



Beyond the Stethoscope – Building a Future in Genetic Counseling for Indian PCB Students Without NEET

Dr.A.Shaji George¹, A.S.Hovan George²

^{1,2}Independent Researcher, Chennai, Tamil Nadu, India.

Abstract – Students studying Physics, Chemistry and Biology (PCB) in the higher secondary level in India have long been steered towards medicine as the most desirable route of career often via the highly competitive NEET exam. Even as medicine is held in high esteem, it is not the only path to meaningful and high potential career in life sciences. This paper discusses genetic counseling as an option to PCB students who would like to enter healthcare without obtaining official medical degrees. Genetic counseling combines biological and psychological fields to advise families on genetic risks, treatments, and prophylaxis measures, and is the future of personalized medicine. The article follows the historical evolution of genetic counseling, trends in the world and in India, and the educational pathway that one needs to take when he or she wants to venture into the field. It evaluates the increasing demand, skill needs, as well as opportunities of the students in India and other countries, along with highlighting the present problems in awareness, emotional challenges, and lack of infrastructure. Going beyond myths, it offers genetic counseling as a future-moving profession merging scientific with compassion and creativity. The argument is then concluded by showing students how genetic counseling can enable them to transform the healthcare profession, keep pace with the trends in biotechnology and AI, and play a role in creating a healthier world.

Keywords: Genetic Counseling Careers, PCB Students Alternatives to NEET, Preventive Healthcare Professions, Genetics and Psychology Integration, MSc in Genetic Counseling, Healthcare Careers in India, Personalized Medicine Future, Demand for Genetic Counselors.

1. INTRODUCTION

In the case of students in the sciences, PCB has always been used as a synonym about the dream of a doctor. Parents make their children study NEET early in life and identify success in biology with enrollment in a medical school. As much as this desire is understandable, it has also made students, teachers and families narrow in their imagination. The bias that medicine is the sole noble profession to pursue by students who major in Physics, Chemistry and Biology in higher secondary level is not only restrictive but also becoming more obsolete with the changing dynamics in healthcare and biotechnology.

Genetic counseling also offers itself as one of the most significant alternatives. This profession does not make students take NEET or spend over ten years of training but offers direct interaction with healthcare and is of tremendous importance in the future of medicine. Genetic counselors are specialists who advise families and individuals on genetic disorders, interpret laboratory tests, and how the genetic risks can affect medical decisions. As prevention medicine and reproductive options are becoming increasingly important in society, genetic counselors are becoming increasingly central to society at an amazing rate.

Take the case of the following contrasts. A student joining medical school under NEET can spend five and a half years in MBBS course, five years in specialization and an additional year in super-specialization. In comparison, a student wishing to pursue genetic counseling could finish the career pathway within about



six years following the completion of grade 12 and often would secure the access to a career that combines science, psychology and patient care at the frontiers of the current healthcare.

The prospects of the profits are no less persuasive. In India, where salaries are sometimes low to doctors because of overcapacity, qualified genetic counselors in India have the capacity to earn a salary of above ₹ 20 lakh per annum with those in other countries earning contracts of about \$200,000 a year (approximately ₹1.6 crore). Not as much as monetary gain, though, the real strength is found in the fact that the professional is able to empower families. DNA-based testing may be used by genetic counselors to anticipate threats hereditarily, assist aspirant parents through in vitro fertilization (IVF), and assist people to comprehend their risk factors to ailments such as cancer and cardiovascular diseases.

The profession has taken strong roots globally. Genetic counseling programs in the United States thrived through soaring progress in molecular biology, cancer genetics, and reproductive technologies in the later 20th century. Genetic counselors now are common participants in the clinical team of hospitals like Johns Hopkins, Stanford, and Mayo Clinic. In India, the field is not that old. The existing statistics show that not below one thousand trained personnel is willing to serve a nation containing over 1.4 billion individuals. This demand and supply break is very impressive. It presents a unique opportunity to the students who are ready to go outside of the usual directions.

This paper will embark on discussing genetic counseling as a viable career option to students of PCB who might be trapped by the doctor or nothing syndrome. This analytical paper starts by putting into perspective the emergence of genetic counseling as a field and exploring its significance today. It subsequently redefines the traditional notions of healthcare heroes by highlighting that the role in prevention is just equally important as treatment. The career plan of an aspiring student will be presented with specific details on the choice of subjects to take in school, options of degree programs in India and overseas and the planning process to take. The next part will be an overview of the career prospects open to genetic counselors and the wages and career advancement they could attain. The challenges will be evaluated openly, and possible solutions will be provided before coming up with a dream of the profession in the age of artificial intelligence and precision medicine. PCB students are also not only distinguished in the field of medicine. Through the consideration of genetic counselling, learners will be at the forefront of the healthcare industry and strike a balance between scientific, humane counseling, and relevance to the future.

2. OBJECTIVES

The main objectives of this study are:

1. To examine genetic counseling as a viable and promising career option for PCB students who do not wish to pursue medicine through NEET.
2. To provide a structured overview of the evolution, current trends, and future prospects of the genetic counseling profession.
3. To map the educational roadmap for aspiring students, highlighting subject choices, degrees, and global opportunities.
4. To analyze the career landscape in India and abroad, including salaries, work domains, and long-term growth.
5. To critically discuss the challenges facing the profession and propose strategies to overcome them.



6. To inspire students, educators, and parents to recognize genetic counseling as a transformative career that integrates science, healthcare, and human connection.

3. THE RISE OF GENETIC COUNSELING WHY IT MATTERS TODAY

3.1 Defining Genetic Counseling in Simple Terms

Genetic counseling is an art and profession that entails a combination of human genetics and interpersonal counseling. Its main aim is to help people and families to comprehend the potential impact of genetic conditions on them, their offspring, or their posterity. Genetic counselors, instead of treating the patient, interpret genetic tests, risk explain, discuss medical options, and assist in decision-making as opposed to doctors.

As an example, a couple who intends to have a family might wish to know whether they are mutated with hereditary diseases. The genetic counselor looks at their medical history, orders or interprets certain genetic tests, explains probabilities, and assists them to make the correct decision that they should take regarding conception and prenatal care. Simply put, whereas doctors treat diseases once they have occurred, genetic counselors treat diseases before they have occurred, predict, and prepare diseases.

3.2 A Brief History of Discipline

The history of genetic counseling dates to the middle of the 20th century, when the development of both cytogenetics and molecular biology allowed identifying some inherited disorders. Genetic counseling originally was a term formalized in the United States during the 1940s, as scientists started to assist families in making sense of the risks to be involved in the case of chromosomal disorders like Down syndrome.

Genetic counseling continued to develop in the 1970s with the development of prenatal diagnosis methods. Professionalism grew worldwide in the 1990s as the Human Genome Project was developed. With the sequencing of the human genome, done in 2003, it came to a point where a large amount of information concerning inherited risks became unlocked, and as such, it was necessary to have trained professionals who can interpret this information in ways that are meaningful and in ways that make sense to humans.

Genetic counseling is now understood as a specialty in healthcare in the United States, the United Kingdom, Canada, and Australia. In India, genetic counseling started to receive specific postgraduate programs in the past 20 years, however, the sphere remains in its early years in relation to the demand.

3.3 Current Trends Driving Genetic Counseling

The rise of genetic counseling is not accidental. Several global healthcare and social trends are fueling its growth.

1. **Personalized Medicine:** Medicine is shifting from one-size-fits-all treatments to approaches tailored to an individual's genetic profile. Genetic counselors are central to this movement, ensuring patients understand the implications of genomic data.
2. **IVF and Fertility Services:** With the rapid growth of assisted reproductive technologies, parents increasingly seek genetic guidance to minimize risks to their children. Counselors collaborate with IVF specialists to assess embryonic health and prevent congenital disorders.
3. **Rising Awareness of Hereditary Diseases:** Conditions such as breast cancer, cystic fibrosis, thalassemia, and sickle cell anemia are now better understood as hereditary. Families at risk



require specialized guidance, which only trained counselors can provide.

4. **Public Health Priorities:** In both developed and developing countries, focus is shifting toward prevention rather than cure. Genetic counseling aligns with this preventive ambition by identifying risks early.
5. **Digital Integration:** Advances in technology allow genetic counselors to work virtually, widening their reach and enabling cross-border consultations. Startups offering DNA-based health testing services are increasingly employing counselors to guide their clients.

3.4 Demand Versus Supply: A Global and Indian Perspective

The imbalance between demand and supply is the most compelling factor that the PCB student should take into consideration and pursue genetic counseling. As of 2024, more than 7,000 in the United States are certified genetic counselors, though the number of individuals requiring them is ever growing as testing becomes mainstream. Other prosperous ones are Europe, Canada, and Australia that have organized certificate courses and clinical team integration roles.

In India, the figures are drastic. By their own estimates, there are less than 1,000 qualified genetic counselors in a country of more than 1.4 billion individuals. In comparison, India alone has over one million physicians and over one million engineers who graduate on an almost regular basis. This dire lack produces occasion and needs. Hospitals, fertility centers, and startups have been reported to have a steady problem with recruiting qualified professionals. Students and parents who want to pursue long-term and sustainable careers with high growth must realize the field as a highly rewarding and professionally stable career.

4. BREAKING THE MYTH DOCTORS ARE NOT THE ONLY HEALTHCARE HEROES

4.1 Comparing Training Pathways

One of the main mental barriers preventing PCB students from considering anything outside medicine is the deeply rooted belief that prestige in life sciences careers comes only with the title of “doctor.” However, when carefully analyzed, the timelines reveal why alternatives like genetic counseling are often more practical.

1. **Doctor (via NEET):** An MBBS in India requires 5.5 years, typically followed by three years of specialization (MD/MS). For super-specializations, add another 2–3 years. This means 10–12 years of formal training before professional independence, often extending to 15 years if highly competitive specialties are pursued.
2. **Genetic Counseling:** A clear pathway combines a three-year bachelor’s degree (BSc in Genetics or Life Sciences), a two-year master’s degree (MSc in Genetic Counseling), and internships. In six years, a student is industry-ready, competent, and employable in a high-demand global profession.

For middle-class families balancing both educational investment and time, the shorter pathway with equally significant financial and professional outcomes is worth serious consideration.

4.2 Shifting from Cure to Prevention

Doctors are indispensable. They treat illness, perform surgeries, and save lives daily. Yet healthcare does not begin or end with treatment. Prevention, risk assessment, and informed choices are equally critical to overall health outcomes. Genetic counselors fill that gap.



For instance, consider a family with a strong history of cancer. While oncologists may treat tumors once they appear, a genetic counselor can identify whether family members carry mutations such as BRCA1 or BRCA2 long before disease emerges. With such knowledge, families can take preventive steps, undergo regular screenings, or make important reproductive decisions.

This preventive orientation reframes what it means to be a healthcare “hero.” The ability to help families avoid disease altogether, or prepare for it intelligently, is no less noble than treating illness after its onset.

4.3 Real-World Example

Take a situation whereby a couple has undergone IVF because of infertility over the years. They are worried not only about conception but also about the healthy future child. In this case, the genetic counselor is critical. The genetic information of the two partners is explored, and the risks are discussed with the IVF clinic by the professional who then chooses embryos that have the fewest possible risks of inheritance. The combination of science and empathy can help the couple make confident decisions, which the counselor achieves by combining both.

In a different case, the young lady loses her mother who passed away after 40 years of breast cancer, and she decides to meet with a genetic counselor to determine her risk. She could be informed through proper testing and counseling that she carries a mutation that predisposes her to getting cancer. With such knowledge at their disposal, she will be able to seek early interventions, converse with physicians on the possibilities of prophylaxis, and postulate her life with more confidence.

4.4 Reframing the Role Empowerment Instead of Treatment

The healthcare stereotype is based on the intervention following a crisis. This story is redefined by genetic counseling through the focus on proactive strategies. The genetic counselor is not just someone who is a scientist or a healthcare professional, but rather an interpreter of intricate genomic information and a person who must navigate emotionally challenging decisions. This combination of criticality and compassion makes the profession stand out.

This role also fulfills several intellectual interests to PCB students. It requires strong understanding of biology, but it is also appreciative of psychology and communication. It also enables one to make a positive impact on human well-being without having to go through the lengthy, unpredictable, and sometimes income straining medical education course.

Above all, it helps highlight the idea that the world must have a rich variety of healthcare workers, not only doctors. The need to prevent and control genetic disorders, fertility issues, and other lifestyle-related problems is only going to increase as the rate of these problems rises within the societies. Genetic counselors, in turn, become rather primary participants of the contemporary healthcare ecosystems.

5. ACADEMIC PATHWAYS A STEP-BY-STEP ROADMAP FOR STUDENTS

Career decisions often hinge on clarity of pathways. For PCB students considering genetic counseling, the essential question is not only what the field is but how to get there. Unlike the medical route, which is standardized through the National Eligibility cum Entrance Test (NEET), the genetic counseling pathway is diverse and depends on subject choices, undergraduate programs, postgraduate specialization, and geographical context. This section provides a structured roadmap that demystifies the requirements for both Indian and international students, offering actionable steps at each stage.

5.1 High School Subject Choices



All learning processes start with the basic subject selection in the senior secondary school. Because genetic counseling is in the overlap of both fields of biology and psychology, the two subjects have key roles in driving the student competency.

For CBSE and ICSE Students

- **Required:** Physics, Chemistry, Biology (PCB).
- **Strongly recommended:** Psychology as an elective subject.

Although psychology is not a requirement in order to qualify, learners who develop an early acquaintance with behavioral sciences have a clear advantage. Counseling involves a high level of empathic communication, listening and translating scientific information into human language. The addition of psychology at the stage also serves as an exercise in these skills and fortification of college applications of the students.

For International Baccalaureate (IB) Students

- **Core Requirements:** Biology (HL), Psychology (HL).
- **Supplementary:** Chemistry (SL) to ensure adequate exposure to fundamental scientific principles.

The IB curriculum promotes interdisciplinary integration. Biology and Psychology This is achieved by combining Biology with Psychology at a higher level to create the intellectual malleability needed in genetic counseling.

For A-levels Students

- **Core subjects:** Biology, Psychology.
- **Desirable subject:** Chemistry to solidify laboratory and scientific foundations.

The focus of all boards is clear there is no compromise with biology, psychology is very valuable and chemistry offers technical strength. Students who match their senior school choices with this, accordingly, place themselves in a good place both with regards to the domestic and international universities.

5.2 Choosing the Right Bachelor's Degree

The undergraduate degree is the basis of academic preparation. Genetic counseling involves an integration of life sciences, research skills as well as psychological acumen.

Recommended Degrees

1. BSc Genetics

Direct exposure to genetic principles, molecular biology, and inherited disorders. This option is ideal for those who seek immediate alignment with their intended postgraduate specialization.

2. BSc Life Sciences / Biotechnology

Broader than genetics, these degrees introduce molecular biology, microbiology, and biochemistry. They are valuable for students interested in flexible career trajectories, including genetic counseling.

3. BSc Psychology (with strong biology electives)

Though not typical, students who major in psychology while keeping biology electives can also



progress toward genetic counseling. This route suits students with stronger inclinations toward patient communication and counseling.

Value of Minors and Electives

Students should aim to combine biology-heavy majors with psychology as a minor wherever possible. For instance, a student pursuing BSc Genetics can benefit from electives in developmental psychology, while psychology majors should prioritize coursework in molecular genetics or health biology.

Skill Building at Undergraduate Level

Beyond academics, students should actively pursue:

- Internships in research labs, hospitals, or biotech startups.
- Workshops on genetic testing and molecular diagnostics.
- Seminars on psychology and counseling ethics.

Such experiences refine both technical and human skills, making applications for postgraduate programs more competitive.

5.3 The Critical Role of Master's Degrees

Unlike medicine, where an undergraduate degree (MBBS) qualifies a student to practice, genetic counseling requires postgraduate specialization. An MSc in Genetic Counseling is the recognized professional entry point globally.

Why a Master's Is Essential

- **Specialization:** Genetic counseling is a niche within healthcare, demanding advanced-level training beyond general genetics.
- **Accreditation:** Many countries require master's training from accredited programs for professional certification.
- **Skill Integration:** Programs combine classroom study of molecular biology and medical genetics with clinical rotations in hospitals and counseling settings.

Program Structure

Typically, two years in duration, MSc programs combine:

- **Coursework:** Medical genetics, molecular pathways, reproductive technologies, epidemiology.
- **Clinical Training:** Direct patient interaction under supervision, case analysis, counseling simulations.
- **Research:** A dissertation or thesis focused on emerging problems in genetic counseling, ranging from ethical issues to new applications of genomics.

5.4 Notable Universities Offering Genetic Counseling Programs

In India

- **Kasturba Medical College (Manipal University):** Offers structured postgraduate courses in genetic counseling with clinical exposure.
- **Jawaharlal Nehru University (Delhi):** Recognized for research in genetics and allied life sciences, with modules relevant to counseling.
- **Amity Institute of Molecular Medicine & Stem Cell Research:** Provides training in genetics with



opportunities for advanced specialization.

India's offerings remain limited, but they are steadily expanding. Students pursuing bachelor's degrees in life sciences from reputed universities should track updates on emerging MSc courses.

Abroad

Internationally, established programs exist at:

- **Stanford University (USA)**
- **Johns Hopkins University (USA)**
- **University of California, Berkeley and UCLA (USA)**
- **University College London (UK)**
- **Imperial College London (UK)**
- **National University of Singapore (NUS)**

Admission to such programs is selective, and it involves not only a good academic experience but also the presence of interpersonal competency and willingness and empathy towards healthcare. Effective candidates usually demonstrate volunteer work in the healthcare system, lab internships, or personal statements in which they demonstrate that they are dedicated to patient welfare.

5.5 Actionable Checklist for Aspiring Students

To simplify planning, below is a staged checklist.

In Class 11–12

- Choose PCB and include psychology wherever possible.
- Participate in science fairs or research projects in genetics.
- Develop communication skills through debates or volunteering.

During Bachelor's Degree

- Choose Genetics, Life Sciences, or Biotechnology with psychology electives.
- Apply for internships at genetics labs or hospitals.
- Attend workshops on bioethics and genetic testing technologies.
- Build a portfolio of practical experiences.

During Master's Preparation

- Research accredited programs in India and abroad.
- Prepare for standardized tests if studying abroad (GRE, IELTS, TOEFL where applicable).
- Collect recommendation letters from professors and professionals.
- Write a clear, reflective statement of purpose highlighting both academic and empathetic skills.

Post-Master's

- Pursue internships or fellowships to establish credibility.
- Stay updated with continuous education through workshops, online courses, and professional societies such as the National Society of Genetic Counselors (NSGC).



5.6 The Broader Educational Perspective

Another strength in genetic counseling as an occupation is that it erases the traditional disciplinary boundaries. Most medical professions are either intensive in science (medicine, nursing, pharmacy) or in psychology (clinical psychology, counseling psychology). Genetic counseling combines the two. Not only technical knowledge, but also interpersonal maturity is acquired by students. This special combination endows the route with intellectual difficulty and emotional satisfaction. Future professionals do not work in the laboratories or engage in scholarly discussions. They take instead a position in which their knowledge has a direct effect on the most cherished of human existence family planning, risk of inherited disease, and health choices that have a generational ripple effect.

6. CAREER LANDSCAPE AND OPPORTUNITIES

Genetic counseling does not inhibit graduates from having a limited job profile. Quite on the contrary, it is a broadening of professional settings. The counselor demand is experienced across hospitals, fertility clinics, biotechnology companies, and even start-up technology in the modern healthcare systems. The profession is associated with prediction and prevention, and as such genetic counselors will be prone to be in areas where medical decision-making intersects with personal decision-making. Another most apparent and conventional area of employment is hospitals. Some of the departments where the counselors operate in tertiary care facilities include oncology, prenatal care, pediatrics, and cardiology. These work in conjunction with the physicians to interpret the outcomes of genetic tests, clarify the dangers to the family, and make sure that the patients are aware of what it means when an illness is inherited. This is not meant to take the place of doctors but rather to supplement them and in many cases, it offers the human touch which the doctors are time bound to provide. Another emerging opportunity is provided by fertility clinics and in vitro fertilization centers. In this case, counselors will work with couples that are contemplating embryo screening or are at more risk of transmitting genetic diseases. This is the only area where immense opportunities can be found in societies that are witnessing a boom in reproductive technologies.

Outside hospitals and clinics there is the biotechnology sector. Genomic testing companies, direct-to-consumer DNA-testing companies, and personalized medicine companies hire counselors on a routine basis. Although the laboratory groups produce test results, only skilled specialists are able to convert complicated information into real life choices. Such a demand is representative of a larger phenomenon: science per se cannot suffice unless it is presented in a clear and human-centered manner. Genetic counselors are the ones who fill that gap, transforming unprocessed genomic information into practical knowledge. There are geographical differences in salaries in such places. In India, even the average annual income of trained genetic counselors has risen to about twenty lakh rupees, which is quite high as compared to the median income of most health care professions, other than medicine. In North America and in Europe, the numbers are far higher as professional employees earn almost two hundred thousand US dollars per year. These statistics not only indicate financial viability of the profession but also its acceptance as an important element of healthcare teams across the world. The career development process is also multidimensional. Most of them start out as clinical counselors, however, with time, they split into leadership, research, or policy advisory roles. Others move to the world of academia where they educate the upcoming generation of professionals. Others are independent sets of practices or growth contributors of startups that bring together genomic innovation and digital platform. The substance is the same in all of these positions enabling people and families to become more confident in exploring genetic information.



7. CHALLENGES AND HOW TO OVERCOME THEM

Although promising, genetic counseling in India and most of other developing nations has structural and cultural issues. The initial and probably one of the most urgent problems is awareness. Parents mostly push their children to either medicine, engineering or in other instances law and management. Students who demonstrate biology aptitude are hardly made aware of alternative careers to NEET. Such social parsimony diminishes the pool of possible applicants to the genetic counseling programs and procrastinates the creation of strong educational infrastructure.

Another issue that is closely related is the few postgraduate programs in India. The demand is extremely high, but few universities at present have accredited master's degrees in genetic counseling. Those students who lack the economic ability to study in a foreign country might be limited in their options. Such an unequal distribution creates a paradoxical scenario whereby a country with a high level of need has little to no institutional ability to educate professionals that would satisfy the need. The discrepancy between the demand and supply might not be eradicated unless the universities and policy makers focus on developing new programs.

The other aspect of the challenge is the emotional level of the profession. Genetic counseling deals with serious and even traumatic decisions. Counselors deal with couples struggling with infertility, with families facing the threat of hereditary cancer or with people dealing with the consequences of having a gene that relates to a debilitating disease. The work is not just scientifically skilled as it requires resilience, patience, and emotional intelligence unlike purely technical jobs. Unless provided with proper training and mentoring, young professionals can burn out or develop feelings of being overwhelmed with the seriousness of the decision the families are making.

To overcome these obstacles, structural change and a personal approach are needed. At a more general institutional level, India must increase its supply of postgraduate education, introduce standard accreditation, and incorporate genetic counseling into national health care planning. Governments and higher education institutions can work with the international organizations in coming up with curriculum structures that can compete in the global arena. Talented students can be attracted through financial scholarships and clear career paths which they would otherwise reject the field.

On an individual level, the students ought to take a proactive approach towards ensuring that they are ready to succeed. Networking is very important. Participating in conferences, belonging to professional societies, and creating mentorship contact with practicing counselors can offer invaluable advice. Lifelong learning is also essential. Genetics is a fast changing field and the professionals who are in tandem with the newer technologies, testing procedures, and ethical issues not only will not be thrown out but also come out as leaders in the field. Lastly, academic excellence should be accompanied by self-care and emotional development. Counselors ought to make deliberate strategies to cope with stress and maintain empathy at the expense of personal welfare. All these issues collectively do not make the profession less attractive. They emphasize the spheres in which the socially engaged students can contribute best. The difference between the present conditions and the possible future states of things implies that the present-day students can influence the development of not only their personal careers but also the development of genetic counseling in India and other countries.

8. THE FUTURE OF GENETIC COUNSELING A CAREER WITH PURPOSE

Genetic counseling as a profession is not stagnant. The advent of artificial intelligence, big data analysis and the advancement in genomic sequencing are redefining it. These forces indicate that genetic



counseling can be displayed among the institutions of the new millennium healthcare.

The introduction of artificial intelligence into genomics is one of such changes. Complicated algorithms have become capable of examining complete genomes much faster than before. But machines, however efficient, are incapable of giving empathy, or contextual insight, or ethical advice. The more AI is applied in the field of technical analysis, the more emphasizes the undeniable significance of people, who can process the information in emotional and social contexts. Genetic counselors play this role in a special way, whereby they make algorithmic conclusions meaningful into informative dialogues that honor human dignity and free will.

The other trend being discussed is the growth of precision medicine. Genetic profiles in hospitals are being integrated into the decision-making process of drugs, cancer treatment, and preventive health care across the world. Due to the growing dependence of clinics on genomics, counselors will have a correspondingly higher demand. This will mean that in India where genetic services are currently being concentrated in a few urban centers there will be an urgency to be integrated everywhere. The use of genetic data interpreters will be needed in schools, rural healthcare initiatives, and in the local hospitals too by professionals who can assist the local population.

The profession will also be in line with the global health objectives. Where conditions such as thalassemia or sickle cell anemia are highly prevalent, early genetic screening and education programs have the potential to dramatically decrease the disease incidence. Individual case counseling can be combined with community-wide approaches to health by genetic counselors. Genetic counseling can soon become part and parcel of the healthcare system in most countries as policymakers are becoming more receptive to prevention-based models that will save the healthcare sector in the long run.

Another frontier is represented by startups. Entrepreneurial projects are also integrating DNA testing in the rest of the world with mobile applications that offer fitness advice, ancestry, or customized diets. Most of these sites are now recognizing the importance of professional advice to supplement the unprocessed genetic reports they produce. Hence, Genetic counselors, need not be confined to the hospitals but may be a part of or even create a company that combines genetic with digital innovation. This is a prospective field for students who have a twofold interest in science and entrepreneurship.

Above all, genetic counseling lies in the change of culture. Societies are now starting to view health as not merely the cure for the disease but as a positive planning of life. Here, genetic counselor transforms into a reliable consultant, one who assists families to predict dangers prior to childbirth, one who assists young adults to comprehend the backgrounds of heredity and one who enhances the effectiveness of the healthcare services by lowering the occurrence of avoidable illnesses. The vision, in turn, is of the world in which all families would visit a genetic counselor as easily as they would visit a pediatrician or a general practitioner these days.

9. CONCLUSION

The information given during exploration proves that genetic counseling is not only an alternative to medicine but also a profession having its applicability, strength, and future. It provides PCB students with a clear avenue that does not require them to go through the NEET bottleneck but leaves them squarely in the healthcare field. Compared to the ten years trend of medicine, genetic counseling offers industry preparedness in six years coupled with intellectual stimulation and robust professional opportunities. The most important benefits are impressive. Due to the shortage of trained counselors across the globe and



countries, the profession responds with high demand. It offers financial security, salaries that are competitive up to most conventional healthcare solutions, particularly on the international scale. It does not just provide an opportunity of giving back to society but also provides economic benefits to society by providing a chance to focus on what is important in healthcare by giving, rather than taking.

The issues still exist, such as the lack of awareness among learners and parents, lack of postgraduate opportunities in India, and the emotional burden of supporting families in challenging times. But these are not impossible impediments. Given active growth of educational facilities, mentorship, and ongoing professional growth, the profession can be advanced by institutions and individuals. Notably, it is these gaps that also indicate opportunity particularly to the first generation of students who may make it their business to be the leaders of the field in India. The prospects are wide in the future. There is an intersection of artificial intelligence, precision medicine, reproductive technologies, and preventive, population-wide efforts to create a world in which genetic counseling is essential. Genetic counselors will be at the forefront in making humanity sense of the complexity of genetic data to caring for action whether in hospitals, startups, policy frameworks, and community health. To parents who are educating their kids, as well as to students planning their life, the message is obvious. PCB graduates have options other than medicine as a noble path. When students adopt the practice of genetic counseling, science, psychology, and understanding are the fields they align themselves. They prepare to meet the international need, individual satisfaction, and the opportunity to influence future generations in healthcare. When they go beyond the stethoscope, they go beyond to choose a career that matters, has potential, and is going to change how the world addresses the issue of health itself.

REFERENCES

- [1] Abacan, M., Alsubaie, L., Barlow–Stewart, K., Caanen, B., Cordier, C., Courtney, E., Davoine, E., Edwards, J., Elackatt, N. J., Gardiner, K., Guan, Y., Huang, L., Malmgren, C. I., Kejriwal, S., Kim, H. J., Lambert, D., Lantigua–Cruz, P. A., Lee, J. M. H., Lodahl, M., . . . Wicklund, C. (2018). The global state of the genetic counseling profession. *European Journal of Human Genetics*, 27(2), 183–197. <https://doi.org/10.1038/s41431-018-0252-x>
- [2] Adam–Atoot, & Adam–Atoot. (2025, January 22). Top 8 reasons why genetic counseling is important. One Health Medical Group |. <https://onehealthmedgroup.com/8-reasons-why-genetic-counseling-is-important/>
- [3] Career Options After 12th PCB Except Medical with Salary. (2024, June 25). Proper Noun. https://www.toprankers.com/career-options-after-12-pcb-except-medical?srsltid=AfmBOorIJgGwH9QjqNX6K5PBFQiOqfHLHTzERxjIS7VrR1WFonIlg8_A
- [4] Espada–Musitu, D., Manero–Azua, Á., Vado, Y., & De Nanclares, G. P. (2024). Genetic counselling in the era of next generation sequencing. *Anales De Pediatría (English Edition)*, 503712. <https://doi.org/10.1016/j.anpede.2024.503712>
- [5] Genetic counseling. (n.d.). Genome.gov. <https://www.genome.gov/genetics-glossary/Genetic-Counseling#:~:text=Genetic%20counseling%20refers%20to%20guidance,to%20their%20condition%20or%20risk.>
- [6] George, A. S., & Siranchuk, N. (2025). From Teacher–Centered to Learner–Driven: A review of the progression towards Student–Centric Education models and Practices. [www.pumrj.com. https://doi.org/10.5281/zenodo.15041868](https://doi.org/10.5281/zenodo.15041868)
- [7] Genetic counseling. (2025, January 31). Genomics and Your Health. <https://www.cdc.gov/genomics-and-health/counseling-testing/genetic-counseling.html>
- [8] George, A., Shahul, A., George, A., T.Baskar, & Hameed, A. (2023). Medical Cancer diagnosis using Texture image analysis. Zenodo (CERN European Organization for Nuclear Research). <https://doi.org/10.5281/zenodo.7853258>
- [9] Grafiati. (2025, August 1). <u>Journal articles on the topic “Active student-centered learning.” Grafiati. https://www.grafiati.com/en/literature-selections/active-student-centered-learning/journal/



- [10] George, D., George, A., & Shahul, D. (2025b). Needle-Free Injection Technology: Transforming healthcare delivery through innovation and Trust-Building. Zenodo. <https://doi.org/10.5281/zenodo.15630446>
- [11] Graphic Era (Deemed to be University). (2025, September 24). 10 medical courses that don't require NEET: High-Salary Career Option. Graphic Era (Deemed to be University), Dehradun - Transforming Dreams Into Reality. <https://geu.ac.in/blog/medical-courses-after-12th-without-neeet/>
- [12] George, D., George, A., & Shahul, D. (2025a). Healthcare Data Nexus: Ethical Navigation of hospital data Collection for AI training in the modern medical landscape. Zenodo. <https://doi.org/10.5281/zenodo.15450150>
- [13] Hima, D. O. K., & Hima, D. O. K. (2023, November 17). The importance of genetic counseling. GenepowerRx. <https://genepowerx.com/the-importance-of-genetic-counseling/>
- [14] George, D., & George, A. (2025c). The Transformative Potential of the Doctor of Humanoid Medicine Degree in bridging Human-Machine Healthcare Integration. Zenodo. <https://doi.org/10.5281/zenodo.15825026>
- [15] Home. (2025, September 26). <https://www.who.int/>
- [16] George, D., George, A., Devi, D. H., & Shahul, A. (2025a). Your future kids might be genetically engineered: implications, possibilities, and ethical considerations. Zenodo. <https://doi.org/10.5281/zenodo.15249246>
- [17] Human Genome Project Fact sheet. (n.d.). Genome.gov. <https://www.genome.gov/about-genomics/educational-resources/fact-sheets/human-genome-project>
- [18] Ifncp, A. S. R., & Ifncp, A. S. R. (2024, October 18). The Hidden Truth about hereditary diseases: Are you at risk? 3X4 Genetics. <https://3x4genetics.com/blogs/consumer-news/awareness-hereditary-diseases>
- [19] George, D., George, A., Shahul, A., & Dr.T.Baskar. (2023). AI-Driven breakthroughs in healthcare: Google Health's advances and the future of medical AI. Zenodo (CERN European Organization for Nuclear Research). <https://doi.org/10.5281/zenodo.8085221>
- [20] Macklin, R. (2021). Double standards redux. *Indian Journal of Medical Ethics*, 06(02), 87–91. <https://doi.org/10.20529/ijme.2021.021>
- [21] George, D., George, A., Devi, D. H., & Shahul, D. (2025b). The Birth of the AI Baby: A technological paradigm shift in Human Reproduction and IVF. Zenodo. <https://doi.org/10.5281/zenodo.15284446>
- [22] Navigator, C. (2024, November 22). The history of genetic counseling. American Profession Guide. <https://americanprofessionguide.com/history-of-genetic-counseling/>
- [23] George, D., & Dr.T.Baskar. (2025). A critical analysis of India's medical workforce projections and the future value of MBBS education. Zenodo. <https://doi.org/10.5281/zenodo.15609680>
- [24] NextMovez. (2025, September 23). Top medical and science career options after 12th without NEET. <https://nextmovez.in/top-medical-and-science-career-options-after-12th-without-neeet/>
- [25] George, D., & George, A. (2025b). Transforming Healthcare with Artificial Intelligence: Strategies, Insights, and Frameworks for Innovation. Zenodo. <https://doi.org/10.5281/zenodo.15685381>
- [26] NSGC > About > About genetic Counselors. (n.d.). <https://www.nsgc.org/About/About-Genetic-Counselors>
- [27] Ormond, K. E., Hayward, L., Wessels, T., Patch, C., & Weil, J. (2023). International genetic counseling: What do genetic counselors actually do? *Journal of Genetic Counseling*, 33(2), 382–391. <https://doi.org/10.1002/jgc4.1735>
- [28] George, D., & George, A. (2025a). The role of artificial intelligence in advancing sustainability across business, medical, and agricultural domains. Zenodo. <https://doi.org/10.5281/zenodo.14907960>
- [29] Radford, C. (n.d.). Understanding the evolution of and term "Genetic counselor": Is the term being used appropriately in your community? *The Oncology Nurse*. <https://www.theoncologynurse.com/issue-archive/2011-issues/august-vol-4-no-5/3270-ton-3270>
- [30] Rai, N. K. (2024, October 8). "Beyond the Stethoscope: Exploring Cutting-Edge Career Paths for PCB Students." <https://www.linkedin.com/pulse/beyond-stethoscope-exploring-cutting-edge-career-paths-rai-oufcc/>
- [31] Rantanen, E., Hietala, M., Kristofferson, U., Nippert, I., Schmidtke, J., Sequeiros, J., & Kääriäinen, H. (2008). What is ideal genetic counselling? A survey of current international guidelines. *European Journal of Human Genetics*, 16(4), 445–452. <https://doi.org/10.1038/sj.ejhg.5201983>
- [32] SciAstra, T., & SciAstra, T. (2024, October 22). Which course is best for PCB students without NEET? SciAstra Answers to all your questions regarding IISER, NISER, IAT, CMI, IACS exams • SciAstra -. <https://www.sciastra.com/blogs/which-course-is-best-for-pcb-students-without-neeet/>
- [33] The genetics of cancer. (2024, August 8). Cancer.gov. <https://www.cancer.gov/about->



cancer/causes-prevention/genetics

- [34] Veritas Scientific Department & Veritas Scientific Department. (2024a, August 27). Genetic Counseling in the progress of modern medicine. Genes Matter. <https://www.veritasint.com/blog/en/genetic-counseling-in-the-progress-of-modern-medicine/#:~:text=16%20mins.&text=The%20National%20Society%20of%20Genetic,inheritaance%20pat terns%20and%20assessing%20risk>.
- [35] Veritas Scientific Department & Veritas Scientific Department. (2024b, August 27). Genetic Counseling in the progress of modern medicine. Genes Matter. <https://www.veritasint.com/blog/en/genetic-counseling-in-the-progress-of-modern-medicine/>
- [36] Veritas Scientific Department & Veritas Scientific Department. (2025, June 17). Genetic Counseling: what you need to know, Genes Matter. <https://www.veritasint.com/blog/en/genetic-counseling-what-you-need-to-know/>
- [37] Wang, V. O. (2001). Multicultural genetic counseling: Then, now, and in the 21st century. *American Journal of Medical Genetics*, 106(3), 208–215. <https://doi.org/10.1002/ajmg.10009>
- [38] Wikipedia contributors. (2025, September 15). Genetic counseling. Wikipedia. https://en.wikipedia.org/wiki/Genetic_counseling
- [39] Williams, E. (2024, July 26). Eight things a genetic counsellor may already be doing in your clinic. Genomics Education Programme. <https://www.genomicseducation.hee.nhs.uk/blog/eight-things-a-genetic-counsellor-may-already-be-doing-in-your-clinic/>