Proposal for Establishment of Genomic Health Management in the Post-genome Era

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Purpose and Method

Because information recorded in the human genome is decided on the instant of fertilization and has lifelong consistency, and so it will directly reflect disease etiology and give critical cues for deductive development of disease preventives, genome examination is expected to make great contribution to disease risk prediction / reduction. But knowledge and experience of diagnosis based on current laboratory tests which are focused on cure-oriented medicine cannot be easily applied to genome examination, because it will provide a huge amount of extremely critical information. Then, the feature and its clinical meaning of genome examination are analyzed, and the requirements for which the diagnostic methodology for disease prevention of the next generation is asked are clarified.

Results

[1] The disease risk prediction by genome examination such as SNPs etc. has the following features. (1) Because immense prior investment has already made from the size of a potential market scale in order to accumulate comprehensive databases using the most of IT technology, there is every possibility that very correct indices of diagnostic tests, such as sensitivity / specificity, positive / negative predictive values, pre-test probability and likelihood ratio, will be obtained so that they do not become as compared with the conventional

laboratory tests. (2) A term until a disorder actually occurs from the time of its prediction may delay remarkably. (3) There are not few possibilities that a severe risk that cannot be reduced at all will become disclosed. (4) Since the risk is potentially shared with blood relative persons, any disclosed problems of an individual will inevitably influence them. (5) Unlike the case of rare disease with a single origin, genome examination becomes the social problem since no human being is free from any disease risk. (6) Because a huge kind of individual's risks that have a wide range of possibilities will be disclosed at once, it is difficult to understand them as a whole and to adequately cope with them based on conventional theory orusual common sense.

[2] Therefore, unlike the conventional medical treatment, the ultimate purpose of which is restore the health of already affected individuals to its original state, diverse targets as follows should be pursued. (a) better prognosis, (b) minimizing the risk resulting from medical intervention, (c) customer satisfaction, (d) minimizing customer regret, (e) minimizing physical and mental pain, (f) minimizing restrictions of physical and mental activity, (g) improving physician's self-evaluation, (h) minimizing physician's regret and (i) objective evaluation of a physician.

[3] Among the conventional theory which supports medical judgment, Evidence Based Medicine (EBM) is the idea which is mainly focused on (a) and (b), and may also have an idea with a means to pursue (g), (h), and (i) by some doctor. On the other hand, Medical Decision Making is used as the method of clarifying choice which mainly makes (a) the maximum and makes cost the minimum. Therefore, there is no appropriate model which can treat these (a) - (i) synthetically at present.

Discussion

With evolving the decision tree of Medical Decision Making, if these targets are represented by some proper indices and the relationship among them are represented by some proper functions, a new model which reproduces actual medical judgment to some extent will be established. To make outputs of this model easily understood, we developed a visualization method for total assessment of health risk management as shown in Fig. 1-3.

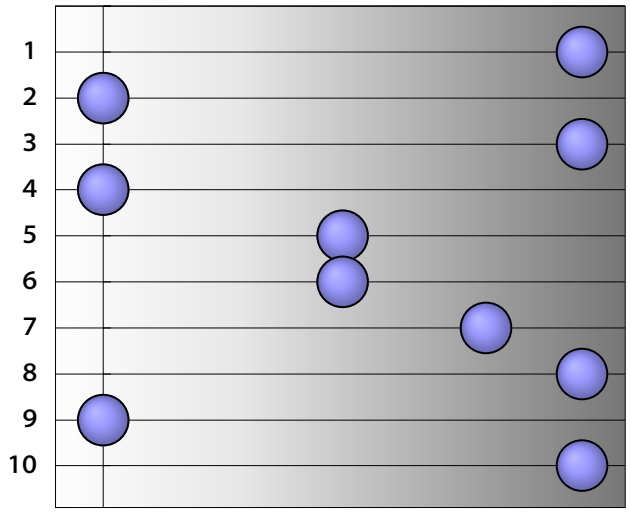
Conclusion

In order to bring out the merit of the genomic diagnosis of the disease risk prediction, and to prevent unnecessary confusion, establishment of, so to speak, Genomic Health Management, is pressing need.

[Fig. 1] Visualization of Total Assessment of Genomic Health Risk

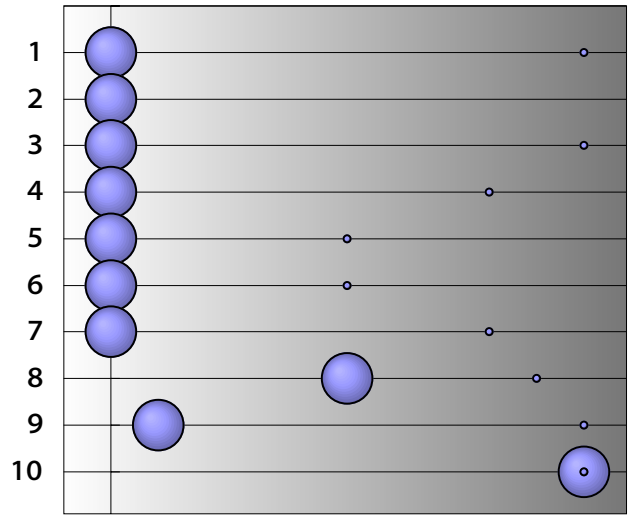
- the numbers of vertical axis means the following aspects
 1. prognosis (the lefter is the better)
 2. iatrogenic risk (the lefter is the smaller)
 3. satisfaction of the concerned person (the lefter is the better)
 4. regret of the concerned person (the lefter is the smaller)
 5. physical and mental pain (the lefter is the smaller)
 6. restriction on physical and mental activities (the lefter is the smaller)
 7. economical burdens and loss of income (the lefter is the smaller)
 8. physician's self-evaluation (the lefter is the better)
 9. physician's regret (the lefter is the smaller)
 10. objective evaluation of a physician (the lefter is the better)
- the size of each sphere represents a probability of each event

[a model case of an untreated phase (an initial phase of usual medical care)]



no treatment will lead poor prognosis
giving up intervention brings no iatrogenic risk
satisfaction is the worst
no regret before some decision is made
depends on patient's situations
depends on patient's situations
earnings lost and treatment fees laid
no physician can look doing nothing
no regret before some decision is made
no decision to be evaluated is made yet

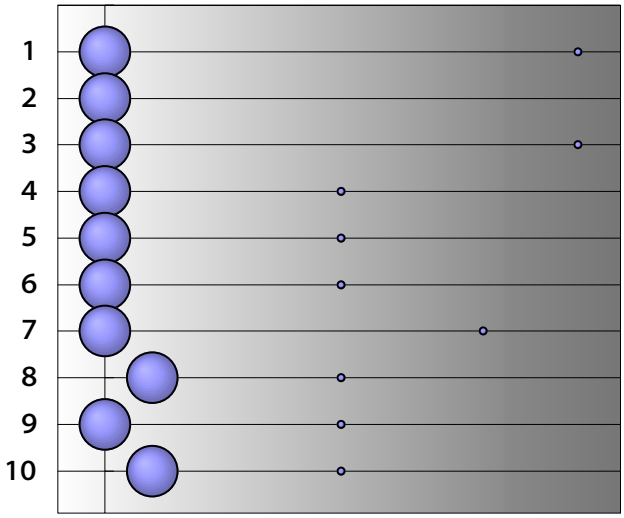
[a model case of a possible disease of 3% pre-test probability (an initial phase of preventive medicine)]



its probability is low but in case prognosis is poor
giving up intervention brings no iatrogenic risk
satisfaction is the worst
regret is reduced for choosing no prevention
depends on patient's situations
depends on patient's situations
earnings lost and treatment fees laid
no physician can look doing nothing
some regret even when the disease will not occur
giving up prevention will get the worst evaluation

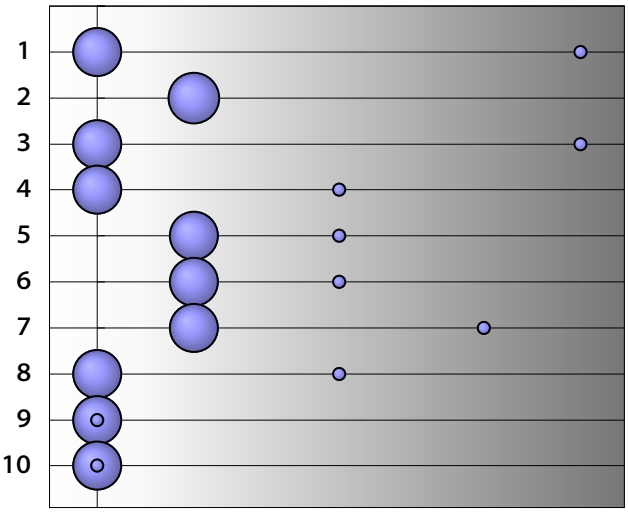
[Fig. 2] Disease Risk Prediction Based on Ordinary Tests (odds ratio = 5)

[a case that the test result is negative]



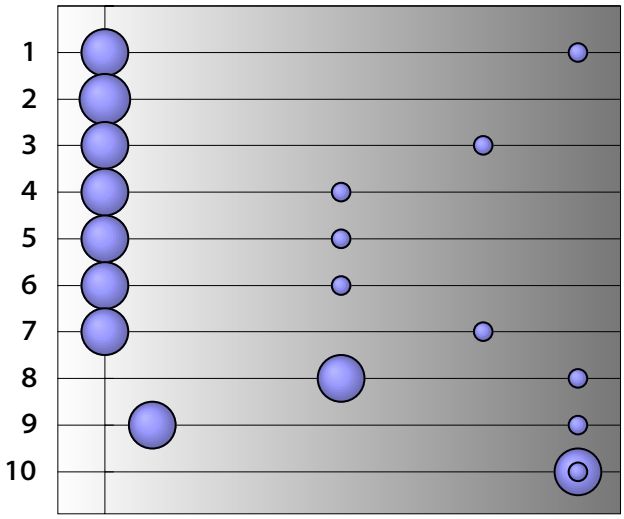
only a small reduction of the probability
giving up intervention brings no iatrogenic risk
satisfaction is the worst when the disease will occur
regret is reduced for unluckiness
depends on patient's situations
depends on patient's situations
earnings lost and treatment fees laid
a physician has some reason to look doing nothing
regret is reduced for some excuse
a physician has some reason to look doing nothing

[a case that the test result is positive, preventive intervention is made and the probability become a half]



poor prognosis in case the intervention fails
no intervention has no risk
satisfaction is the worst when the disease will occur
regret is reduced for doing one's best
pain caused by preventive intervention
restriction caused by preventive intervention
costs for preventive intervention
large satisfaction for doing one's best
no regret for doing one's best
a physician will be rated highly for best efforts

[a case that the test result is positive but no preventive intervention is made]



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regret is reduced for choosing no prevention
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earnings lost and treatment fees laid
uneasiness even when the disease will not occur
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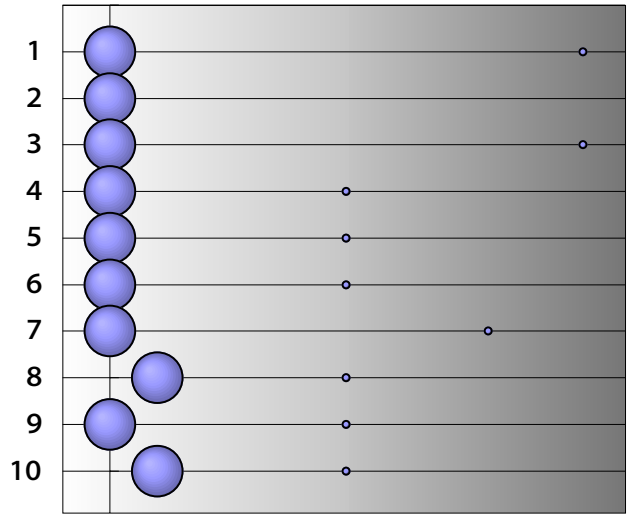
giving up prevention will get the worst evaluation

[Fig. 3] Disease Risk Prediction Based on Genomic Tests (probability = 90%)

[a case that the test result is negative]



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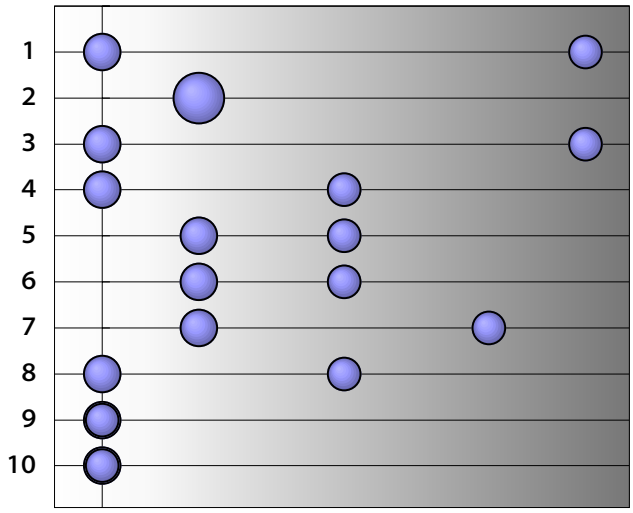

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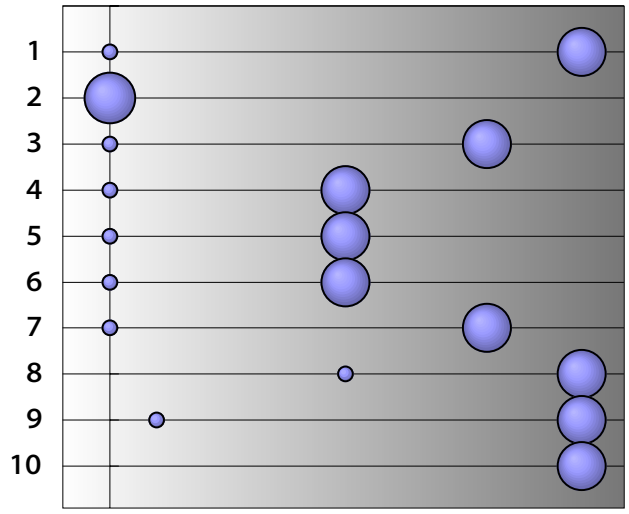

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