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ORIGINAL ARTICLE

Coming to terms with the imperfectly normal child: attitudes of Israeli parents of screen-positive infants regarding subsequent prenatal diagnosis

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Abstract

This study examines the interface between newborn screening and prenatal diagnosis from the point-of-view of parents of screen-positive children. Many conditions covered by newborn screening represent classic (autosomal recessive) Mendelian disorders. Parents of screen-positive infants therefore often come to learn that they are carriers of the disease, and face a decision whether to test for it in future pregnancies. Semi-structured interviews were conducted in 2015–2017 with 34 Israeli parents whose child was screen positive. Three major themes emanated from the parents' attitudes toward prenatal testing for the disease in prospective hypothetical pregnancies: rejection of prenatal testing for the disease associated with the screen positive, and relying instead on newborn screening to reveal if a future baby is also sick (18/34, 53%); support of prenatal testing to get more information (7/34, 21%) and support of prenatal testing in order to abort in case of a test positive (9/34, 26%). We discuss the importance of newborn screening for reproductive decision-making, highlighting the arguments associated with positive and negative parental views of the possibility of having another child with the same condition associated with the screen-positive of the child that had already been born. The conclusions challenge the common assertion that parents pursue the dream of the "perfect child" through prenatal diagnosis that "naturally" leads to selective abortion. The diversity of views expressed by Israeli parents of screen-positive children highlights the diversity of normative scripts of "genetic responsibility" in the context of parenthood.

Keywords Israel · Newborn screening · Prenatal genetic diagnosis · Disability · Reproductive decisions

Introduction

Prenatal genetic diagnosis and newborn screening stand for two different approaches to advance public health. Prenatal genetic diagnosis (PND) aims to provide couples or individuals with predictive information to guide reproductive decision-making. Based on the presented information and within legal restrictions, prospective parents may opt to terminate a pregnancy (Gammeltoft 2014; Risøy and Sirnes 2015). Newborn screening (NBS) identifies a small percent of infants in the first days of life with pre-symptomatic metabolic disorders that can usually be treated through medications and diet. NBS is thus concerned with the so-called "secondary prevention" (Polizzi et al. 2013) based on observable phenotypes, representing medical efforts to forestall the clinical manifestation of a genetic disease in an at-risk patient, such as dietary prophylaxis for phenylketonuria. These technologies may reinforce each other in the sense that a positive newborn screen may trigger the use of PND in a subsequent pregnancy. The availability and use of PND after a positive newborn screen is not simply an opportunity for more informed decision-making but may pose a dilemma of "avoiding the birth of individuals with particular genotypes" (Juengst 1995) similar to the genotype and presumed phenotype of an older sibling.

This study examines the interface between NBS and PND from the viewpoint of users with high stakes: parents of children who received a positive screen result in NBS. Many conditions covered by NBS represent classic (autosomal recessive) Mendelian disorders. Parents of screen-positive infants therefore often come to learn that they are carriers of a disease only after

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the child is born and identified by NBS, and not earlier, as most carrier couples are unaware about their carrier status and risk of having an affected child. Parents then face a decision whether to test for that disease in future pregnancies. Today, such parents have access to a range of reproductive technologies that include prenatal diagnosis, preimplantation genetic diagnosis, or other in-vitro reproductive technologies that use donor gametes. There are only few studies, however, of prospective utilization of reproductive genetic technologies among parents of screen-positive children after neonatal screening (Hayeems et al. 2008; Sawyer et al. 2006; Bombard et al. 2017).

The aim of this study was to assess the attitudes of Israeli parents following a positive NBS result toward prenatal diagnosis and termination of pregnancy in a subsequent hypothetical pregnancy. While screening technologies are directed toward the entire population, the relevance of prenatal genetic testing is expected to be higher for parents who are known to be at a high risk for an affected pregnancy, including parents who have already experienced an affected pregnancy and/or birth, such as the parents in our study. Life with a screen-positive child may change parental attitudes toward the ideal of the "perfect child" which is often associated with PND (Landsman 2009; Rothschild 2005). Such parents may, after becoming familiar with the care demands required for their screen-positive child, decide not to diagnose the condition prenatally and thus avoid a difficult pregnancy termination decision. Instead, they may consider that NBS for that condition provides sufficient diagnostic information. Early scholarship asserted that parents who reject offers of prenatal testing, or who choose not to terminate following a positive result, do so out of an ideological opposition to abortion and/or because they want more control over their own pregnancies (Rapp 1998, 1999). Doctors may hold mixed feelings about PND, reflective of their different professional outlooks and the national policies that guide their work (Ville and Mirlesse 2015). Nevertheless, rejection of the opportunity to pursue a prenatal diagnosis by at-risk parents is often labeled as irrational and irresponsible by medical practitioners and the public at large (Buchbinder and Timmermans 2011; Landsman 2009; Rothschild 2005; Remennick 2006).

Israeli media reports present parents who choose to avoid prenatal diagnosis as "irresponsible or primitive," and parents who choose not to abort in cases of embryopathy as "crazy or deviant" (Rimon-Zarfaty and Raz 2010:211). Unlike many of their counterparts in the USA and Europe, Israeli leaders of disability advocacy organizations are generally in favor of prenatal genetic testing that leads to selective abortion, while at the same time expressing their support for already-born disabled individuals (Raz 2004). Remennick (2006) found that Israeli women endorsed prenatal genetic testing that leads to selective abortion due to strong health provider support of such tests: emerging social norms that equate "good mothering" with taking "genetic responsibility," intolerance toward disability, and fear of the burden of care for a disabled child. We seek to problematize this outlook by highlighting the nuanced factors that influence the decision-making of Israeli parents of screen-positive children regarding what to do about a potential future child with a disability or special needs, including the option of rejecting prenatal diagnosis.

The history and practice of newborn screening in the USA and Israel

Newborn screening programs in the USA began in the 1960's with a screening test for phenylketonuria (PKU), a disease that, if left untreated, leads to severe mental retardation. Early identification of PKU—and of other metabolic disorders like it—in pre-symptomatic newborns, is followed by enzyme replacement treatment and a dietary regimen that prevent the symptoms of the disease. However, while the USA has opted in 2006 for expanding NBS to more than 50 rare conditions, other countries have limited NBS to fewer conditions (Raz and Timmermans 2017; Timmermans and Buchbinder 2013; Wieser 2010).

Because of the rarity of conditions screened for, the natural history and epidemiology of many conditions selected for expanded panels—including intervention or treatment alternatives—remains uncertain (Natowicz 2005; Brosco and Seider 2008). In many of the screened conditions in the expanded panel, a significant amount of clinical variation within the screened population exists (Grob 2006, 2008). The ensuing cascade of testing and medical surveillance increases rather than resolves uncertainty for many parents (Paul 2008; Gurian et al. 2006), creating "patients-in-waiting," or families kept in limbo about the presence of disease in their newborns (Timmermans and Buchbinder 2010).

Newborn screening in Israel

Following the USA, the original basis of newborn screening which started in 1964 in Israel was the detection of PKU and hypothyroidism (Cohen et al. 1966). As in the USA, the currently practiced screening process is performed about 48 h after birth, using a minute amount of blood collected on a dried blood spot card, which is subsequently subjected to biochemical analysis predominantly using mass spectrometry assays. With about 170,000 live births (almost 100% uptake) screened annually and about 100 screen positives per year (http://www.cbs.gov.il/reader/cw_usr_view_SHTML?ID=964), the Israeli NBS system is fully computerized, and answers are available online, yet public awareness of NBS in general remains low (Zuckerman 2017). NBS is offered free of charge and requires no parental consent, which explains its low public awareness. Although opting out exists, it is rarely used. Unlike the USA which expanded newborn screening to more than 50 conditions in 2006, in Israel, NBS (using the same technology) is limited to 13 conditions. Two

important disorders—hemoglobin diseases (including sickle cell anemia) and cystic fibrosis (CF)—are part of NBS in the USA but not in Israel, where CF is part of the national adult carrier screening program (that started with Tay-Sachs), and thalassemia is screened in community-based programs (Zlotogora and Israeli 2009). Due to the universal health care in Israel's socialized health system, post-service problems are expected to be much less common than in the USA, where the parents of many of the screened newborns may not have the health insurance to pay for post-testing follow-ups and treatments (Timmermans and Buchbinder 2010).

Repro-genetic decisions of parents of screen-positive infants

The routinization of prenatal testing as driven by a pursuit of the "perfect child" has drawn criticism from feminist, bioethics, critical social science, and disability rights perspectives (Duster 2003; Ettore 2000, 2002; Parens and Asch 2000). Empirical, socio-anthropological research on the uptake of and attitudes toward PND implies that PND is often neither "chosen" nor "informed," but rather stems from compliance to medical authority, particularly for individuals from impoverished or culturally diverse backgrounds (Press and Browner 1993). Other research, however, suggested that relationships between social expectations and personal beliefs and choice regarding PND and its refusal, which are embedded in prior medical experiences, are more complex than assumed (Markens et al. 1999).

We still know very little regarding how parents use carrier status ascertained through newborn screening to guide reproductive decision-making. Hayeems et al. (2008) concluded in a review of the research that in the CF population, the majority of parents report that carrier status results would *not* influence their reproductive plans, but the knowledge of carrier status itself remains important. Of parents whose infant was identified as a CF carrier through newborn screening, 81% said their infant's screen positive "made no difference" to their reproductive plans, whereas 13% had decided to have no more children and 6% decided to have fewer children (Lewis et al. 2006).

Of the 40 parents of children with various genetic conditions in mid-southern rural US, three-quarters refused prenatal testing other than ultrasound with subsequent pregnancies, and only 10 parents reported that they would seek prenatal testing in a future hypothetical pregnancy (Kelly 2009). While this could be related to the strong influence of conservative Protestant religious denominations and the limited availability of abortion providers in the region, only few of these parents discussed their perspectives on abortion as religiously inspired. Rather, "many parents did not perceive the information they understood to be available from prenatal testing to be useful or relevant to the circumstances of their reproductive decisions" (Kelly 2009: 89).

Studies of subsequent reproductive decision-making of couples, who found out through neonatal screening that their child has CF, continue to show mixed results. In a study by Dudding et al. (2000), two thirds of the women chose to avoid having another child with CF. The uptake of prenatal diagnosis was 66% in women who had a subsequent pregnancy; of these, 69% terminated or would have terminated an affected fetus. Fifty-nine percent of the women who decided against a further pregnancy made this decision to avoid having another child with CF. In a study by Sawyer et al. (2006), of the 56 mothers of children who had CF and had undergone NBS in Australia, 16% reported at baseline that they would not use PND. Of the 82% who reported that they would be likely to have performed prenatal diagnosis in a subsequent pregnancy, 37% said they will use PND to prepare for an ill child, 39% said they will use PND to decide whether to terminate the pregnancy, and 26% said they will use PND to terminate the pregnancy. Five years after baseline, prenatal diagnosis was used in 33 of the 55 pregnancies (60%). Five of the 33 tested pregnancies were affected and all ended in termination. The study by Sawyer et al. (2006) highlights the dynamic nature of reproductive choices in relationship to family circumstances with decisions significantly changing in both directions over time. More recently, however, mothers of CF children identified through NBS in Canada reported moderate uptake (55%) of carrier testing and limited influence on family planning (Bombard et al. 2017); most participants did not expect the results to influence family planning (65%). Interviews also identified a lack of utility in family planning for some because of maternal age.

Women's accounts of their reproductive reasoning in light of knowing they are carriers of fragile X also show a wide range of factors and the diversity of how genetic information may be taken up and used (Raspberry and Skinner 2011a,b). The majority of these women viewed the 50% risk of transmitting the FX gene as a powerful reason for choosing not to reproduce, or to reproduce only with the assistance of technologies that eliminate the known genetic risk. Yet, a substantial minority initiated or continued unmediated pregnancies, invoking religious beliefs intertwined with risk-taking that informed their choices.

Prenatal genetic diagnosis is considered in the Israeli secular, Ashkenazi public as a medical priority and a moral duty (Hashiloni-Dolev 2007; Raz 2009a,b; Remennick 2006; Zlotogora et al. 2016). There is quasi-universal utilization of ultrasound in pregnancy, among both Jewish and Arab women (Gofin et al. 2004). Of all pregnant, advanced maternal age (> 35 years old) Jewish women, 47% have performed amniocentesis, as compared to 10% of all Jewish women younger than 35 (Grinshpun-Cohen et al. 2015). Even with the availability and accessibility of a national program "for the

prevention of Down Syndrome" (which includes screening using the triple test, and free amniocentesis for women older than 35 years), more than 50% of Down syndrome cases in Israel are brought to term—with most of the affected babies born in Orthodox Jewish and Muslim Arab-Israelis communities where termination of pregnancy is banned by religious law (Zlotogora et al. 2007). This is an overall low rate of pregnancy termination for Down syndrome, compared to the USA (67%) and West Europe (88–92%, see Natoli et al. 2012). Nevertheless, in some countries, the uptake of Down screening itself may be low, for example the Netherlands has only an uptake of < 30% (Crombag et al. 2014).

While termination of pregnancies is allowed in Israel only according to definite criteria, the criterion concerning malformations and/or genetic diseases is vague and may be accepted by the medical committee even in cases of relatively mild medical problems especially before 22 weeks of pregnancy (Rimon-Zarfaty and Raz 2010). This regulation would have enabled, in principle, termination of pregnancy of fetuses affected by the conditions screened in NBS (Shapira 1995). Applications for abortion due to "genetic defects" count for 17–20% of all applications submitted to hospital "abortion committees," and 98% of them are granted (The Knesset Research and Information Center 2003).

Methodology

This study, which focuses on NBS in Israel, is part of a broader research project that examines and compares the design and reception of newborn screening in California and Israel. By looking at the design and implementation, through policy analysis and interviews with policy makers, we examine how the diverse expansion of newborn screening in California and Israel has been legitimated, lobbied for, and made public. By looking at the reception, through longitudinal interviews with parents of newborns with abnormal findings, we examine public satisfaction with and attitudes toward newborn screening, locating its impact in the lived experience of parents, their peer network of support and communication, and the ways they draw on screening results for making life plans concerning health care and future family planning.

The first stage of the research included a comprehensive policy analysis of national NBS guidelines in Israel, which we compared to NBS guidelines in the USA and Europe. Following IRB approval, the first and second authors conducted, in 2015–2017, semi-structured interviews with 34 parents (29 mothers and 5 fathers) whose child was screen positive, to find out how they make sense of the information they receive. The interviewees were all Jews except for one Muslim, their age range was 23–50, and they were characterized by a diversity of religiosity levels and geographic locations. The children's age range was between 1 month and 10 years, with an average of about 2.5 years. The conditions they were screen positive for included PKU ($n = 9$), congenital adrenal hyperplasia (CAH, $n = 8$), hypothyroidism (7), maple syrup urine disease (MSUD, $n = 4$) ,homocystinuria (3), and G6PD (3). About 25% of the interviewees had other children who were also screen positive. They were recruited through family health centers (*Tipat Halav*), relevant patient organizations, and by using the snowball sampling method. Interviews were conducted in Hebrew, in the office, at the home of the respondents, or over the telephone (about 20%), and lasted 30–90 min.

The interview guide covered the following areas: sociodemographic characteristics; what did the respondents know about NBS beforehand; what do they think about the process of consent; satisfaction with the information and care they received; exploration of anxiety created by screen information and sources of support; and the impact of NBS on their future reproductive intentions including the future use of prenatal diagnosis. We encouraged respondents to discuss their perceptions and experiences freely. A second round of follow-up interviews after 6–12 months was conducted with 22 of the families to find out about parents' experiences with false positives and/or a-symptomatic positives, as well as about post-diagnostic care management and interactions with the health system and with other parents. We qualitatively analyzed the transcribed interviews to uncover discursive themes and categories of themes recurring among respondents (Denzin and Lincoln 1994). Using a grounded theory approach to data analysis (Strauss and Corbin 1990), we also systematically coded the empirical material in dialog with a close reading of salient themes in the medical sociology literatures (Timmermans and Tavory 2007). Relevant quotes coded per selected themes and relevant interviews were translated from Hebrew to English to allow further comparative analysis by the research team. Three major themes emanated from the parents' attitudes toward prenatal testing for the disease in prospective hypothetical pregnancies: rejection of prenatal testing for the disease associated with the screen positive (18/34, 53%); support of prenatal testing to get more information (7/34, 21%); and support of prenatal testing in order to abort in case of a test positive (9/34, 26%).

Rejecting prenatal genetic testing that leads to selective abortion

Most parents (18/34, 53%) viewed positively the possibility of having another child with the same condition as the older sibling. They said they would keep a future pregnancy even if the fetus is affected by the same condition as their current child. These parents were diverse in terms of their level of religiosity and education, as well as the diseases associated with their screen-positive child. There were many cases in

which parents whose child had the same condition differed in their attitudes due to the diverse manifestation of symptoms within the same disease category. We use the term "screen positive" over the more common term "disease" because of the diagnostic uncertainty associated with these diseases, with some babies remaining a-symptomatic (Timmermans and Buchbinder 2010). The common denominator of this subgroup of parents was the relative mildness of their child's symptoms. The following quotes illustrate this stance and the importance of living with the child and coming to terms with their condition:

> I am willing to raise more children with this syndrome, so no prenatal testing is needed... If I had known [that the fetus is affected with CAH) during the first pregnancy, I would have considered selective abortion… because of the lack of knowledge about the syndrome and fear of the unknown. Today, in retrospect, I am glad that the option did not exist at all. We are very happy about it. (I., Mother, CAH).

In this case, the child was diagnosed with CAH, a condition in which the adrenal glands, due to a missing or nonfunctional enzyme, make too much of the androgen hormone and not enough cortisol or aldosterone. Girls with CAH may be born with external sex organs that appear more masculine. If not treated, the child will develop both male and female sexual characteristics, well before normal puberty should begin. The main treatment for classic CAH is cortisone, taken in pill form daily throughout life.[1] The effects of CAH can vary greatly from person to person. Most babies found to have CAH during newborn screening have "classic CAH." One type of classic CAH is called "salt-wasting" which is a serious condition needing immediate treatment. However, children with other types of CAH do not have immediate risks to their health but still need follow-up. A small number of children are found through newborn screening to have milder or "nonclassic CAH," and may remain a-symptomatic.

This phenotypic variability thus poses a dilemma about whether and how aggressively to treat the child when first diagnosed. This explains why the quoted mother said that because of the lack of knowledge about the syndrome and fear of the unknown, she would have considered selective abortion had the fetus (who is now a screen-positive infant) been prenatally tested. All the parents we interviewed agreed that it is only once you live with the child that you can realize the actual implications of their condition, which—for as many as 53% of the parents in this study—was not considered sufficient to justify selective abortion. Few parents also related their rejection of PND to religious faith:

> I am not in favor of termination of pregnancy even when a disease is found. I rely on God, that he doesn't give a person something he can't cope with… Everything is for the best… Even a disease. (M., mother, PKU).

However, for most parents, it was a non-religious conclusion, stemming from the argument that there was no reason to discontinue the pregnancy if it is something that can be relatively easily treated:

> What my child has is not a disease really, it's sensitivity to beans and to some drugs. Obviously, there is no need for prenatal genetic testing. (M., mother, G6PD).
> In my first interview, I was traumatic and I said I would terminate the next pregnancy [if prenatal diagnosis shows the fetus had PKU], but now, I am not ready to do abortion. It's hard for me mentally, what, because of diet? A year ago, I was too hasty. (A., mother, PKU, second interview).

This quote is significant in demonstrating how living with the child for a year changed the mother's opinion (cf. Sawyer et al. 2006). In her first interview, 2 months after the birth of a PKU screen-positive child, this mother expressed a preference for PND and termination of pregnancy based in part on her recollection of her physician's presentation of a worse cenario:

> The doctor explained to me that the disease is expressed in line with the type of the mutation. This time it is mild—maybe next time it is difficult. The plan is to test in each pregnancy. My husband is reluctant to have an abortion but for me, psychologically speaking, I cannot choose not to abort. I am not living in illusions, I am living in the real world. Science tells me that a normal child can develop but it's such a conflict. (A., mother, PKU, first interview).

Three of these 18 parents (17%) said they will do prenatal testing, not to abort but on the contrary, to take better care of the fetus, "to know in advance and be prepared," for example so that the mother avoids foods that the baby cannot digest. Two mothers of PKU children mentioned in this context that if the new NIPT (non-invasive prenatal testing, by which a fetus' DNA can be sampled from the mother's blood, thus diminishing concerns about miscarriage associated with amniocentesis) technology could be used to test for PKU, that would be perfect for their purposes, since they could start having low phenylalanine diet early in pregnancy. This was their personal recollection and we do not know what their physician originally communicated.

[1] Information retrieved from https://www.newbornscreening.info/Parents/otherdisorders/CAH.html, last accessed 4 July, 2017.

Prenatal diagnosis as a source of more information

Living with a screen-positive child with mild and treatable symptoms was not seen by all parents as reason to fully reject prenatal testing. Some (7/34, 21%) parents qualified their response, arguing that prenatal diagnosis could be important if it provided more information concerning the severity of the condition, for example through the detection of specific genetic variations:

> This is not an easy case, it depends on the severity of the disease, although even with the classic type [of CAH] it is possible to live... but with steroids all the life of the child... it seems unnecessary... It is unnecessary to continue pregnancy with a child who has a classic disease. You know, this is not a simple question…. if not classic then I would continue the pregnancy. (C., mother, CAH).

Parents' concerns in this matter were not just about filling in missing information but also about potential testing errors:

> I'm in a very serious dilemma. If you really know that it's [the disease] something serious, I personally would recommend termination of pregnancy... but as I heard there were many erroneous tests and mistakes that the children were born healthy and intact... so my position is very ambiguous… It depends on the severity of the disease and how unequivocal it is but I would prefer to abort. (S., father, hypothyroidism).

Hypothyroidism is a condition in which the person does not make enough thyroid hormone. Babies who do not have enough thyroid hormone are often slow to grow, sluggish, and have learning delays. The main treatment is thyroid hormone replacement, given in tablet form daily to all babies with hypothyroidism. Children with hypothyroidism who start treatment soon after birth usually have normal growth and intelligence and can live typical and healthy lives (http://www.newbornscreening.info/Parents/otherdisorders/CH.html, accessed 5 July, 2017). Even with symptoms that are relatively mild and controllable, for some parents the dilemma was still there:

> A difficult dilemma... The heart says to stop the pregnancy. It is a serious disease, that will not be a normal life, it is better to stop it for the benefit of everyone. *But only if it is 100 % certain.* (S., mother, hypothyroidism).

Although genetic testing for congenital hypothyroidism is (in most cases) futile, in 15–20% of the cases, the condition is caused by mutations in genes that play role in the proper growth, function, and development of the thyroid gland.

Three parents could not make up their mind regarding prenatal testing, saying this was a question they were still struggling with. A mother of an infant who is screen positive for CAH told us that because of the shock she experienced when the nurse first told her about the screen positive, she would prefer finding out about CAH through prenatal testing:

> I cannot explain the impact of the blow of this screen positive that you hear of after a pregnancy that was utterly perfect. You just gave birth, full of hormones, aching after delivery, it's so unfair… at least for me it was.

She was however unable to say what would be her decision regarding the continuation of pregnancy, and expressed an unresolved dilemma:

> The parents are the ones who have to live with the trauma for good... The parents need to make a decision, what they want, even if it means aborting a sick fetus... Who knows what will happen in real life, because *our child is perfect*. So why abort such a child? Because he will take three pills a day? Who does not take pills today? In short, this twister in my head ... I do not think I really have a position. (J., mother, CAH).

The mother brackets and demystifies the notion of the "perfect child" that appears as a popular ideal in many studies of how PND is seen by parents (Landsman 2009; Rothschild 2005; Remennick 2006). She says that her child, who is screen positive for CAH, is perfect. But evidently, this is subjective "perfection," infused with imperfections. As the mother immediately adds: "why abort such a child? Because he will take three pills a day? Who does not take pills today?" This echoes the reactions of parents of screen-positive infants in other countries. For many of these parents, the dream of a "perfect child" was replaced by the reality of an a/pre-symptomatic child, whose condition remains contingent on future metabolic challenges but does not take away from the overall sense of perfection. As Buchbinder and Timmermans (2011: 62) aptly sum it, "newborn screening technologies give shape both to previously invisible forms of imperfection and fragile new forms of normality."

Two families in our study were using artificial reproductive technologies in the form of IVF and preimplantation genetic diagnosis (PGD). Their common rationale was avoiding the possibility of another sick baby and not wanting to pursue selective abortion. One of the families did not want to consider selective abortion due to Jewish religious prohibitions:

> Following the child's disease, we performed more comprehensive genetic tests and we are currently being treated with fertility and PGD treatments to prevent such a disease in the next pregnancy. We will do genetic diagnosis of an IVF embryo before returning it to the uterus in order to rule out the genetic disease… There was also an option of chorionic villus testing and aborting in case the fetus has the disease, religiously we had a problem with that, so we went for the second option [PGD]… also from my own psychological perspective, I couldn't be under such tension, I preferred to know that the fetus in my womb is healthy. (M., mother, HCY[2]).

The second family using PGD was secular; they chose PGD after having a miscarriage due to an embryopathy:

> We had a spontaneous pregnancy, and we discovered it was another sick fetus after the abortion. Now I am pregnant again after treatments and PGD and know that this fetus is healthy. (S., mother, CAH).

Prenatal testing for selective abortion

At the other end of the spectrum, some (9/34, 26%) of the parents who supported prenatal testing said it may result in selective abortion if the fetus shared their affected child's genotype. Three of the five fathers who were interviewed were in this group—an intriguing over-representation. Some of the parents in this group also backed their support of termination of pregnancy following a positive PND with arguments concerning the family hardship of raising another screen-positive child:

> I certainly couldn't raise another sick child. It would be unfair to him, to us and to the other brothers. T. [the screen positive infant] is still little and spoiled, but she is a queen. Wise, smart, but taking too much attention. (A., father, MSUD).

MSUD, "maple syrup urine disease," is a type of amino acid disorder named for the sweet maple syrup smell of the urine in untreated babies. As in other metabolic disorders, there is a spectrum of severe, intermediate, and intermittent forms of MSUD. Most children need to eat a very low-protein diet and drink a special formula as a substitute for milk (http://www.newbornscreening.info/Parents/aminoaciddisorders/MSUD.html; accessed 5 July, 2017).

> I have no doubt that if I was pregnant I would make sure there was no PKU and if so, I would abort, because I already have three children, it's not easy to raise a child like that. If it was my first child I might have thought otherwise. (Y., mother, PKU).

These last two quotes demonstrate the diverse arguments of parents and their embeddedness in family contingencies. PKU in itself was not seen by other parents, and even by the abovementioned mother, as a reason to terminate a pregnancy. But already having three children made it a different story for this mother. That the experience of having other affected children influences parents' decision to use PND and termination of pregnancy for the condition, corresponds with factors previously known to impact decision-making. Attempts to reach a consensus on what counts as a serious (enough) condition in the context of PND thus should take into account the woman's/couple's awareness and experience of the condition and the impact of the condition on affected individuals and their families (Clancy 2010; Bryant et al. 2005).

Discussion

Newborn screening and prenatal genetic diagnosis are two major elements in the contemporary global landscape of public health genetics (Timmermans and Shostak 2016) that may become intertwined in the biographical trajectories of individual families. Our findings demonstrate how Israeli parents of screen-positive infants have varied opinions, from rejecting prenatal diagnosis (relying instead on newborn screening to reveal if a future baby is also sick), using PND for more information, as well as being prepared to abort a prospective child with the same condition. The main finding was that slightly more than half of the parents (18/34, 53%) viewed positively the possibility of having another child with the same condition associated with the screen positive of the older child. After becoming familiar with the care and supervision their screen-positive child requires, these parents were reluctant to diagnose the condition prenatally and considered newborn screening for that condition sufficient for diagnostic purposes. This view was common in parents of otherwise diverse religiosity and education levels, whose screen-positive child's manifestation of symptoms was mild. Many of the parents interviewed were thus not only accepting "imperfections," but remained open to the potential for having additional children with special needs and disabilities. Considering the study limitations, it is important to recall that our sample was comprised almost entirely of Jewish Israelis with various levels of religiosity, many of them secular; important segments of the

[2] HCY, short for homocystinuria, is an amino acid disorder. Babies look healthy and normal at birth. Over time, if the condition is not treated, it can cause growth and learning delays. The milder form can be treated with vitamin B6 supplements. The other type does not respond to vitamin B6. Symptoms of both types vary widely from person to person. https://www.newbornscreening.info/Parents/aminoaciddisorders/CBS.html, accessed 14 July 2017

Israeli population, such as Arab-Israelis and Ultra-Orthodox Israelis, should be added in future studies. The results are only applicable to a specific group of parents (i.e., those that have already a child whose NBS results were positive). Future studies should also compare the attitudes about a hypothetical pregnancy with parents' actual reproductive behaviors and decisions, as these have been shown to change considerably (Sawyer et al. 2006).

This study highlights the importance of newborn screening for reproductive decision-making. Before the expansion of NBS, the diagnosis of CF commonly was reported to end the reproductive lives of many families, because of the fear of having more children with that condition (Sawyer et al. 2006). For example, in a study from 1992, of 227 families in New England with a CF child, 51% had had one spouse surgically sterilized, and 62% of them indicated that the diagnosis of CF had affected the decision to be sterilized; of the 70 families still fertile and living with the child's other parent, 56% did not intend to have more children (Wertz et al. 1992). More recent studies show that the majority of women with a screen-positive CF child subsequently conceived. It is reasonable to assume that with CF becoming a manageable chronic disease, and with greater personal experience with screen-positive children combined with greater access to reproductive technologies including PND, there is greater acceptance of the option of having another child, even if it might be affected. More recently, mothers of CF children identified through NBS, reported moderate uptake of carrier testing and limited influence on family planning (Bombard et al. 2017).

This "secondary benefit" of NBS (Bombard et al. 2017) related to the impact of incidentally finding out one's carrier status on family planning highlights how screening technologies may have unintended consequences. In addition, new technologies may further compensate for the perceived drawbacks. Thus, in our study, some parents voided the dilemma of possibly terminating a pregnancy based on prenatal genetic testing by resorting to IVF followed by PGD, extending the cascade from NBS in a new technological form. At the same time, the routine bundling of heterogeneous metabolic conditions, some of which are treatable while others are not, in a single newborn screening panels makes counseling for each condition more daunting (Leib et al. 2005). Such discussions are further informed by personal and cultural outlooks as well societal policies on whether disability requires any kind of prevention. The case of CF is telling: it is part of NBS in the USA but not in Israel. In Israel, CF has been added to the national program for adult carrier screening which originally started with Tay-Sachs and is often screened for prenatally (Zlotogora and Israeli 2009).

Even though disability services are not easily accessible and having a child with disabilities is a life-changing event (Blum 2015), surveys show that US citizens support both the right to know through PND and the decision to continue a pregnancy of an affected fetus (Steinbach et al. 2016). Israel, in contrast, has long held a less tolerant view of disability: despite the welfare state origins, Israeli legislation related to disability associates disability with impairment, a medical problem, and a personal tragedy rather than a civil rights issue (Rimmerman et al. 2015; Mor 2005; Soffer et al. 2010). Previous studies, which did not concern NBS, argued that Israeli prospective parents generally wish for a perfectly healthy baby, which is interpreted as a child without disabilities (Hashiloni-Dolev 2007; Raz 2004; Remennick 2006). Our findings contrast this generalization by highlighting the more nuanced reality of parents of screen-positive children and the pragmatic rejection by most of them of subsequent PND. It should be stressed however that the rejection we found among the majority of parents in Israel was not a wholesale rejection of PND, which may still be practiced for testing other conditions. What influenced these parents' opinions most was their current experience caring for a screen-positive child.

Conclusions

Our findings problematize and contrast the common assumption that parents in Israel, and perhaps elsewhere, pursue the dream of the "perfect child" through PND that "naturally" leads to selective abortion in cases of mild or probable embryopathies. The diversity of views expressed by parents of screen-positive children—with a majority view that rejects PND for the condition associated with the screen positive—highlights the diversity of normative scripts of "genetic responsibility" in the context of parenthood (Raspberry and Skinner 2011a, b; Arribas-Ayllon et al. 2011). Parenting screen-positive infants is a challenging daily ordeal. It begins with the shock on being notified of the diagnosis after birth, which continues through emotional crises and adjustment problems during the first months, compounded by problems with dietary techniques as the child begins to eat solid foods (Awiszus and Unger 1990). Further research on how parents of screen-positive children make reproductive plans will contribute to and promote the informed choice of reproductive technologies in the context of coming to terms with the normality of imperfection.

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Compliance with ethical standards

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

Conflict of interest The authors declare that they have no conflict of interests.

References

Arribas-Ayllon M, Sarangi S, Clarke A (2011) Genetic testing: accounts of autonomy, responsibility and blame. Routledge, London

Awiszus D, Unger I (1990) Coping with PKU: results of narrative interviews with parents. Eur J Pediatr 149(1):S45–S51

Blum LM (2015) Raising generation Rx: mothering kids with invisible disabilities in an age of inequality. New York University Press, New York

Bombard et al (2017) A secondary benefit: the reproductive impact of carrier results from newborn screening for cystic fibrosis. Genet Med 19(4):403–411

Brosco JP, Seider MI (2008) Adverse medical outcomes of early newborn screening programs for phenylketonuria. Pediatrics 122(1):192–197

Bryant L, Hewison JD, Green JM (2005) Attitudes towards prenatal diagnosis and termination in women who have a sibling with Down's syndrome. J Reprod Infant Psychol 23(2):181–198

Buchbinder M, Timmermans S (2011) Medical technologies and the dream of the perfect newborn. Med Anthropol 30(1):56–80

Clancy T (2010) A clinical perspective on ethical arguments around prenatal diagnosis and preimplantation genetic diagnosis for later onset inherited cancer predispositions. Familial Cancer 9(1):9–14

Cohen BE, Szeinberg A, Peled I, Szeinberg B, Bar-Or R (1966) Screening program for early detection of phenylketonuria in the newborn in Israel. Isr J Med Sci 2(2):156–164

Crombag N et al (2014) Explaining variation in Down's syndrome screening uptake: comparing the Netherlands with England and Denmark using documentary analysis and expert stakeholder interviews. BMC Health Serv Res 14:437. https://doi.org/10.1186/1472-6963-14-437

Davis TC et al (2006) Recommendations for effective newborn screening communication: results of focus groups with parents, providers, and experts. Paediatrics 117:326–340

Denzin NK, Lincoln Y (1994) Handbook of qualitative research. Sage, Thousand Oaks

Dudding T, Wilcken B, Burgess B, Hambly J, Turner G (2000) Reproductive decisions after neonatal screening identifies cystic fibrosis. Arch Dis Child Fetal Neonatal Ed 82(2):F124–F127

Duster T (2003) Backdoor to eugenics. Routledge, London

Ettore E (2000) Reproductive genetics, gender and the body: 'please doctor, may I have a normal baby?'. Sociology 34:403–420

Ettore E (2002) Reproductive genetics, gender and the body. Routledge, London

Gammeltoft TM (2014) Haunting Images: A Cultural Account of Selective Reproduction in Vietnam. University of California Press, California

Gofin R, Adler B, Palti H (2004) Screening tests in prenatal care: a national study in Israel. Isr Med Assoc J 6:535–539

Grinshpun-Cohen J, Miron-Shatz T, Berkenstet M, Pras E (2015) The limited effect of information on Israeli pregnant women at advanced maternal age who decide to undergo amniocentesis. Israel J Health Policy Res 4:23. https://doi.org/10.1186/s13584-015-0019-6

Grob R (2006) Parenting in the genomic age: the 'cursed blessing' of newborn screening. New Genet Soc 25:159–170

Grob R (2008) Is my sick child healthy? Is my healthy child sick? Changing parental experiences of cystic fibrosis in the age of expanded newborn screening. Soc Sci Med 67:1056–1064

Gurian EA, Kinnamon DD, Henry JJ, Waisbren SE (2006) Expanded newborn screening for biochemical disorders: the effect of a false-positive result. Pediatrics 117:1915–1921

Hashiloni-Dolev Y (2007) A life (un)worthy of living: reproductive genetics in Israel and Germany. Springer- Kluwer, Berlin

Hayeems RZ, Bytautas JP, Miller FA (2008) A systematic review of the effects of disclosing carrier results generated through newborn screening. J Genet Couns 17(6):538–549

Juengst E (1995) "Prevention" and the goals of genetic medicine. Hum Gene Ther 6:1595–1605

Kelly S (2009) Choosing not to choose: reproductive responses of parents of children with genetic conditions or impairments. Sociol Health Illness 31(1):81–97

Kerr SM, McIntosh JB (2000) Coping when a child has a disability: exploring the impact of parent-to-parent support. Child Care Health Dev 26:309–322

Landsman G (2009) Reconstructing motherhood and disability in an age of "perfect" babies. Routledge, London

Leib JR, Gollust SE, Hull SC, Wilfond BS (2005) Carrier screening panels for Ashkenazi Jews: is more better? Genet Med 7(3):185–190

Lemke T (2007) Susceptible individuals and risky rights: dimensions of genetic responsibility. In: Dumit J, Burri V (eds) Biomedicine as culture. Instrumental practices, technoscientific knowledge, and new modes of life. Routledge, London

Lewis S, Curnow L, Ross M, Massie J (2006) Parental attitudes to the identification of their infants as carriers of cystic fibrosis by newborn screening. J Paediatr Child Health 42(9):533–537

Markens S, Browner CH, Press N (1999) 'Because of the risks': how US pregnant women account for refusing prenatal screening. Soc Sci Med 49:359–369

Mischler EH, Wilfond BS, Fost N, Laxova A, Reiser C, Sauer CM, Makholm LM, Shen G, Feenan L, McCarthy C, Farrell PM (1998) Cystic fibrosis screening: impact on reproductive behaviour and implications for genetic counselling. Pediatrics 102:44–52

Mor S (2005) Between charity, welfare, and warfare: a disability legal studies analysis of privilege and neglect in Israeli disability policy. Yale J Law Humanit 18(63):63–136

Moyer V et al (2008) Expanding newborn screening: process, policy, and priorities. Hastings Cent Rep 38(3):32–39

Natoli JL, Ackerman DL, McDermott S, Edwards JG (2012) Prenatal diagnosis of down syndrome: a systematic review of termination rates (1995-2011). Prenat Diagn 32(2):142–153

Natowicz M (2005) Newborn screening - setting evidence-based policy for protection. N Engl J Med 353(9):867–870

Novas C, Rose N (2000) Genetic risk and the birth of the somatic individual. Econ Soc 29:485–513

Parens E, Asch A (eds) (2000) Prenatal testing and disability rights. Georgetown University Press, Washington, D.C.

Paul D (2008) Patient advocacy in newborn screening: continuities and discontinuities. Am J Med Genet Part C 148C:8–14

Polizzi A, Carbone P, Taruscio D (2013) Expanded newborn screening: a chess board motif in public health. J Pediatr Biochem 6(1):66–70

Press NA, Browner CH (1993) "Collective fictions": similarities in reasons for accepting maternal serum alpha-fetoprotein screening among women of diverse ethnic and social class backgrounds. Fetal Diagn Ther 8(1):97–106

Rapp R (1998) Refusing prenatal diagnosis: the meanings of bioscience in a multicultural world. Sci Technol Hum Values 23(1):45–70

Rapp R (1999) Testing women, testing the fetus: the social impact of amniocentesis in America. Routledge, New York

Raspberry K, Skinner D (2011a) Enacting genetic responsibility: experiences of mothers who carry the fragile X gene. Sociol Health Illness 33(3):420–433

Raspberry K, Skinner D (2011b) Negotiating desires and options: how mothers who carry the fragile X gene experience reproductive decisions. Soc Sci Med 72:992–998

Raz A (2004) "Important to test, important to support": attitudes toward disability rights and prenatal diagnosis among leaders of support groups for genetic disorders in Israel. Soc Sci Med 59(9):1857–1866

Raz A (2009a) *Community Genetics and Genetic Alliances: Eugenics, Carrier Testing, and Networks of Risk*. New York and. Routledge, London

Raz A (2009b) Eugenic utopias/dystopias, reprogenetics, and community genetics. Sociol Health Illness 31:602–616

Raz A and Timmermans S (2017) Divergent evolution of newborn screening: Israel and the US as gene worlds. BioSocieties (accepted for publication)

Remennick L (2006) The quest for a perfect baby: why do Israeli women seek prenatal genetic testing? Sociol Health Illness 28(1):21–53

Rimmerman A, Soffer M, David D, Dagan T, Rothler R, Mishaly L (2015) Mapping the terrain of disability legislation: the case of Israel. Disabil Soc 30(1):46–58

Rimon-Zarfaty, N. & A. Raz 2010. Abortion Committees as Agents of Eugenics: Medical and Public Views on Selective Abortion following Mild or Likely Embryopathy. Chapter 9 In: Birenbaum-Carmeli, Daphna and Carmeli, Yoram (Eds.), Kin, Gene, Community: Reproductive Technologies among Jewish Israelis. Oxford: Berghahn Press

Risøy S, Sirnes T (2015) The decision: relations to oneself, authority and vulnerability in the field of selective abortion. BioSocieties 10(3): 317–340

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

Rothschild J (2005) The dream of the perfect child. Indiana University Press, Bloomington

Sawyer S et al (2006) Changing their minds with time: a comparison of hypothetical and actual reproductive behaviors in parents of children with cystic fibrosis. Pediatrics 118(3):649–659

Shapira A (1995) Wrongful life. In: Suits by defective newborns for faulty genetic counseling, in the human genome project: legal, social and ethical implications—proceedings of an international workshop. Israel Academy of Sciences and Humanities, Jerusalem

Shilling V, Morris C, Thompson-Coon J, Ukoumunne O, Rogers M, Logan S (2013) Peer support for parents of children with chronic disabling conditions: a systematic review of quantitative and qualitative studies. Dev Med Child Neurol 55:602–609

Soffer M, Rimmerman A, Blanck P, Hill E (2010) Media and the Israeli disability rights legislation. Disabil Soc 25(6):687–699

Stafler P, Mei-Zahav M, Wilschanski M, Mussaffi H, Efrati O, Lavie M, Shoseyov D, Cohen-Cymberknoh M, Gur M, Bentur L, Livnat G, Aviram M, Alkrinawi S, Picard E, Prais D, Steuer G, Inbar O, Kerem E, Blau H (2016) The impact of a national population carrier screening program on cystic fibrosis birth rate and age at diagnosis: implications for newborn screening. J Cyst Fibros 15:460–466

Steinbach RJ, Allyse M, Michie M, Liu EY, Cho MK (2016) This lifetime commitment: public conceptions of disability and noninvasive prenatal genetic screening. Am J Med Genet A 170A(2):363–374

Strauss A, Corbin J (1990) Basics of qualitative research. Grounded theory procedures and techniques. Sage, Newbury Park

The Knesset Research and Information Center (2003) Background paper on selective abortions. Jerusalem (in Hebrew)

Timmermans S, Buchbinder M (2010) Patients-in-waiting: living between sickness and health in the genomics era. J Health Soc Behav 51(4):408–423

Timmermans S, Buchbinder M (2013) Saving babies? The consequences of newborn genetic screening. University of Chicago Press, Chicago

Timmermans S, Shostak S (2016) Gene worlds. Health 20(1):33–48

Timmermans S, Tavory I (2007) Advancing ethnographic research through grounded theory practice. In: Bryant, Charmaz K (eds) Handbook of Grounded Theory. Sage, London, pp 493–513

Vailly J (2008) The expansion of abnormality and the biomedical norm: neonatal screening, prenatal diagnosis and cystic fibrosis in France. Soc Sci Med 66(12):2532–2543

Ville I, Mirlesse V (2015) Prenatal diagnosis: from policy to practice. Two distinct ways of managing prognostic uncertainty and anticipating disability in Brazil and in France. Soc Sci Med 141:19–26

Wertz DC, Janes SR, Rosenfield JM, Erbe RW (1992) 1992. Attitudes toward the prenatal diagnosis of cystic fibrosis: factors in decision making among affected families. Am J Hum Genet 50:1077–1085

Wieser B (2010) Public accountability of newborn screening: collective knowing and deciding. Soc Sci Med 70:926–933. https://doi.org/10.1016/j.socscimed.2009.12.001

Zlotogora J, Israeli A (2009) A comprehensive screening program for cystic fibrosis. Isr Med Assoc J 11(9):555–557

Zlotogora J, Haklai Z, Leventhal A (2007) Utilization of prenatal diagnosis and termination of pregnancies for the prevention of down syndrome in Israel. Isr Med Assoc J 9(8):600–602

Zlotogora J, Grotto I, Kaliner E, Gamzu R (2016) The Israeli national population program of genetic carrier screening for reproductive purposes. Genet Med 18(2):203–206

Zuckerman, S. 2009. The expansion of newborn screening in Israel: ethical dimensions. PhD Dissertation, Case Western Reserve University

Zuckerman S (2017) Indifferent or uninformed? Reflections of health professionals on parental education and consent for expanded newborn screening in Israel, 2008–2016. Int J Neonatal Screening 3:12. https://doi.org/10.3390/ijns3020012