

Genetic Counseling Services and Training of Genetic Counselors in Israel: An Overview

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Abstract Genetic counseling services have existed in Israel since 1964 and are available in almost all the major hospitals. Given the socialized healthcare system and small country size, genetic services are generally accessible and often free. The existence of founder mutations in various communities in Israel makes genetic testing easier to perform. Yet, the ethnic, cultural and religious diversity of the population has major implications on the design of the screening programs and the use of genetic services. The Israeli Association of Genetic Counselors (IAGC) was established in 2008 and had existed informally since 1989. There are two Master level genetic counseling training programs (6 students/class, 2 year program): Hebrew University-Hadassah Medical School (established in 1997) and the Technion (established in 2009). Genetic counselors' clinical training is largely observational and 2 years of supervised counseling sessions post degree are required for board exam eligibility. Genetic counselors are licensed and lead counseling sessions individually, but currently must work under medical geneticist supervision. This is the first article to summarize the history and training of Master level genetic counselors in Israel. Genetic services, coverage and regulations are also described.

Keywords Israeli Association of Genetic Counselors · Genetic Counseling Program · Genetic counselors' training

Michal Sagi and Wendy R. Uhlmann worked together on this paper after Uhlmann's visit to the Genetic Counseling Program of the Hebrew University-Hadassah Medical School, Jerusalem.

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Introduction

Genetic counseling is practiced in all the major hospitals in Israel, covering a wide range of indications and applications from preimplantation genetic diagnosis to predictive testing. Providing genetic counseling in Israel presents both opportunities and challenges. The small size of the country enables patients to access genetic services without having to travel far. Israel has a socialized healthcare system, which results in availability and coverage of most genetic services for the general population.

Israel has a population of about 7.5 million citizens, with 76 % Jews, 20 % Arabs (including Bedouins) and 4 % other small groups (Central Bureau of Statistics 2011). Each group is heterogeneous within itself, the Jews according to the country of origin from which they immigrated to Israel (Cohen et al. 2004) and the Arabs according to the region of the country or even the village in which they live (Jaber et al. 2000). The precise origin is particularly important when providing genetic counseling and genetic testing, since in each subgroup some hereditary disorders have been reported with an increased frequency (Zlotogora and Chemke 1995). Genetic research, carried out by Israeli geneticists in the various communities, has resulted in the availability of tests for more genetic disorders (Rosner et al. 2009). However, the widespread application of these advances is limited due to complex cultural and religious issues that have significant implications for genetic counseling and use of genetic testing.

Genetic counseling by non-physicians has been practiced in Israel almost 40 years. There are two genetic counseling training programs and the first program was established in 1997. Medical genetic services provided in Israel include a wide range of screening and diagnostic testing, and genetic

counselors are involved in most of these activities. Yet, there are barriers that prevent genetic counselors from expanding their services and improving their professional status. This article describes clinical genetic services in Israel and focuses on the training and services provided by genetic counselors, as well as the challenges they face.

History

The first genetics clinic, which in fact was called the “Genetic Counseling Clinic” opened in 1964 in Jerusalem at Hadassah University Medical Center, Department of Human Genetics. Medical Genetics has been recognized as a medical specialty by the Israeli Medical Association and the Ministry of Health since 1986. Physicians certified in internal medicine, pediatrics or obstetrics and gynecology could undergo 2-years of training and take a board examination to become certified in medical genetics (Chemke and Zlotogora 1997). Since 2010, physicians certified in any specialty can undergo training in medical genetics.

Genetic counseling by non-physicians has been practiced in Israel since the early 1970’s, first by graduates of Sarah Lawrence College (United States) who moved to the country and also by a few MSc’s and PhD’s in Genetics, who received their degrees in Israel. Given advances in genetics in the 1980s and 1990s, there was an increasing need for genetic counseling services and more MSc’s and PhD’s in genetics or human genetics, as well as a few more graduates of US programs, provided these services. The number of genetic counseling providers and approach to providing services changed significantly when graduates from Israel’s genetic counseling training programs joined the workforce beginning in the late 1990s.

An association of genetic counselors was established in 1989 with the main goal of providing continuing education at biannual meetings. In 2008, efforts of a group of genetic counselors successfully resulted in the association being registered by the Israeli Corporation Authority at the The Ministry of Justice as “The Israeli Association of Genetic Counselors” (IAGC), with a much broader agenda and activities. The aims of this new professional organization were announced as: Advancing the professional status of genetic counselors, improving their employment conditions and salaries; regulating licensure of genetic counselors; advancing the status of the profession; enhancing public awareness and accessibility to genetic services (www.genetic-counselors.org.il/about.asp). Facilitating genetic counselors’ participation in writing the board exam with the head of the Department of Community Genetics in the Ministry of Health, accomplished in 2008, was the first achievement of the new association. In 2009, efforts of the

IAGC resulted in the Ministry of Health’s recognition of “genetic counselor” as one of the para-medical professions.

Israeli Health Care System and Coverage of Genetic Services

The National Health Insurance Law, passed in 1995 and updated annually, provides for a standardized “basket of services” (inpatient and outpatient diagnostic procedures, treatments, medications and hospitalizations) for all residents of Israel (www.mfa.gov.il/MFA). A mandatory monthly health insurance tax is paid by residents. Supplemental insurance that provides more extensive coverage can be purchased. Genetic counseling is included in the basic basket, and many, but not all genetic tests are covered.

The National Program for the Detection and Prevention of Birth Defects, established by the Ministry of Health in 1980, (Chemke and Zlotogora 1997) covers screening of high-risk populations (defined as having a carrier frequency of a particular disease of at least 1:60), newborn screening and prenatal diagnosis. Free genetic screening is provided for several genetic diseases (currently: Tay-Sachs, cystic fibrosis, familial dysautonomia and thalassemia) (www.health.gov.il/Subjects/pregnancy/before_pregnancy/genetic). More extensive screening, including Fragile X syndrome, spinal muscular atrophy (SMA) and other selected autosomal recessive diseases, is offered with coverage shared between the patient and the supplementary insurance (Berkenstadt et al. 2007; Rosner et al. 2009). In 2002, the Ministry of Health expanded the free-of-charge health basket to include a targeted carrier screening program directed at the communities in which severe genetic diseases are present with a frequency higher than 1/1000 live births. As there are no known genetic diseases with such a high frequency in any of the Jewish communities, the program targets the Arab, Druze and Bedouin populations (Zlotogora et al. 2009a), who live mostly in villages and have a very high rate of consanguineous marriages. Genetic counseling must accompany results disclosure for those who are found to be carriers.

The Jewish ultra-orthodox religious community uses a separate system for carrier screening, managed by the international organization Dor Yeshorim (http://webexposite.com/preview/dor_yeshorim/). Since in this community, marriages are arranged by the parents and termination of pregnancy is generally banned, the purpose of this program is to prevent marriages of two carriers (Bach et al. 2007). Testing high school students and young adults is done anonymously, without any genetic counseling (Sagi 1998). The only information communicated is whether the potential match is “suitable” (meaning that the potential couple does not carry mutations in the same gene) and actual test results are not disclosed.

Standard screening during pregnancy, for the detection of Down syndrome and other birth defects, including first trimester screening, triple test and ultrasound screenings are covered. Chorionic villus sampling and amniocentesis are free of charge if the woman 1) is age 35 or older 2) has a 1 in 380 or greater risk on a first or second trimester screening test or 3) has a high risk for a genetic disorder. Preimplantation genetic diagnosis (PGD) is fully covered for couples at risk to have children affected with a serious genetic disease or for carriers of chromosome rearrangements. There is national newborn screening in Israel, covered by the Ministry of Health, which was updated in 2009 to include 12 severe diseases that are treatable and are not detected by carrier screening programs (www.health.gov.il/Subjects/Genetics/newborn_neonatal_screening).

Genetic Services in Israel

Medical Genetics Centers that include clinics and laboratories (cytogenetic and molecular) are found in 16 hospitals, which are almost all of the major hospitals in Israel. As of June 2012, there are approximately 40 medical geneticists (personal communication), 50 certified genetic counselors and 10 genetic counselors in practicum (records of The Israeli Association of Genetic Counselors, 2012).

Genetic counseling providers use a non-directive approach. Because of the cultural and religious diversity of the Israeli society, genetic counselors are trained to respect both high demanding/highly aware individuals/couples, as well as those who reject the service (particularly prenatal diagnosis) due to religious or cultural reasons. Most genetic counseling sessions are conducted in Hebrew, and rarely in English. Unfortunately, there is a serious lack of Arabic speaking genetic counselors, which significantly impacts communication between counselors and Palestinian women, who usually do not speak Hebrew. Frequently, Palestinian women come to the clinics accompanied by either their husbands or relatives, who do speak Hebrew. Israel also has a number of immigrants from different countries (especially from the former USSR and Ethiopia); language barriers exist because interpreters are not always available in hospitals.

For more than a decade, genetic counselors' provision of counseling after prenatal abnormal findings (detected by screening or ultrasound) has been a major component of their work. Cancer genetic counseling also has become a major area of practice and is provided mainly by genetic counselors. Given the high incidence of BRCA1/2 mutation carriers among Ashkenazi Jews (Abeliovich et al. 1997; Levy-Lahad et al. 1997) and the existence of founder mutations in Ashkenazi, Sephardic and Middle Eastern Jews (Sagi et al. 2011; Shiri-Sverdlov et al. 2001), genetic testing is widely used by women with a personal or family history

of breast and/or ovarian cancer. In 2012, BRCA1/2 sequencing was added to services covered by Health Plans in cases where the chance of finding a mutation in one of these genes is predicted to be at least 10 % (according to specified risk calculation software). Testing for the three Ashkenazi Jewish founder mutations in the HNPCC genes is also available (Goldberg et al. 2008).

Genetic carrier screening is provided based on the couple's ethnicity. The scope of genes recommended for testing in the Jewish population is periodically updated, by the Association of Medical Geneticists and by the Ministry of Health, according to the ongoing identification of founder mutations. In the Arab, Druze and Bedouin populations, multiple founder mutations are generally screened for, at the level of specific villages or even tribes (Zlotogora et al. 2009b). The National and Ethnic Mutation Databases (NEMDBs) are continuously updating mutation depositories that contain extensive information on the described genetic heterogeneity found in the Jewish and non-Jewish populations in Israel (Available at: www.goldenhelix.org/israeli). The Israeli National Genetic Database was launched in 2006 to improve knowledge of genetic disorders and their occurrence in the various ethnic groups in the Israeli population for clinical purposes, genetic counseling and research (Zlotogora et al. 2007b).

Acceptance of Genetic Services

The diversity of the Israeli population, in terms of culture and religion, impacts the acceptance of genetic services. There is a significant association between the religious observance women practice and the performance of various genetic tests. For example, a study carried out in the Jewish population showed that 94.4 % of secular women over age 35 had prenatal diagnosis, while 36.4 % of religious and none of the ultra-religious women had this test (Sher et al. 2003). In the Arab population, acceptance of prenatal diagnosis is higher among Christians (58 %) than among Muslims (15 %), reflecting differing views towards pregnancy termination (Zlotogora et al. 2007a). Carrier screening is widely utilized by Israeli couples, mainly for the diseases covered by the Ministry of Health but also electively for Fragile X syndrome (Berkenstadt et al. 2007), SMA (Ben-Shachar et al. 2011), several other Mendelian conditions for which testing is recommended by The Israeli Association of Medical Geneticists, and also Gaucher Disease, even though testing is not recommended by this professional society (Zuckerman et al. 2007).

Regulation of Genetic Services

The Ministry of Health is responsible for the regulation of the health system, including genetic services. The Ministry

of Health issues guidelines on different aspects of genetic testing and screening. For example: required standards for genetic laboratories, eligibility for covered amniocentesis, recommended screening for Down syndrome. These guidelines frequently are based on recommendations of professional organizations, such as the National Council for Gynecology, Neonatology and Genetics or the Association of Medial Geneticists.

Termination of Pregnancy

Abortion in Israel is subject by law to the legal approval of a 'committee for pregnancy termination' that is authorized to grant abortion requests. Up to week 24, the committee is composed of two physicians (one has to be a gynecologist) and a social worker. At least one of the committee members has to be a woman. Abortions are approved for various indications, including a risk for the newborn to have a physical or mental disability (Book of Laws, 1977). Late terminations, up to term, must be approved by a larger committee, composed of the heads of the medical center, department of obstetrics and gynecology, department of neonatology, a senior social worker and the head of the genetics department. A risk higher than 30 % for a serious disability has to be estimated for approval of late terminations (www.health.gov.il/hozer/mk23_2007.pdf).

Genetic Information Law

The Israel Parliament passed a Genetic Information Law in December 2000 (Genetic Information Law, 5761-2000, Book of Laws). The law bans employers and insurers from asking a person to provide genetic information or to undergo genetic testing and prohibits them from making use of results of such testing. The law also defines who is qualified to provide genetic counseling: a medical geneticist, a genetic counselor and a specialist medical practitioner (e.g. neurologist, oncologist). In addition, the law defines the appropriate qualifications required for each of the specialists who provide genetic counseling.

Licensure of Genetic Counselors

Since 2008, the Ministry of Health has administered a board exam yearly that all candidates must pass to be eligible for a license; genetic counselors take a different exam than medical geneticists. Before 2008, licenses were issued to individuals who had practiced genetic counseling for at least 3 years and had graduated from genetic counseling programs or had an MSc or PhD degree in Genetics or Human Genetics. Currently, in

order to be eligible for the licensure exam, a genetic counselor must first work under the supervision of a medical geneticist and/or licensed genetic counselor in a clinic at a genetics center for 2 years and submit a logbook of 85 cases representing all areas of counseling. Genetic counseling sessions are observed in the beginning and later the relationship becomes more of a consultation, with a senior genetic counselor or a medical geneticist signing all their counseling letters.

Subsequent to passing the board exam, the genetic counselor can obtain a lifetime license from the Ministry of Health; recertification and documentation of continuing education are not required. Until a license is granted, the graduate is considered a trainee (in practicum) and is not regarded as a "genetic counselor."

Genetic Counselor Training

There are two Master's Degree genetic counseling training programs in Israel: Hebrew University-Hadassah Medical School, Jerusalem (established in 1997) and the Technion (Israel Institute of Technology), Haifa (established in 2009). Both are 2-year programs with one class of 6 students at a time, due to limitations in staff and clinic rotation sites. As of June 2012, there have been 51 graduates (45 from the Hebrew University and 6 from the Technion). Most of the graduates have remained in Israel to provide genetic counseling services.

The following sections will describe the training provided in the longer-standing program at the Hebrew University- Hadassah Medical School, which author Michal Sagi directs. This genetic counseling training program involves a combination of coursework and clinical training with an option to do research and complete a thesis.

Acceptance to the Program

Students have usually completed 2-years of army service and 3 years of university studies prior to enrollment in the program. Most students have a Bachelor of Science degree (BSc) in Biology or Medical Sciences; the few who have a Bachelor degree in Psychology have to take a year of supplementary studies in Biology. Very high grades in undergraduate studies are a prerequisite for applying to the program and applicants have to submit their CV and a letter that summarizes their motivation to enter the program. After applications are reviewed by a team of genetic counselors and a medical geneticist faculty member, 30–40 % of the applicants are invited for an interview. The acceptance rate is about 15–20 % of the total applications.

Coursework, Clinical Work and Thesis

The current coursework and clinical training for genetic counseling students is listed in Table 1. About 80 % of the courses are taken together with other MSc or PhD students; about 25 % of these courses were originally designed for genetic counseling students and later offered to other graduate students. Each year students spend two months, 3–4 days a week, in genetics clinics; one month at Hadassah Medical Center and one month split between two other hospitals (Table 1). If students decide to do a research thesis, they will typically graduate 4–6 months later. Most of the projects have been performed in research laboratories and very few are epidemiological or psychosocial projects; most of the mentors are not program faculty. Completion of a research thesis is a prerequisite for any PhD program, and generally most students wish to have this option for their careers. In fact, almost all the graduates to date have completed a research project and about one-third of the graduates have continued their studies for a PhD degree, either directly after graduating from the genetic counseling program or after a few years of working as genetic counselors.

The Profile of Genetic Counselors

As in December 2012, there are 60 genetic counselors working in Israel (including those in practicum). All genetic counselors

to date have been females, except for one male. Twenty-five (41.7 %) graduated from a genetic counseling program in Israel and 6 (10.0 %) graduated from programs in the United States, 16 (26.7 %) have an MSc in Genetics/Human Genetics and 13 (21.7 %) have a PhD in Genetics/Human Genetics (3 of the 13 are also graduates of the genetic counseling program in Jerusalem). Genetic counselors with a PhD generally are not in research positions; they have similar positions as genetic counselors with a Master degree but may have more supervising and teaching responsibilities.

Status of Genetic Counselors

In most clinics, genetic counselors independently counsel patients for 1–2 h sessions and refer patients for prenatal diagnosis, carrier testing and other tests, consulting the medical geneticist only when necessary. However, this independence in providing genetic counseling services is not recognized in current legislation. Genetic counselors are licensed in Israel but are not considered an independent profession. In 2005, the Ministry of Health, stipulated that genetic counselors have to work in a genetics clinic under the supervision of a medical geneticist. This guideline has significantly limited the job options for genetic counselors, both in hospitals and community clinics and restricted their working with non-geneticists. While genetic counselors can work with non-geneticists, such as oncologists or gynecologists, a medical

Table 1 Coursework and clinical training of genetic counseling students in the Hebrew University – Hadassah Medical School Program

First year	Second year
Coursework	
Basic clinical genetics	Advanced clinical genetics
Molecular genetics I	Molecular genetics II
Gene expression	Embryology
Molecular cytogenetics	Fetal ultrasound
Metabolic diseases	Statistics for genetic counselors
Genetic screening	Medical psychology
Seminar in medical genetics I	Seminar in medical genetics II
Genetic Lab technologies	Decision-Making course
	Seminar on research in genetic counseling
	Workshop in genetic counseling (includes role-playing)
	Ethics in modern genetics
Clinical training	
The clinical work is all observational: 60–70 sessions of general genetics cases including pediatrics, prenatal, and preimplantation genetic diagnosis (PGD). Students submit 30 clinic reports that focus on the genetic condition and the information that had been communicated to the clients and submit a comprehensive paper on one of the prenatal conditions.	The clinical work is mostly observational with an emphasis on counseling techniques: 60–70 sessions of general genetics and cancer genetics cases. Students take pedigrees and practice writing summary letters. They submit summaries for 20 sessions commenting on the counseling and the decision-making.

geneticist still has to be responsible. In addition, although the profession has been defined and recognized by the Ministry of Health, in most of the hospitals, genetic counselors are not being employed under this professional title; instead, they are hired as “lab workers,” “academics in social sciences and humanities,” and other non-specific titles. This further impacts genetic counselors’ status and salaries.

It is of note that genetic counselors in Israel are licensed but currently cannot work with non-geneticists, whereas in the United States, genetic counselors can work with non-geneticists but may not be licensed if their state does not have a licensure law. Historically, in the United States, genetic counselors first worked with clinical geneticists in traditional genetics clinics – pediatric, prenatal, adult and general genetics clinics. In the 1990s, genetic counselors’ work began expanding into diverse practice settings and specialties; many counselors work with non-geneticists, including cardiologists, neurologists, obstetricians/gynecologists, pediatricians, oncologists and perinatologists/maternal-fetal medicine specialists (Balkite and Smith 1999; Walker 1999; National Society of Genetic Counselors Professional Status Survey 2012). In regards to genetic counselor supervision, NSGC model licensure language specifically does not stipulate a supervision requirement except for genetic counselors with provisional/temporary licenses (<http://www.nsgc.org/Advocacy/StateLicensureforGeneticCounselors/ModelLicensureProvisions/tabid/324/Default.aspx>).

Given advances in genetic testing and increasing population needs for genetic services, Israeli genetic counselors want to be recognized as an independent profession and expand their practice settings and roles. This includes the ability to work in community clinics and to work with non-geneticists and clinicians in other specialties (e.g. obstetricians/gynecologists, oncologists, neurologists). Since 2009, genetic counselors have been discussing these role and practice expansion issues at their IAGC meetings and have surveyed members. In addition, the IAGC has initiated discussions with the Ministry of Health, advocating for genetic counselor autonomy and status enhancement.

In December 2012, the Ono Academic College (Kiryat Ono, Israel), held a conference entitled: “Genetic Counseling in Israel: Past, Present and Future” (www.ono.ac.il/24712/?lang=en) that was attended by genetic counselors, physicians and representatives from the Ministry of Health. Genetic counselors highlighted “gaps” in the field of genetic counseling: 1) between the increasing need for genetic counseling services and the limited working opportunities due to the restrictions posed by the Ministry of Health on genetic counselors’ employment and 2) between the high competence of genetic counselors and their low status in the medical system. It was decided at this conference that given these gaps, the Ministry of Health will be asked again to reconsider the regulation and supervision requirements for genetic counselors.

Conclusion

This is the first article to summarize the history and training of Master level genetic counselors in Israel. Genetic counselors with Master’s degrees have practiced in Israel for almost 40 years and most genetic counselors have received their training in Israel. While much has been achieved in establishing genetic counseling services in Israel, expanding genetic counselors practice into specialty areas and community health settings and their work opportunities with other clinicians will better position Israel to realize the promise of genomic medicine.

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References

- Abeliovich, D., Kaduri, L., Lerer, I., Weinberg, N., Amir, G., Sagi, M., et al. (1997). The founder mutations 185delAG and 5382insC in BRCA1 and 6174delT in BRCA2 appear in 60 % of ovarian cancer and 30 % of early-onset breast cancer patients among Ashkenazi women. *American Journal of Human Genetics*, *60*, 505–514.
- Bach, G., Zeigler, M., & Zlotogora, J. (2007). Prevention of lysosomal storage disorders in Israel. *Molecular Genetics and Metabolism*, *90*, 353–357.
- Balkite, E. A., & Smith, M. E. (1999). Evolving roles, expanding opportunities. In W. R. Uhlmann, J. R. Schuette, & B. M. Yashar (Eds.), *A guide to genetic counseling* (2nd ed., pp. 523–551). New York: Wiley-Blackwell.
- Ben-Shachar, S., Orr-Urtreger, A., Bardugo, E., Shomrat, R., & Yaron, Y. (2011). Large-scale population screening for spinal muscular atrophy: clinical implications. *Genetics in Medicine*, *13*, 110–114.
- Berkenstadt, M., Ries-Levavi, L., Cuckle, H., Peleg, L., & Barkai, G. (2007). Preconceptional and prenatal screening for fragile X syndrome: experience with 40,000 tests. *Prenatal Diagnosis*, *27*, 991–994.
- Central Bureau of Statistics (2011). www1.cbs.gov.il/reader
- Chemke, J., & Zlotogora, J. (1997). Genetic services in Israel. *European Journal of Human Genetics*, *5*(suppl2), 105–111.
- Cohen, T., Vardi-Saliternik, R., & Friedlander, Y. (2004). Consanguinity, intracommunity and intercommunity marriages in a population sample of Israeli Jews. *Annals of Human Biology*, *31*, 38–48.
- Goldberg, Y., Porat, R. M., Kedar, I., Shochat, C., Sagi, M., Eilat, A., et al. (2008). Mutation spectrum in HNPCC in the Israeli population. *Familial Cancer*, *7*, 309–317.
- Jaber, L., Halpern, G. J., & Shohat, T. (2000). Trends in the frequencies of consanguineous marriages in the Israeli Arab community. *Clinical Genetics*, *58*, 106–110.
- Levy-Lahad, E., Catane, R., Eisenberg, S., Kaufman, B., Hornreich, G., Lishinsky, E., et al. (1997). Founder BRCA1 and BRCA2 mutations in Ashkenazi Jews in Israel: frequency and differential penetrance in ovarian cancer and in breast-ovarian cancer families. *American Journal of Human Genetics*, *60*, 1059–1067.
- Rosner, G., Rosner, S., & Orr-Urtreger, A. (2009). Genetic testing in Israel: an overview. *Annual Review of Genomics and Human Genetics*, *10*, 175–92.

- Sagi, M. (1998). Ethical aspects of genetic screening in Israel. *Science in Context*, 11, 419–429.
- Sagi, M., Eilat, A., Ben Avi, L., Goldberg, Y., Bercovich, D., Hamburger, T., et al. (2011). Two BRCA1/2 founder mutations in Jews of Sephardic origin. *Familial Cancer*, 10, 59–63.
- Sher, C., Romano-Zelekha, O., Green, M., & Shohat, T. (2003). Factors affecting performance of prenatal genetic testing by Israeli Jewish women. *American Journal of Medical Genetics*, 120A, 418–422.
- Shiri-Sverdlov, R., Gershoni-Baruch, R., Ichezkel-Hirsch, G., Gotlieb, W. H., Bruchim Bar-Sade, R., Chetrit, A., et al. (2001). The Tyr978X *BRCA1* mutation in Non-Ashkenazi Jews: occurrence in high-risk families, general population and unselected ovarian cancer patients. *Community Genetics*, 4, 50–55.
- Walker, A. P. (1999). The practice of genetic counseling. In W. R. Uhlmann, J. R. Schuette, & B. M. Yashar (Eds.), *A guide to genetic counseling* (2nd ed., pp. 1–32). New York: Wiley-Blackwell.
- Zlotogora, J., & Chemke, J. (1995). Medical genetics in Israel. *European Journal of Human Genetics*, 3, 147–154.
- Zlotogora, J., Haklai, Z., & Leventhal, A. (2007a). Utilization of prenatal diagnosis and termination of pregnancies for the prevention of Down syndrome in Israel. *The Israel Medical Association Journal*, 9, 600–602.
- Zlotogora, J., van Baal, S., & Patrinos, G. P. (2007b). Documentation of inherited disorders and mutation frequencies in the different religious communities in Israel in the Israeli National Genetic Database. *Human Mutation*, 28, 944–949.
- Zlotogora, J., Carmi, R., Lev, B., & Shalev, S. A. (2009a). A targeted population carrier screening program for severe and frequent genetic diseases in Israel. *European Journal of Human Genetics*, 17, 591–597.
- Zlotogora, J., van Baal, S., & Patrinos, G. P. (2009b). The Israeli national genetic database. *IMAJ*, 11, 373–375.
- Zuckerman, S., Lahad, A., Shmueli, A., Zimran, A., Peleg, L., Orr-Urtreger, A., et al. (2007). Carrier screening for Gaucher disease: lessons for low-penetrance, treatable diseases. *JAMA: The Journal of the American Medical Association*, 298, 1281–1290.

Websites

- www.genetic-counselors.org.il/about.asp
- www.mfa.gov.il/MFA
- www.health.gov.il/Subjects/pregnancy/before_pregnancy/genetic
- http://webexposite.com/preview/dor_yeshorim/
- www.health.gov.il/Subjects/Genetics/newborn_neonatal_screening
- www.goldenhelix.org/israeli
- www.health.gov.il/hozer/mk23_2007.pdf
- www.nsgc.org/Advocacy/StateLicensureforGeneticCounselors/ModelLicensureProvisions/tabid/324/Default.aspx
- www.ono.ac.il/24712/?lang=en