk, R., & Gressell, J. (2014) Mimicry and modernity in the Middle East: fashion invisibility and young women of the Arab Gulf. *Consumption, Markets and Culture*, 17(4), pp. 392-412. DOI:10.1080/10253866.2013.865166

Spear, B. Heath-Chiozzi, M. & Huff, J. (2009) Clinical application of Pharmacogenetics. *Trends in Molecular Medicine*, 7(5), 201-204.

Su, P., (2013) Direct-to-Consumer Genetic Testing: A Comprehensive View. *Yale Journal of Biology and Medicine*. 86(3), 359-365.

Takhar, A. Maclaren, P. & Parsons, E. (2010) Consuming Bollywood: Young Sikhs social comparisons with heroes and heroines in Indian films. *Journal of Marketing Management*, 26(11/12), 1057-1073. DOI:10.1080/0267257X.2010.508978

Teichler-Zallen, D. (1997) *Does it run in my family?: Consumer's guide to DNA testing for genetic disorders*. New Jersey: Rutgers University Press.

Teichler-Zallen, D. (2008) *To test or not to test a guide to genetic screening and risk*. New Brunswick : Rutgers University Press.

Ulo, M. (2015) *Interpreting Biomedical Science: experiment, evidence, belief*. London: Elsevier.

Ulver, S. & Ostberg, J. (2014) Moving up, down or sideways? *European Journal of Marketing*, 48(5/6), 833-853. <http://dx.doi.org/10.1108/EJM-07-2012-0418>

Ustuner, T. & Holt, D. (2007) Dominated Consumer Acculturation: The Social Construction of Poor Migrant Women's Consumer Identity Projects in a Turkish Squatter. *Journal of Consumer Research*, 34(1), 41-56.

Watson, J. & Crick, F. (1953) A structure for deoxyribose nucleic acid. *Nature*, 171(4356), 737-738.

Williams, S. Annandale, E. & Tritter, J. (1998) The sociology of health and illness at the turn of the century: back to the future? *Sociological Research Online*, 3(4), <http://www.socresonline.org.uk/3/4/1.html>

Williams-Jones, B. & Ozderim, V. (2008) Challenges for corporate ethics in marketing genetic tests. *Journal of Business Ethics*, 77, 33-44. doi:10.1007/s10551-006-9299-7

Wilson, J. & Jungner G. (1968) *Principles and practice of screening for disease*. Geneva: World Health Organization.

Zwart, H. (2009) Genomics and identity: the bioinformatisation of human life. *Medicine, Health Care and Philosophy*, 12(2), 125-139. doi: 10.1007/s11019-009-9187-x.

Zwilling, M. & Fruchter, G. (2013) Matching product attributes to celebrities who reinforce the brand: an innovative algorithmic selection model. *Journal of Advertising Research*, 53(4), 391 - 410. DOI: 10.2501/JAR-53-4-391-410

23andMe (2015) Bring your ancestry to life through your DNA. (accessed 4th of March 2015) retrieved from [<https://www.23andme.com/en-gb/ancestry/>].

23andMe (2015) Learn how the DNA may affect your health. (accessed 5th of March 2015),
retrieved from [<https://www.23andme.com/en-gb/health/>].