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Precision health contributions to public health: An integrative review

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Precision health is an all-encompassing term, which can describe a type of care that shows the intersectionality of genomics, precision health or medicine and public health. This integrative review aimed to investigate how precision health strategies could contribute to the public health and improve health-related outcomes among populations. The search strategy included 5 main keywords combined with other 63 descriptors, resulting in 252 potential combinations. A total of 1,576 published articles were retrieved from the search. Fourteen articles met the inclusion criteria. Most addressed health-related outcomes were linked with chronic diseases like diabetes and cancer. The analyzed papers also discussed contextual effects and risk factors such as smoking under the scope of precision health and its interfaces with public health. Application of precision health to public health requires more collaborative work; the use of science and technology to help individuals achieve better health outcomes is costly, although over time may result in more efficient, cost-effective resource allocation. The downside of it is the risk of excessive focus on genes and technology detrimental to other relevant determinants of health (e.g. social factors). It is important to give the population, government, health providers and other stakeholders equal voice in health innovation discussions.

Key words: Precision health, precision medicine, public health, health innovation.

INTRODUCTION

Precision health is a concept that is emerging in the field of public health, which shows a form of treatment in which the context of the condition of the patient is understood while finding the best intervention, promoting more personalized care (Feero, 2017). Precision medicine is an approach for disease treatment and prevention that takes into account individual variability in environment, lifestyle and genes for each person. Precision medicine also differs from genomics, in the sense that genomics covers topics that do not include healthcare, like zoology, but also does not cover public health topics like the effect of wearable sensors on

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behavior (Feero, 2017). The terms “Precision Health” and “Precision Medicine” are often used interchangeably. Although “Precision Medicine” was coined first, broadening the scope of the term, switching to “Precision Health” seems to be more suitable once it is not limited to medical interventions or medical actions but it brings together different fields of knowledge and practice. This present study will adopt the term “Precision Health”. Therefore, “Precision Health” describes a type of care that discusses the intersectionality of genomics, Precision Medicine, and Public Health (Feero, 2017). By using the term “health” instead of “medicine”, we can couple the scientific aspects of medicine with the context of the conditions of patients, whether environmental effects, personal characteristics, or other factors that could be possibly detrimental to health, thus more aligned to with Public Health. Precision Health also includes an interprofessional health team approach to health promotion, disease prevention care instead of just the medical viewpoint that focuses on disease management and episodic care.

National initiatives have been conducted to promote the interdisciplinary concept of Precision Health. For example, an initiative led by a national organization, National Institutes of Health (NIH), called the “*All of Us Research Program*”, strives to extend precision medicine to all diseases by conducting continuous research on a cohort of over one million U.S. participants (National Institutes of Health, 2018). By doing so, it demonstrates how the general population, stakeholders who have an effect on policy, healthcare providers, and researchers can come together to improve public health.

Precision Health focuses on creating patient subpopulation and then administering specific intervention to each group appropriately (Feero, 2017). For example, both the United Kingdom 100,000 Genomes Project and United States Precision Medicine Initiative (PMI) will use patient data to create genomic sequences. In turn, this population data can be used to allow for understanding of diseases on specific molecular terms, thus allowing patients to gain more insight into the pathways of alleviating rare medical problems. For example, the United Kingdom 100,000 Genomes Project focuses on sequencing patients with rare disease, their families and cancer patients. As 80% of rare diseases are genomic, by understanding the family genomes of those who are affected, the causes can be identified, and individual care can be improved (Vaithinathan and Vanitha, 2017). The United States PMI uses a national group of 1 million people to investigate genetic and environmental determinants of health, to improve pharmacogenomics (how genes affect a human’s response to drugs). In turn, those with knowledge of their respective alleles can use data-driven information to select effective treatments for their genotype. In doing so, both these projects involving cohorts can streamline medicine to be more cost-effective and avoid side effects, empowering individual care (Vaithinathan and Vanitha, 2017). Nevertheless, for large-scale studies to be successful, each individual must be compared to a diverse cohort, without convenience sampling, requiring an excellent epidemiological cohort structure (Khoury et al., 2016).

Additionally, it is important to give the public, government, health providers, as well as other parties in the healthcare system equal stake in decision-making, demonstrating the importance of public health and healthcare intersectionality. By having participation of all parties, it will allow for policy and resources to come together to create innovative approaches to fix the current populations’ needs (Khoury et al., 2016). If the public is not given an active voice, an already imbalanced healthcare distribution may worsen health disparities (Khoury et al., 2012). It is important to highlight that even in genomic applications, a large cohort is needed as diseases are usually due to multiple factors. Additionally, large numbers of people are needed to make subgroup data for disease stratification and understanding of environment-gene relationships (Khoury et al., 2016). Cost and reimbursement from insurance companies may also become problematic over time, as sequencing DNA with new technology and deriving drugs and therapies for specific treatments will both be expensive (U.S. National Library of Medicine, 2017). Precision health focuses on prevention through not only encouraging lifestyle and environment choices, but by using a wide variety of biomarkers to diagnose risk of developing disease, like blood, saliva and urine, just to name a few (Vargas and Harris, 2016). Other resources such as wearables, smartphones applications (e.g. Apple partnership with Stanford Precision Health) are part of Precision Health strategy (Mach, 2017). The former United States administration encouraged governing bodies to implement policies that support Precision Health, such as the Precision Medicine Initiative (Dzau et al., 2016). From the Public Health perspective, the current challenge is still over health inequalities, which are not explained neither by the genes per se nor by improvement of technology itself but by social stratification and lack of basic conditions such as high quality education, decent housing, social support, clean water, among others.

This integrative review aimed to investigate how precision health strategies could contribute to public health and improve health-related outcomes among populations.

METHODOLOGY

This study is an integrative review that addresses experimental and non-experimental studies to understand the analyzed outcome, it combines data from theoretical and empirical literature, and has a wide range of purposes, such as definition of concepts, review of theories and evidence, and analysis of methodological problems of a particular topic (Whittemore and Knafl, 2005). The research question was “How can public health improve health-related outcomes based on precision health strategies?” Searches were conducted on US National Library of Medicine, National Institutes

of Health (PUBMED) on March 25th of 2017 by two authors of this study that searched independently on the same day. The PubMed "advanced search builder" tool and search strategy were used as follows for "Title/Abstract".

The authors searched for 63 descriptors (Medicine/ Health/ Healthcare/ Health Care/ Medicine 2.0 /Medicine 3.0/ Biomedical Technology/ Individual Treatment/ Personal Intervention/ Preventive Medicine/ Preventive Medicine/ Prevention/ Health Promotion/ Disease Prevention/ Disease/ DNA/ DNA Sequencing/ Phenotype/ Genotype/ Genomics/ Genetics/ Genetic Variation/ Molecular Diagnostics/ Molecular Phenotypes/ Molecular Classification/ Molecular/ Environment/ Environmental/ Data/ Data Science/ Data Application/ Big Data/ Targeted Therapy/ Medical Imaging/ Heterogeneity/ Pharmacogenomics/ Somatic Mutation/ MassARRAY/ Personalized Therapy/ Precision Therapy/ Predictive Factors/ Disease Taxonomy/ Disease Pathology/ Natural History of Disease/ Treatment Customization / Time-to-Subsequent-Disease-Progression/ Clinical Trials/ RCT/ Epidemiology/ Global Health/ Health Informatics/ Health Information Technology/ Health Technology/ Biomarker/ Biomarker Technology/ Clinical Decision-Making/ Risk Factors/ Chronic Disease/ Cancer/ Diabetes/ Cardiovascular/ Obesity/ Respiratory) that were individually combined with 5 main fixed keywords [("Precision Health" OR "Precision Medicine" AND "Public Health" AND "descriptor X") / ("Personalized Health" OR "Personalized Medicine" AND "Public Health" AND "descriptor X)], resulting in a total of 252 potential combinations of keywords. Example: [("Precision Health" OR "Precision Medicine" AND "Public Health" AND "diabetes") + ("Personalized Health" OR "Personalized Medicine" AND "Public Health" AND "diabetes")]. The exclusion criteria for papers selection were: 1) papers in which abstract were not available by the date of search, and 2) study type reviews. The inclusion criteria for papers selection were: 1) texts with abstracts and full text availability, and 2) studies that involved humans and other animals.

When the searches were concluded, potential divergences were discussed between the two researchers responsible for this step. There was no limit for the year of publication. The search process retrieved 1,576 potential papers. The 1st phase of paper selection was according to "Title" (75 remaining papers), followed by "Abstract" (31 remaining papers). Titles and/or abstracts not related to the subject were excluded; 17 potential papers were fully printed for analysis due to the fact that they addressed the subject of this review. 14 papers met the inclusion criteria and were included in this integrative review.

RESULTS

The content of a diverse selection of 14 papers was extracted. The studies included were undertaken between 2008 and 2017. Papers ranged from long-term experiments to discuss obscure variables that correlated with certain diseases. Majority of the articles (79%) primarily addressed lifestyle and other contextual, public health interventions. Additionally, all papers reinforced the importance of prevention in public health and the benefits in moving to a health system model that focuses on prevention.

DISCUSSION

Addressing the population perspective

Population health is a term used to describe a group of patients/families that have similar conditions such as diabetes, cardiovascular disease and asthma. Population health departments exist in some of the major health centers in effort to reduce the costs of care and produce better health outcomes for the populations served. Population health uses evidence-based interventions. Public health in precision medicine is through the use of evidence and scientific data, and then using this information in conjunction with the community/population of interest to make health decisions. These data can be used by health protection agencies like the Centers for Disease Control and Prevention (CDC) to sequence pathogens and then assist populations and individuals control diseases. On a smaller scale, data from family trees, including factors from lifestyle and behavior can be analyzed to guide the individual to precise screenings in order to make disease prevention to be more effective. Evidence-based public health is divided into three different types: Types 1, 2 and 3 (Khoury et al., 2011). Type 1 focuses on the risk factors of diseases and how to prevent them. On the other hand, Type 2 consists of comparing different interventions to create targeted solutions for specific diseases and risk factors. Finally, Type 3 focuses on the actual conditions the patients are under while administering the intervention. However, although Type 3 is utilized the least, it is also the most difficult to implement, as it depends heavily on clinical trials, rather than "general' information. Evidence-based analysis can also be applied to test whether an intervention (such as a change of diet) is actually benefiting a population, and can have signal when readjustments must be made (Khoury et al., 2011).

On the whole, the health of an individual is also based on the nearby environment, including family, community, and behavioral factors all functioning in unison. In turn, Precision Medicine treatments will not only include precise targeted drugs, but also include analysis of the population the individual is a part of, and form interventions using changes to the environment, health policy improvements, and education. By using population-based epidemiological studies to account for a variety of determinants at once, precision medicine can empower global public health by enabling risk factor prediction depending on the environment of an individual (McEwen and Getz, 2013).

Biological biomarkers can be used to create subpopulations of every disease for more targeted therapies, rather than having broad categories such as diabetes or hypotension. In turn, costs of medical care can be reduced, as useless screenings and treatments can be bypassed. With the addition of new subpopulations of diseases created by specific biomarkers, sample sizes for Randomized Clinical Control Trials (RCCTs) can also be reduced, leading to more efficient research. In turn, costs of individual care can be made lower, allowing for more health care to be more accessible (McEwen and Getz, 2013).

By collecting population-specific data effectively and

intervening with specific policy and environmental factors in mind, developing populations will have better access to the advantages of precision medicine. In this current age, most health care is focused on expensive treatments and technology usage after the onset of the medical condition. However, it is much more cost-effective to focus on prevention. This is done through analyzing biologic risk factors of populations, utilization of biomarkers, using molecular level characteristics of a population to assess the benefits and risks of an intervention, and allow the individual to have more say in care choices, as well as more access to at-home interventions (Downing, 2009).

Innovations involving precision medicine can make healthcare more affordable among all populations through focus on prevention. Through an important data bank of biological differences between populations, medical products can be made to identify vulnerability and create diagnostic tools to assess onset of a medical condition much earlier. In turn, late-stage treatment as well as trial-and-error approaches can be avoided. In addition, randomized control trials which contribute to health evaluation can be made economical. By utilizing health information exchange through new banks of data, evidence on a product can be obtained without expending an immense amount of resources with the RCCT (Downing, 2009). In addition, through genomic data and pharmacogenomics, adverse and aberrant effects of specific medical products can be found out sooner. By doing so, dangerous medications that are thought to be positive for certain populations, as well as extra costs for treatment can be avoided. Finally, the emphasis on patient participation in Precision Health can promote individual care using genomic data (Downing, 2009). “My Family Health Portrait”, available through the U.S. Department of Health and Human Services, (https://familyhistory.hhs.gov/FHH/html/index.html) is a web tool that displays standardized information, and can be easily used by consumers to evaluate their own risks. Together with this innovative platform, new applications are being developed for the individual using information banks to allow the consumer to learn from home, instead of the “standard” healthcare environment (Downing, 2009).

Social and contextual effects

Studies demonstrate how non-medical variables are usually overlooked but can directly affect the overall health of an individual, and can be used in the Precision Medicine model to promote public health (Roman and Panduro, 2015; Vazquez AI et al., 2012). Common health problems that stem from lifestyle choices such as obesity, alcoholism, type 2 diabetes, brain disease, and liver damage are treated by specialists after they occur, instead of being prevented before they occur (Roman and Panduro, 2015). Typically, the induction of diabetes started 20 to 30 years earlier before the diagnosis of the disease, as the sedentary lifestyle and high caloric intake lead to risk factors such as hyperglycemia and insulin resistance. The same can be said about non-alcoholic steatohepatitis (NASH), a nonalcoholic liver disease, in which liver damage can be predicted almost ten years prior to onset (Roman and Panduro, 2015). Common trends can also be seen in lifestyle choices such as alcoholism and unsafe sexual behavior. However, a patient who is expected to develop a certain disease will have varying susceptibility due to his/her own environment and genes. Even with lifestyle choices, the way in which an individual is affected will be based on innate genetics, as certain alleles are directly involved in controlling metabolism, appetite and the circadian cycle, which can affect the extent to which a complex disease will affect someone (Roman and Panduro, 2015). This intersection can be seen in Mexico, where the average diet is highly dependent on carbohydrates and saturated fats, and most of the populations are ApoE2/ ApoE4 carriers (which both increase the risk of high cholesterol, diabetes and liver damage). In turn, the population has a high rate of dyslipidemia (high amount of fat in blood) and is one of the most overweight and obese populations in the world. Future complex diseases can be avoided by physical exercise, even if genetic “disadvantages” are present. Studies show that future liver damage can be countered in the early stages through proper diet and regular exercise. Emotions also play a role in physical health, and can be influenced by not only the environment, but also the genes one have. For example, there are two variations in the catechol-O-methyltransferase gene, which makes dopamine and norepinephrine. The “Val” version increase resistance to stress, whereas the “Met” version creates a lower stress threshold, which can lead to unhealthier lifestyles and complex diseases (Roman and Panduro, 2015).

Lifestyle can also directly influence the brain of an individual, which can lead to disease. For example, those who are more stressed, either due to lifestyle or greater susceptibility, can have a hippocampus and medial prefrontal cortex with less sensory strength, leading to a greater chance of depression, Cushing’s disease, Type 2 diabetes, and post-traumatic stress disorder (Vazquez AI et al., 2012). Additionally, the prefrontal cortex becomes less powerful with less exercise, which can cause higher stress levels and poorer decision-making. All these parts work together to control regular environmental adjustments such as hunger, thermoregulation and sleeping, and when these processes are compromised, health issues can arise. Studies have also shown that prenatal stress in mother can lead to impaired brain development in child, and poor maternal care or maternal anxiety can cause metabolic syndrome and begin the induction of diabetes (Vazquez AI et al., 2012). Poor childhood experiences can impair brain development, leading to low self-esteem and the gateway to poor habits such as overeating and risky sexual behavior, which in

turn can compromise the cardiovascular, metabolic, and immunologic body functions. By also lowering the self-esteem of the individual, there is a greater chance of having a smaller hippocampus, which will lead to elevated stress responses (Vazquez AI et al., 2012). In turn, the household as well as the environment of an individual becomes increasingly more important in the concept of precision health. By understanding the relationships between specific environmental detriments and tying them to specific health problems using the brain as a connector, the non-medical roots of certain issues can be analyzed and targeted.

Cancer prevention

The concept of precision medicine is beginning to be heavily utilized in the detection and prediction of cancer. Newfound biomarkers and other predictors in conjunction with new genetic data forms multiple breakthroughs in screening for potential risk for cancer by analyzing the proteins of an individual. Through the use of proteomics, protein biomarkers can be found in different specimens. Using the mass spectrometry, the entire protein product of a cancer cell, ranging from secretions to extracellular space, can be mapped out and analyzed (Hanash and Taguchi, 2011) .Specimens used to find biomarkers can also vary. For example, the discharged blood of the lungs was analyzed and a biomarker that had the ability to detect lung cancer 30 months prior to original diagnosis (Hanash and Taguchi, 2011) was found. Liquid biopsies can also be conducted to find circulating tumor DNA even before genetic screening, by viewing the blood instead (Bertier et al., 2016). By analyzing a wide variety of specimens and unique sources for biomarkers, cancer can be more predictable. By predicting this medical condition well before the onset of disease, preventive strategies could be optimized.

The Human Genome Project is an important tool that is built towards precision medicine, because it works to determine the exact DNA sequences in a human genome (Hanash and Taguchi, 2011). Genetic material can determine regulation, coordination, and other human characteristics. Through new technologies such as protein profiling and the use of DNA chip, the effect of genes in the disease of an individual can be analyzed. More than 1100 genetic biomarkers have been discovered through these methods to work towards targeted cancer therapy (Bertier et al., 2016). Breast cancer risk can now be predicted using models that screen the BRCA1/ BRCA2 genes, which are responsible for breast cancer, as well as age, ethnicity, lifestyle, family history and environmental factors. In addition, the specific genetic mutations of cancer cells (like olaparib inhibiting BRCA1/ BRCA2/ BRCA3 in ovarian cancer) can be investigated (Bertier et al., 2016). The process becomes more feasible with the rise of genetic banks, which can be used as comparison points to find driver mutations that contribute to cancer, rather than passenger mutations (which do not contribute to cancer) (Bertier et al., 2016). The microenvironment can also have an effect on the growth of harmful cancerous mutations. These stages of growth are called “driver” events or “driver” mutations. In primary melanomas (type of tumor), there are many progressive mutations before the end product is reached (Manamperi, 2008). Through studies done on 293 genes relating to cancer growth, it was found that the presence of abnormal tissue growth could be tied to harmful mutations stemming from ultraviolet radiation exposure (Vazquez AI etal., 2012).

The Precision Health trial design, emphasizing targeted, specific therapy, can also influence prevention by creating new interventions. For example, it was recently found that aspirin can assist in colorectal cancer prevention. Through studies conducted on colorectal cancer, it was found that urinary PGE-M (metabolite biomarker) levels were a risk factor indicated in the administration of aspirin. In turn, patients with high Mrna expression of 15-hydroxyprostaglandin dehydrogenase had lowered colorectal cancer risk after taking aspirin (Manamperi, 2008). Vaccinations also have an impact on cancer prevention- as it was shown that those with HPV-related cancers like oropharyngeal could dramatically reduce their risk factor by taking vaccines (Manamperi, 2008) HPV-associated oropharyngeal risk factors can also include childhood tonsillectomy and race. Vaccines that prevent non-viral cancer are also being created- these target immunogenic proteins and antigens (Manamperi, 2008). Additionally, through genomic practices, drug design (pharmacogenomics) can be improved. This will be done by analyzing unique individual information on how one is biochemically expected to respond to a drug leading to targeted interventions (Hanash and Taguchi, 2011). This research can also be directed at disease-causing microorganisms, as sequencing them will allow for understanding of how they can bypass the defenses of certain individuals. In turn, once again, targeted interventions can be improved (Hanash and Taguchi, 2011). This concept of Precision Health can be taken in developing nations for more enhanced and more effective control of common disease. By using affordable diagnostics for diseases that are specific to certain populations, individual care can be more accessible.

Chronic disease and risk factors

Smoking cessation

Smoking is a leading contributor to early death, with at least five million individuals dying each year from illnesses that stem from smoking. Through studies, it was found that genes of the alpha5-alpha3-beta4 nicotine

receptor contribute very strongly to nicotine dependence (20). Studies (n=73,000) have shown that the 15q25 chromosomal region that contains this receptor has a clear association with heavy smoking ($p=5.57 \times 10^{-72}$) (19). Low levels of alpha5 and other variations of the receptor can lead to a lower risk of developing nicotine dependence. The environment of an individual is also important, as genetic risks become exponentially more powerful if smoking begins at a young age. For example, parent monitoring and the number of adolescent peers around an individual that smoke both alter the power of the alpha5 subunit (Hanash and Taguchi, 2011). Even in pregnant women who smoke, smoking cessation was more likely to occur when there was a variation in alpha5 and there were environment and social factors that encouraged quitting smoking. In another study performed, there were three groups, one with a low-risk variation of alpha5, one with the high-risk variation of alpha5, and one group with the high-risk alpha5, but with pharmacological interventions (Bierut et al., 2014). It was shown that interventions like therapy and medications had a great impact on the occurrence of smoking cessation. In turn, by analyzing the genomics of each individual and looking for the presence of certain genes, one can predict the level of dependence one will have on smoking and nicotine. Although, a safe environment that encourages cessation should be produced for everyone, by using strong environmental influences and interventions (such as raising cigarette prices), it is possible to encourage people to quit smoking, even in high-risk variations of the genome. In addition, by coupling outside interventions with early genomic analysis of 15q25 chromosome in different populations, the potential risk for developing nicotine dependence in subgroups as a whole can be predicted (Bierut et al., 2014). In turn, future risk for more dangerous diseases can be avoided, promoting public health approaches and health risk communication campaigns to increase awareness of such problems.

Diabetes

Type 2 diabetes continues to be an important health issue that is affected by a variety of different factors. Although, this type of diabetes can be predicted through body mass index and obesity, due to other variables such as genetics and environment, discrepancies can arise (Vazquez AI et al., 2012). This can be shown through South Asian populations that obtain insulin resistance and eventual T2D at BMI levels not even marked as obese in some European populations (Spiegel and Hawkins, 2012). Primary prevention, including encouraging healthy foods and exercises in a world where there is an increased emphasis and processed food can allow for an intervention that is extremely cost-efficient and just as effective as drug treatments (shown through a meta-analysis of 21 trials) (Spiegel and Hawkins, 2012). Additionally, risk for T2D carries over to offspring if the mother has gestational diabetes or is malnourished, so analyzing the state of the mother during pregnancy becomes increasingly important. Pharmacogenomic testing also is extremely important as it is found that those with family history of the disease have a risk that is up to six times greater than an individual without family history (Spiegel and Hawkins, 2012). Finally, metabolic profiles are also very important, as it was found that during the Framingham Offspring Study, having a combination of three specific amino acid could increase the risk factor of an individual by five (Spiegel and Hawkins, 2012). In turn, the creation of an efficient biomarker test could be a possibility, and could be a much greater predictor than factors such as BMI, which has high variability, based on the population.

Metabolically healthy obesity

In the world today, obesity is a leading epidemic, which can cause the onset of conditions such as metabolic syndrome, type 2 diabetes mellitus and cardiovascular disease. However, not all obese people are at the same risk of these diseases. A subpopulation of 'metabolically healthy obese' humans that have all the physical characteristics of an obese individual, but have little risk for dangerous medical conditions exist (Phillips, 2016). Stratifying obese populations based on metabolic health subtype can allow for improved diagnosis and treatment. However, metabolically healthy obese individuals can progress into becoming metabolically unhealthy obese. In Tehran lipid and glucose study, it was found that 43.3% of those tested went from healthy to unhealthy obesity, the main predictors being insulin resistance and overall lipid profiles (Phillips, 2016). The study also showed that metabolic health is the most important characteristic for determining cardiometabolic risk, and in turn, by stratifying those with different metabolic phenotypes into groups, personalized care can improve. Precision medicine can be empowered as those with greater risk of metabolic and cardiovascular problems can be identified earlier and can focus on improving metabolic health profile (including improving lifestyle and environment choices) (Phillips, 2016). This is important as lifestyle choices can influence one metabolic phenotype over another, as dietary quality and physical activity are more associated with MHO. Over time, this can make seeking interventions more efficient and more cost-effective (Phillips, 2016). This example reflects a case study, or a specific research example that is explored in a group, and thus may not be applicable to the entire population (Phillips, 2016).

Review limitations

This review has some limitations. Firstly, there are different databases available for research. PubMed used

in the search is one among several existing ones; thereby potential papers that would be suitable for this review were not included. Another aspect is that publications addressing precision health and public health just gained attention on research agenda few years ago, which explains the scarce number of papers on the topic. When the descriptors “Precision Public Health” were searched on PubMed by the time this article was finished (February 2018), 22 papers were retrieved, and only 9 addressed “Precision Public Health”. Majority of the analyzed papers in this review discussed the broad scope of Precision Health and potential applications in disease prevention and health promotion instead of presenting results of primary data analysis.

Costs and criticism

The great achievement of precision medicine for individual care for diseases such as cancer is undeniable (Kensler et al., 2016). It is important to point out the downsides of the excessive focus on genetics and technology plus the impact of precision health costs over society. Precision Health approach brings the advent of lowering the costs of healthcare in long term. Previously, some aspects were taken into consideration as the unsustainable costs of some drugs, principally the orphan drugs ruled by pharmaceutical companies. Ferkol and Quinton (2015) brought up this to discuss using the example of the drug Ivacaftor used to reduce pulmonary exacerbations, normalize sweat chloride concentrations, improve lung function together with the quality of life in patients with the G551D mutation, and cost approximately $300 thousand dollars yearly. Although, the expectations are higher than the potential cost-benefit of precision health to preventative actions (16), focus on precision medicine may miss the point when it comes to public health. The enthusiasm for precision health and medicine initiatives is derived from the assumption that it will contribute to clinical practice and thereby advance the health of populations (Bayer and Galea, 2015). This enthusiasm has to be considered with caution, as agreed. Researchers, Public Health practitioners and other professionals who work in the health sector in general have to understand that the challenge of the century goes beyond genes, big data, and technology solely because the major current Public Health issues are social forces related (social disparities). Another point is that people that really need care are not getting the care that they need. Precision health could not receive all the credits as the solution to mitigate health inequalities principally due to the high costs and the uncertainty of Precision Health approaches will be translated to better health outcomes among populations (Bayer and Galea, 2015).

Conclusion

The application of Precision Health to Public Health requires different resources (financial, interdisciplinary team of diverse stakeholders), work and time for its maturation. The use of science and technology to build genetic datasets as well as conduct clinical trials will be originally costly, although it might result in more efficient and cost-effective healthcare in the long run but this is still a black box. Most of the current precision health initiatives are individual-centered focus on the treatment of certain diseases rather than on prevention itself. High costs of Precision Health might be a relevant limitation factor when extended to Public Health. Considering the current challenges of Public Health worldwide, it is desirable that Precision Health be used to reduce health disparities. This is still not considered.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

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