Original Paper

European Journal of Human Genetics

Eur J Hum Genet 1997;5:351–363

Received: March 21, 1997
Revision received: July 9, 1997
Accepted: August 1, 1997

Non-Participation in Predictive Testing for Huntington's Disease: Individual Decision-Making, Personality and Avoidant Behaviour in the Family

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Key Words
Huntington's disease
Predictive testing
Non-participants
Risk perception
Decision-making
Personality
Avoidant attitude

Abstract
Subjective risk perception, perceived impact of Huntington's disease (HD), perceived benefits and barriers of predictive testing and personality characteristics of persons withdrawing from the predictive test programme for HD and of siblings of test applicants were studied in a mailed survey. The belief that important decisions do not need to depend on a test result and the anticipated inability to cope with a bad result played an important role in the decision not to be tested. Nevertheless half of the group who ever considered testing, still planned to undergo a test in the future. A comparison of tested and untested persons revealed that the first group is more likely to overestimate the risk than the second group, but that both groups did not significantly differ from each other regarding anxiety, ego strength and coping strategies. An intrafamilial analysis of tested and untested siblings confirmed these findings. The problems during data collection and the reasons for the dropout are an illustration of the avoidant behaviour regarding HD and the predictive test in many individuals and families.

Introduction

Huntington's disease (HD) is a late-onset neurodegenerative disease, characterized by involuntary movements (chorea), progressive dementia and affective disturbances (e.g., aggression, paranoia). This is caused by a selective and progressive neuronal degeneration in the basal ganglia and the cerebral cortex [1]. Predictive testing for HD has been available as a clinical service since 1987, initially by DNA-linkage and since mid-1993 by direct mutation analysis [2–4]. In the Centre for Human Genetics in Leuven, the predictive test programme is multidisciplinarily organized by a clinical geneticist, a psychologist, a psychiatrist, a neurologist and a social worker. We refer to Evers-Kiebooms [5] for a full description of the approach. Psychological profiles, risk perception, reasons for testing and post-test reactions of test participants have been extensively described in Decruyenaere et al. [6, 7].

The low uptake for predictive testing and the growing amount of information [6, 8–15] about psychological

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1018–4813/97/0056–0351$15.00/0

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characteristics of tested persons inspired a number of hypotheses and empirical studies about factors that play a part in taking or not taking the test. Some studies included factors from theoretical cognitive-affective models about health behaviour. A frequently tested model is the Health Belief Model [16, 17] which postulates that four basic beliefs determine an individual's decision to attend a health service: perceived susceptibility and perceived severity of the disease, perceived benefits and perceived barriers of testing. These variables are influenced by other aspects, such as personality characteristics (e.g., trait anxiety [18]), demographic aspects (e.g., education [18]), current and past experiences (e.g., health status of family members, memory of fear [19]) and, last, cues to action (e.g., an invitation for screening [17]). Several authors have provided ample data to suggest that test participants are self-selected and mentally resourceful [6, 8, 11]. Kessler [15] hypothesized that Barron's psychological construct 'ego strength' [20] differentiates between test utilizers and non-utilizers. A study of Van der Steenstraten et al. [21] reported that non-participants were more pessimistic about their future than were participants, as measured by the Beck Hopelessness Scale. No differences were found for mental functioning (measured by the General Health Questionnaire). More non-participants than participants expected to be carriers of the HD gene. The aim of the present paper is to describe two groups of asymptomatic untested at-risk individuals – a group that initially applied to testing but withdrew from the programme and a group of untested siblings of test applicants – regarding variables of the health belief model (perceived susceptibility to HD, perceived severity of the disease, perceived benefits and barriers of predictive testing), sociodemographic variables and personality characteristics (anxiety, ego strength and coping strategies). Secondly, the group of untested subjects was compared with the group of test applicants. Thirdly, we assessed intrafamilial differences between test participants and untested persons belonging to the same sibship: (pairwise) comparisons of tested and untested siblings were made.

When selecting a sample of untested individuals at risk for HD, all researchers face the same methodological problem. The main problem is that the total group of untested individuals also includes at-risk persons who are not informed about the genetic aspects of HD and/or about the availability of predictive testing or who deny the hereditary aspect of the disease. Since these subgroups of the population at risk are partially unknown, composing a representative sample is very difficult. Moreover, ethical considerations, such as the respect for privacy and for the right not to know [22, 23] are impediments to contact these persons at risk directly. The above-mentioned studies on non-participants used different sampling procedures (individuals who initially considered testing but withdrew from the programme [21] and members of a Huntington's Disease Association, reacting to a call for participation in a survey on the test [14]). We used the first sampling method in combination with another approach to reach the group that never applied for predictive testing.

Methodology

Subjects

In the period November 1987–December 1994, 103 Flemish-speaking persons with a 50% prior risk and belonging to 68 different sibships applied for testing in the Centre for Human Genetics of Leuven; 40 individuals withdrew from the programme and 63 received a test result (27 received an unfavourable and 36 a favourable result). Except when objective arguments hindered participation (cf. infra), the social workers of the HD team informed both groups about the present study and asked for consent to invite their untested siblings to participate in a mailed survey about the predictive test. Moreover, they also invited the first group to take part in the study.

Withdrawals. Inviting all 40 persons who withdrew to take part in this survey was not possible. We could not obtain current addresses or phone numbers of 6 of them. One person had become affected. We did not survey two pregnant persons out of concern that questions about HD would be particularly distressing. So, 31 withdrawals were eligibile for assessment. They were informed by phone about the study by the social workers of the HD team. Seven of them immediately refused to participate because they did not want to think or talk about the test. So, 24 persons who withdrew from the predictive test programme received mailed questionnaires.

Siblings of the Test Applicants. The tested persons and those who withdrew from the programme were asked for the addresses of their untested siblings whom we could send a questionnaire. A group of 112 adult (>18 years) unaffected siblings of the test applicants were eligible for participation in the study. We eventually mailed the survey to 62 of them because participation was not possible for the 50 other sibs: 6 contacted persons refused to ask their siblings to participate in the study because they considered it too threatening to talk about the disease and the predictive test with their brothers and sisters (18 siblings); 4 contacted persons agreed to ask their siblings to participate, but were reluctant to contact one sibling because his/her situation was too problematic (suspicion about first symptoms of HD in the sibling, psychological and/or relational problems) (4 siblings); 5 contacted persons declined permission to approach siblings who were unaware that the contact person had requested predictive testing (16 siblings); 6 contacted persons did not want to ask their siblings to participate in the study because of strained or broken family relationships (7 siblings); according to 5 contacted persons, 5 siblings were not interested in participating in the study.

Fourteen persons who withdrew from the test protocol and 31 siblings returned the survey after some weeks. Six months later, the social workers of the HD team phoned non-responders to get some

insight in their reasons for not returning the questionnaire. Five persons of the group who withdrew from the predictive test programme answered that they did not want to think or talk about the disease and the predictive test anymore. Two subjects of this group promised to return the questionnaire, but did not after all and 3 others could not be reached. In the group of siblings who never applied for predictive testing, 6 persons answered that they did not want to think or talk about the disease and the predictive test, 2 replied that they were 'not interested', 12 promised to return the questionnaire (5 of them completed the questionnaire some weeks later) and we could not reach 11 siblings. Fifty untested persons, belonging to 30 different families, eventually returned the questionnaires: 14 of the 31 (45%) persons who considered testing but withdrew and 36 of the 112 (32%) siblings of test applicants. The low response rate will get special attention during the discussion.

The two groups of untested persons will first be described regarding the above-mentioned variables. We will also compare their personality profile with that of the general population [24–26]. Secondly, we will compare the untested group with the tested persons. Thirdly, intrafamilial comparisons are made in 16 families by comparing tested with untested siblings. The nonparametric statistical tests used in this study are described in Siegel and Castellan [27].

Tests and Questionnaires

The mailed questionnaire sent to the untested persons covered the following topics:

(1) Demographic data

(2) Risk perception. This was assessed with two questions: (a) what is your risk for getting HD? (open question; we asked them for a percentage) and (b) perceived susceptibility: what is your subjective feeling about becoming ill in the future? (multiple-choice question). We provided some space for free comments.

(3) Perceived severity of the disease: influence of the disease on daily life. This was assessed with one open-ended question.

(4) Attitudes toward the predictive test: benefits and barriers. First, we asked whether the at-risk persons had every thought about requesting the predictive test and we assessed their motivation for considering and for declining the test (open-ended questions). Then they had to indicate the personal relevance of 12 arguments in favour of the predictive test and 17 arguments against it on a Likert scale (0 = not important, 6 = very important). Additionally, they were asked to select the most important argument for and against the test from these two lists. The lists are based on the literature and on clinical experience with tested and untested persons. We also asked whether they intended to seek predictive testing in the future (multiple-choice question).

In addition, we included the following tests:

- *Spielberger State Trait Anxiety Inventory* (STAI, contains two scales: general and situational anxiety) [24],
- *Ego Strength scale* of the Minnesota Multiphasic Personality Inventory [20, 25],
- *Utrechtse Coping list* (UCL). The UCL, a Dutch adaptation of the Westbrook Coping Scale, assesses coping strategies: active coping, palliative coping, avoiding reactions, social support seeking, depressive-regressive coping, expression of emotions or anger and comforting ideas [26].

The test applicants' data were available from the pre-test psychometric testing and counselling sessions. During pre-test counselling, we asked only for their motivation to take the test, and not for their barriers.

Table 1. Demographic data of untested (a and b) and tested persons (c)

	(a) Test applicants who withdrew n = 14	(b) Siblings of test applicants n = 36	(c) Tested persons n = 63
Sex			
Male	4 (29)	18 (50)	31 (49)
Female	10 (71)	18 (50)	32 (51)
Age			
Mean	41.3	37.1	35.4
SD	8.2	10.1	9.6
Education			
<High school	1 (7)	3 (8)	1 (2)
High school	3 (21)	26 (72)	37 (59)
>High school	10 (71)	7 (19)	25 (40)
Marital status			
Single	2 (14)	3 (8)	6 (9)
Stable relationship	11 (79)	30 (83)	56 (89)
Divorced	1 (7)	3 (8)	1 (2)
Children			
None	3 (21)	8 (22)	32 (51)
One or more	11 (79)	28 (78)	31 (49)

Figures in parentheses are percentages.

Results

Description of the Two Groups of Untested Subjects

Demographic Data (table 1, columns a and b). The 'withdrawal' group appeared older than the siblings but this difference was not significant (two-tailed t test). The proportions of men and women were not statistically different in both groups (χ^2 test). Most individuals had a stable relationship and had one or more children; the difference between the two groups is not significant (Wilcoxon 2-sample test with continuity correction). Siblings who withdrew from the test programme were significantly more educated than siblings who never applied for predictive testing (Wilcoxon test; $z = 3.0$; $p < 0.01$).

Personality Profiles. The mean scores for general and situational anxiety, for ego strength and coping strategies are presented in table 2 (columns a and b). We found no significant differences between the untested 'withdrawal' group and the untested siblings (two-tailed t tests). Compared to the general population (column d) [24–26], the total untested group had however a significantly higher mean ego strength and was, on average, more actively coping with problems, used more palliative coping reactions, was seeking more social support and had more com-

Table 2. Means and standard deviations for general and situational anxiety (Spielberger State Trait Anxiety Inventory; STAI), ego strength (Minnesota Multiphasic Personality Inventory; MMPI) and coping strategies (Utrechtse Coping List; UCL) of the untested (a and b) and the tested group (c) and of the general population (d)

	(a) Test applicants who withdrew n = 14	(b) Siblings of test applicants n = 36	(c) Tested group n = 63	(d) General population
STAI				
Trait-anxiety	37.8 (10.2)	35.6 (8.7)	37.2 (10.1)	38.38 (10.8)
State-anxiety	38.1 (9.4)	33.9 (8.4)	37.2 (9.3)	37.64 (11.9)
MMPI				
Ego strength	55.5 (11.8)	58.6 (8.6)	58.0 (10.9)	50.00 (10.0)
UCL				
Active coping	19.9 (4.0)	19.3 (4.3)	20.1 (3.3)	18.40 (3.58)
Palliative c.	18.1 (4.8)	16.6 (3.4)	18.1 (3.3)	15.32 (3.62)
Avoiding	15.5 (3.1)	18.8 (3.8)	15.2 (2.8)	14.71 (3.29)
Soc. support s.	14.4 (4.1)	12.9 (4.2)	13.9 (4.4)	11.07 (2.95)
Depressive c.	11.1 (2.9)	10.3 (2.5)	11.8 (5.4)	10.55 (2.87)
Exp. emotions	6.6 (2.2)	6.5 (1.6)	6.3 (1.5)	6.25 (1.70)
Comforting ideas	13.4 (3.8)	13.3 (2.2)	13.4 (2.5)	11.54 (2.57)

Figures in parentheses are standard deviations.

Table 3. Frequency of answers of untested subjects on the open-ended question on risk perception: 'What is your risk to get HD? ... %' and free comments on it (missing: 4 persons)

Risk, %	Freq.	Some comments
50	39	Parent affected
10	1	It's a gamble
15	1	I'm under treatment
20	1	Because of my age: 48 years
25	1	Because of my age: 55 years
33	1	That's what the doctor said ... but other people have told my risk is 50%
60	1	I think there are some symptoms present
90	1	This is the best attitude towards the disease for me

forting ideas (two-tailed t tests). The other scores did not significantly differ from the population means.

Risk Perception. The first question on risk perception and the answers are presented in table 3. The vast majority of the untested people gave a risk figure of 50%, with the comment that their parent is affected. The results concerning the subjective feeling of getting ill in the future are presented in table 4. The differences between the persons who withdrew from testing and untested siblings were not statistically significant (Wilcoxon test). We found no significant correlations with age. Some remarks of the untested persons on options 1 and 2: 'I think I have symptoms'; 'I look like my affected father'; 'It is the best attitude toward the disease for me'; 'There are six affected persons in my family; I have the feeling that I cannot escape'. Remarks on options 4 and 5: 'Because of my age'.

Based on the respondents' subjective risk perception, we defined a group of overestimators and underestimators. We made the assumption that all subjects were asymptomatic (one person with psychiatric problems was excluded). We considered as overestimators: persons choosing options 1 and 2 of question 2 and persons older than 50 years who chose option 3 of question 2. We considered as underestimators: persons choosing option 5 and persons younger than 45 years choosing option 4. This resulted in 10 overestimators (2 of the 'withdrawal' group and 8 of the siblings) and 5 underestimators (1 of the 'withdrawal' group and 4 of the siblings). The others were considered as having an 'accurate' perception of their risk (5 persons of the 'withdrawals' and 16 of the siblings). The difference between the 'withdrawal' group and the siblings was not statistically significant (Wilcoxon

Table 4. Frequency of answers on the multiple choice question on risk perception: 'What is your subjective feeling about getting ill in the future?' (missing: 2 subjects)

Options		Test applicants who withdrew n = 14	Siblings of test applicants n = 34
1	I feel that I will become ill later	0	2 (6)
2	I feel that my chance to get the disease is larger than may chance not to get it	1 (7)	6 (18)
3	I feel that the chance of getting ill is as large as the chance of not getting ill	4 (29)	15 (44)
4	I feel that my chance to get the disease is smaller than my chance not to get it	3 (21)	5 (15)
5	I feel that I will not become ill later	0	1 (3)
6	I do not know	6 (43)	5 (15)

Figures in parentheses are percentages.

test). The 'don't know' answers (n = 11) were not included in the analysis.

Perceived Influence of the Disease. We classified the answers to the open question in categories. Thirteen at-risk individuals (26%; 3 'withdrawals' and 10 siblings) answered that the disease had an influence on their reproductive decisions: fewer children than initially wanted (n = 4), no children (n = 1), sterilization (n = 1), adoption (n = 1) and not specified (n = 6). A second category is influence on personality, reported by 8 individuals (16%; 4 'withdrawals' and 4 siblings): difficulties to enjoy life, anxiety, ... (n = 3), the tendency to enjoy life more intensely (n = 2), self-observation (n = 1) and not specified (n = 2). An influence on the relationship with the partner was mentioned by 7 untested persons (14%; 2 'withdrawals' and 5 siblings): difficulties to start a relationship (n = 2), problems in the relationship (n = 2) and not specified (n = 3). One person mentioned an impact on decisions overall and another an impact on practical affairs. Finally, 16 at-risk individuals (32%; 4 'withdrawals' and 12 siblings) claimed that the disease had no influence on daily life. Four persons mentioned an influence on 2 of these life aspects and 8 persons (16%) did not fill out this question.

Reasons in Favour of Testing. Seventeen subjects reported that they had never considered taking the test. These persons were asked to complete the questions about barriers against the test but not the questions about motives for testing. The others (all of the 'withdrawal' group and 19 of the siblings) were first asked for their reasons for considering the test in an open-ended question and afterwards, they had to rate the importance of 12 arguments in favour of the test on a 7-point scale (0 = not important, 6 = very important). We only give the results of these ratings because the open question produced no additional new data. The 12 reasons are presented in table 5, ranked according to their mean importance score. Since the differences between the test applicants who withdrew and the siblings were not significant for the 12 items (two-tailed t tests), we pooled the results of the two groups in table 5.

The subjects also had to choose the single most important reason for requesting the test; we mention the frequency of each reason in column 2 of table 5. The need for certainty and the need to inform the children about the risk were indicated as 'the major reason' by 8 respectively 14 at-risk persons. These two reasons were important for most of the responders, given the high mean importance rating. We compared the mean psychometric test scores (anxiety, ego strength and coping strategies) of these two groups of 8 and 14 subjects and found no significant differences.

Barriers against Testing. The untested group (n = 50) was asked for barriers against the test by means of an open-ended question and a list of 17 barriers to take the test. The mean importance scores and the frequency of 'the most important argument against the test' are presented in table 6. We present pooled data since no significant differences were found between the test applicants who withdrew and the siblings (two-tailed t tests). The anticipated inability to cope with a bad test result was indicated as 'the most important barrier' by 8 non-participants, the expectation of being happier when not knowing by 7 non-participants and the perceived burden of the pre-test counselling protocol by 8 non-participants. Given the mean importance scores, the first two reasons played an important part for most individuals, while the latter

Table 5. Reasons for considering the test: mean importance score and frequency with which each reason was mentioned as 'the most important reason' (n = 33)

	Mean	Frequency 'most important'
To have certainty	4.4	8
To inform my children about their risk	3.7	14
To relieve uncertainty	3.3	1
To prepare me and my family for the future	2.4	1
To decide about reproduction	2.3	4
To decide about practical matters	2.2	4
It was obvious to consider the test when being informed about its existence	2.2	–
To decide about marriage or engagement	1.2	1
I suspected that the disease had already started	0.7	–
I know persons with positive experiences with the predictive test	0.5	–
A medical doctor proposed to do the test	0.4	–
Family members wanted me to do the test	0.3	–

Table 6. Barriers against taking the test: mean importance score and frequency with which each reason was mentioned as 'the most important barrier against the test' (n = 45; 5 missing)

	Mean	Frequency 'most important'[1]
I think that important decisions do not have to depend on my test result	3.1	4
I think I would not be able to cope with a bad test result	2.9	8
I am happier when not knowing whether I will become ill or not	2.6	7
I want to wait until a treatment is available	2.3	2
I am concerned about the reactions of my children	1.9	3
The test result would have an influence on my partner relation/on starting a new relation	1.8	3
My risk to get the disease is low, taking into account my age	1.3	2
The pre-test counselling is too burdensome	1.3	8
I am afraid that the test result would have an influence on my studies/career	1.3	0
I am too young	1.3	1
My children are still too young to be informed	0.9	1
I am convinced that I will not get the disease	0.9	–
Persons in my environment are against taking the test	0.9	–
I am concerned about the reactions of my parents	0.7	–
Fear of confirmation that the disease has started	0.6	–
I am concerned about the reactions of my brothers and sisters	0.6	–
I know persons with negative experiences with the predictive test	0.4	–

[1] Only 39 subjects indicated a major barrier.

was only important for a small subgroup of untested persons.

The group of 8 subjects for whom the pretest counselling was the most important barrier had a significantly lower mean ego strength and were significantly more anxious (trait) than subjects who said to be happier when not knowing (n = 7). At-risk individuals (n = 8) who thought that they could not cope with a bad test result were between, but the difference with the two other groups was not significant (mean ego strength = 52.4 vs.

58.6 vs. 63.6 and mean general anxiety = 41.1 vs. 39.0 vs. 31.6; analysis of variance with a posteriori Scheffé tests). The answers on the open-ended question yielded some additional information. Five persons claimed that their reason for not taking the test related to their busy life: 'no time, too busy'. Three persons reported that they did not take the test because their family was complete: 'my children are already born now'.

Future Testing. We asked those who ever considered taking the test (n = 33) whether they planned to apply for the test in the future (multiple-choice question): 12 persons answered 'I do not know', 5 answered 'certainly' (2 of them entered the predictive test programme), 11 'probably', 4 'probably not' and 1 answered 'certainly not'. The difference between the 'withdrawals' and the siblings was not statistically significant (Wilcoxon test). Considering future testing was not significantly associated with age or having children, nor with psychological traits or risk perception (Kendall tau).

Comparison of Tested and Untested Subjects

Demographic Variables (table 1, column c). The tested and the (pooled) untested group did not significantly differ for sex (χ^2 test), age (two-tailed t tests) and marital status (Wilcoxon test). Untested subjects were significantly more often parents of one or more children than tested subjects (Wilcoxon test; $z = 3.11$; $p < 0.01$). For the educational level, we compared the segregated groups of untested persons with the test participants, since the two groups of untested subjects differed from each other with respect to education. The difference between the 'withdrawals' and the tested group was not significant. However, test participants were significantly more educated than siblings who never applied for predictive testing (Wilcoxon test; $z = -2.35$; $p < 0.05$).

Personality Profiles (table 2, column c). The untested group did not significantly differ from the tested group with respect to their mean scores for anxiety (STAI: general and situational anxiety), ego strength (MMPI scale) and coping strategies (7 scales of the UCL) (two-tailed t tests).

Risk Perception. In the tested group, all subjects were aware of their 50% numerical risk during pre-test counselling. In a similar way as for the untested group, we divided the tested group in over- and underestimators, based on the pretest counselling data about subjective risk perception. The result was 29 overestimators, 4 underestimators and 21 persons with 'accurate' risk perception; 9 persons gave no clear answer on this topic. The difference between the tested and the untested group was significant (Wilcoxon two-sample test with continuity correction; $z = 2.39$; $p < 0.05$): untested persons are more likely than tested subjects to have an accurate risk perception, while tested persons are more likely to overestimate their risk of getting HD.

Perceived Influence of the Disease. During pretest counselling, 22 of the 63 test participants (35%) answered that HD had an influence on reproduction: they had fewer children than initially planned (n = 8), they postponed having children until the test is done (n = 8) or they are undecided about reproduction (n = 6). Eighteen (28%) persons reported a negative impact on personality: difficulties to enjoy life, anxiety, shyness ... Six test participants (10%) mentioned that HD had a negative influence on the relationship: difficulties to start a relationship (n = 3) and problems in the relationship (n = 3). Eight persons mentioned an influence on two of these life aspects. The other persons (n = 25; 40%) reported no clear impact. The difference between the number of tested and untested subjects reporting an impact/no impact on life aspects (pooled across impact categories) was not statistically significant (χ^2).

Attitudes Toward the Test. For the test applicants, we discussed motives for requesting the test during pre-test counselling. The major reasons of the tested group were: relief from uncertainty (n = 42; second motive for 17 persons), pregnancy planning (n = 12; second motive for 18 subjects) and informing the children (n = 9; second motive for 9 persons). Eight persons had practical considerations (job, finances ...) as second motive. For untested persons, informing the children was the major motive for considering the test. Information about barriers against the test was not systematically collected during pretest counselling for the predictive test.

Intrafamilial Analysis of Tested and Untested Siblings

We performed an intrafamilial analysis of test participants and their untested siblings. We identified 8 families with three members participating in the study and 8 families with two members (17 tested persons and 23 of their untested siblings).

Sociodemographic Data. Appendix 1 gives details about the 16 sibships; appendix 2 contains overall sociodemographic data of the tested and untested participants of these 16 families. In 8 families, the tested person was the eldest sibling of the family and in 4 cases, the tested person was the youngest sib. The educational level of tested and untested siblings participating in our study was the same within 7 families. In 6 families, the tested person had a higher educational level than the untested persons

and in one family the tested person had a lower educational level than the untested persons.

Personality Profile. Pairwise comparsions of one tested and one untested sibling belonging to the same sibship were performed for the psychometric test scores (ego strength, situational and general anxiety and the seven coping strategies). If more than one tested or more than one untested sibling was available within one family, we used the following criteria to select the pair of subjects: (1) the tested and untested sibling had the same sex and/or (2) the age of the untested person was as close as possible to the age of the tested sibling. Data were available for 16 matched pairs. Within each pair, we calculated the difference between the test scores of the tested and the untested person for the 10 psychological variables. None of the 10 mean difference scores were significantly different from zero (two-tailed t test). We found no correlation of the psychometric scores of the untested siblings with the pre- and the posttest psychometric scores of the tested persons. We examined also whether the scores on the psychological variables of the untested siblings were associated with the predictive test result of their tested sibling. The Pearson correlation coefficient was significant for one coping strategy, Expression of Emotions ($r = 0.59$; $p < 0.05$). The untested siblings showed more often expressions of emotions as coping mechanism if their tested sibling received a favourable test result.

Risk Perception. All participants of the 16 families had a correct perception of the 50% risk figure. The data about subjective risk perception were missing for 3 tested and 4 untested siblings. There was no systematic relation between the risk estimation of the untested and tested siblings. We checked also whether the subjective risk perception of the untested siblings was associated with the predictive test result of their tested sibling. The Pearson coefficient was not significant ($r = -0.41$; $p = 0.16$; $n = 13$).

Influence of HD on Daily Life. For 4 families we have incomplete data. In the other families, all tested individuals mentioned that HD influenced important aspects of their life. This was not so for 5 untested individuals. The nature of the influence was complex but the available data suggest more impact on reproductive decision-making in the group of test participants (Appendix 3).

Attitudes toward the Predictive Test. We found no systematic association between the two groups of siblings concerning the arguments for considering the predictive test.

Discussion

We described 50 untested persons at risk for HD with respect to demographic characteristics, personality characteristics, risk perception, influence of HD on life and attitude toward the predictive test. The first salient observation of our study was the large proportion of dropouts, which was mainly caused by the fact that they perceived the topic as too threatening, by a lack of communication in the families and by rifts in family relations. These reactions suggest that mentioning HD and predictive testing aroused a variety of anxieties. The reluctance of some at-risk persons to ask blood samples of family members in the period that only linkage analysis and no direct testing was possible, pointed also in this direction. This avoidance protects the at-risk persons from painful feelings about the disease and the risk, such as anxiety, anger or guilt. For a number of at-risk people, this attitude may be the main reason for not requesting a predictive test. However, this hypothesis cannot be tested because these individuals refused to participate. Within the untested sample, we described two groups: a group that withdrew from the test programme and a group of brothers and sisters of test applicants, who never requested testing. The groups differed from each other with respect to educational level: the first group was significantly more educated than the last. Moreover, we found no significant difference between the educational level of those proceeding with and withdrawing from testing. More educated people seem more likely to find their way to a genetic centre than less educated persons (which does not imply that more educated people proceed more with testing). These findings evoke several questions. Is the threshold to visit a genetic centre too high for less educated people? Are less educated people less informed about genetic risks and genetic tests? Or are less educated people more inclined to participate in surveys? Definite conclusions about the role of the educational level could not be drawn since we could reach only a part of the untested HD population. Given the proliferation of predictive testing today, further research should clarify the role of education and genetic information, not only in specific risk groups but also in the population at large.

Psychological Profile

The psychological profile of untested at-risk individuals did not significantly differ from that of the test participants. Thus the hypothesis that ego strength differentiates between test participants and non-participants was not confirmed. However, compared to the general popula-

tion, the untested persons had a higher mean ego strength, were more actively coping with problems, used more palliative coping reactions, seeked more social support and had more comforting ideas.

The findings about the personality profile, combined with the reasons for the dropout of the survey, suggest that at-risk subjects are a heterogeneous group with at least two subgroups: a group of untested resourceful persons who overall seem able to cope well with uncertainty and to face their decision not to take the test and another group with avoidant behaviour toward the disease and the test. This implies that the untested subjects who participated in this study may be a selected sample from the total group of untested at-risk persons. This selection may have been made by the untested persons, but also by the siblings whom the social workers contacted during the first stage of the study. The result of the selection may be that especially open-minded, resourceful persons took part in the survey. The findings reflect different styles of coping with health-threatening information. Miller et al. [28, 29] made a distinction between two different modes of coping with medical stressors: monitoring and blunting. Monitoring refers to the extent to which individuals pay attention to and process threatening information. Monitors have the tendency to evaluate the stressor as more negative and uncertain than it actually is. Blunting (avoiding threatening cues) involves the extent to which individuals distract themselves from such information. It is less likely that blunters visit a physician or attend to a medical examination or screening. This implies that, overall, blunters are more difficult to reach. This also suggests that test participants are more likely to be monitors than blunters. Miller et al. [29] moreover showed that persons fare better (psychologically, behaviourally and physiologically) when we tailor the information to their coping styles: generally those with a monitoring style tend to do better when given more information, and those with a blunting style do better with less information. In addition, monitors with little confidence in their coping abilities, who face a threatening and uncontrollable medical situation, require not only information but also emotional support to help them deal with their situation. These psychological findings confirm the importance of matching the amount of information to the patient's needs. They highlight the importance of non-directiveness in genetic counselling and of the right not to know, an ethical principle brought into the limelight by the development of predictive medicine [22, 23, 30, 31]. These findings should warn general practitioners and neurologists who introduce the predictive test as the obvious course of action or who put (subtle) pressure for testing on at-risk persons. This also holds for health professionals who use too aggressive information campaigns to 'promote' predictive (and other genetic) testing.

Risk Perception

Most at-risk subjects, tested and untested, were aware of their actual risk to get HD. However, some of them did not experience this risk as 50/50. Several coping or defensive mechanisms may play a part in the subjective perception of this risk, such as denial [32, 33], unrealistic optimism [34], defensive pessimism [35, 36] or magical thinking (patient preselection) [37]. Salient findings were that nearly half of the untested group had a subjective risk experience corresponding to the objective risk figure. Overestimation of the risk occurred more than underestimation, in tested and in untested persons, but the proportion of overestimators versus underestimators was significantly larger in the tested than in the untested group. This suggests that an important proportion of persons, especially test takers, adopt a kind of defensive pessimism, which involves setting unrealistic low expectations in a risky situation and working through worst-case situations in an attempt to harness anxiety so that behaviour is unimpaired [35, 36]. The authors showed that this strategy is effective to be prepared for the worst. It is possible that underestimation or minimization of the risk occurs more in the group of subjects that we could not reach, because we expect that they use more avoidance or minimization processes as defence mechanisms [29].

Perceived Impact of HD

Most of both tested and untested people reported an impact of HD on their life, in the first place on reproductive decisions, but also on personality and on the relation with the partner.

Reasons for Testing

Two thirds of the untested persons of this study had considered the predictive test for diverse reasons. Clarifying the risk for the children was more important for non-participants than for participants, since the majority of the former group had already children, while the latter group tended to postpone reproduction until a test result was given [7]. Thus, the availability of the test played a larger role in family planning for test participants than for untested persons.

About half of those who ever considered the test reported that they probably or certainly would ask for the test in the future. These at-risk persons postpone the test,

for example until their children are older or until they have reproductive plans, which may be a very realistic option. This is also reported by Glew et al. [38]. On the other hand, as already stated in the introduction, intentions about taking the test were poor predictors of uptake. Social desirability may play a part in the reported positive intentions toward the test. Only 2 untested subjects who participated in this study have entered the predictive test programme so far. This shows that our survey was not experienced as a trigger to ask the predictive test for persons vacillating between asking the test and not asking it. They seem to require other more important cues to decide, for example, a son starts a relationship or the couple is planning to have children.

Barriers against Testing

The anticipated inability to cope with a bad test result, the belief that one is happier when not knowing, the opinion that important decisions in life do not have to depend on a test result and the lack of a treatment were important barriers for most of the untested subjects. Other studies [13, 21, 39–41] confirm these findings. In the research of Quaid and Morris [13], declining predictive testing was argued by worry about the children, the lack of a treatment, the possible loss of health insurance, the financial costs of testing and the irreversibility of the test result.

The existence of the test protocol, in particular the pre-test counselling sessions, seems to discourage some people to take the test. This group proved to have a significantly lower mean ego strength and a significantly higher anxiety level than the group who declined testing because they prefer the uncertainty to the certainty of becoming ill in the future. This illustrates that a reluctance toward pre-test counselling may obscure feelings of anxiety and lack of self-confidence to undergo the test.

Another finding was that the anticipated adverse effects on the partner or the children influenced some non-participants. The disease and the risk impose an enormous psychosocial burden on the partner, especially when the partner was not informed of the familial disorder before marriage or when the couple has children. The threat for the children is indeed one of the most dramatic aspects of HD [42–46]. Demyttenaere et al. [47] moreover showed that we should also take the hidden dynamics of families and partner relationships into account in the attempt to fully understand the choices of the at-risk persons.

Intrafamilial Comparison

The results of the intrafamilial analysis have a rather limited value because of the small numbers of families involved. The tested person tended to be the eldest sibling of the family. No systematic (positive or negative) associations were found between the tested and the untested siblings regarding the personality profile and the reasons for considering the predictive test. An interesting finding was that untested siblings were more likely to show expressions of emotions as coping strategy if their tested sibling had received a good result. The Canadian HD research group [48] reported on the negative reactions of an untested person to the good test result of a sibling: the untested person had translated the good result of the tested sib into an increase of the own risk and this resulted in an increase of anxiety. The authors stated that 'though principles of dominant inheritance may be clearly understood, an altered risk in one candidate often results in an altered perception of risk to other sibs'. In our study, the correlation between the subjective risk perception of the untested sibling and the test result of the tested sibling was not statistically significant.

Conclusion

The processes involved in not participating in predictive testing for HD are very complex. They are influenced by risk perception and by perceived costs and benefits of testing. Interactions with personality characteristics such as ego strength and coping style with threatening information also play an important part in decision-making about the predictive test. Moreover, social aspects (concern with the partner and the children) and emotional and/or unconscious mechanisms (such as family dynamics and defence mechanisms) should be taken into account when trying to understand non-participation. The expected burden of pre-test counselling also proved to have an influence.

The study showed that a proportion of the persons at risk have an avoidant attitude toward HD and the predictive test, and toward surveys about these topics. This attitude may be the main reason for not requesting a predictive test. General practitioners and neurologists should be aware of the importance of non-directive counselling when informing about the availability of a predictive test for HD. Pressure to take a predictive test may result in maladjustment after testing.

Our findings did not confirm the hypothesis that ego strength differentiates between test participants and non-

participants. The results of the study of Van der Steenstraten et al. [21] on 34 nonparticipants in predictive testing for HD were only partly confirmed. They reported that untested persons were more pessimistic about the future and felt more vulnerable than test participants. Our study showed that the untested at-risk population includes at least two subgroups: one group of rather robust persons, who are able to face the disease, the genetic risk and the availability of a predictive test and another group with an avoidant attitude and anxieties about the risk and the disease. Van der Steenstraten's selection procedure (members of the Huntington's disease Association) may explain the different findings. A disadvantage of most sampling procedures is that they result in a sample that is not representative for the entire population at risk for HD. Although the combination of sampling procedures in our study improves the representativeness, the group of our study can also not be considered as a representative sample in the strict sense. However, the use of different selection procedures may result in the identification of various subgroups, each with their own characteristics. In this way, a differentiated picture of the population may grow. Sampling techniques vary from passive procedures (volunteers) to active recruitment. However, too invasive methods clash with ethical principles. How far can we go? The answer lies in reaching a balance between different values: respect of autonomy, privacy and confidentiality, the right to known and the right not to know and the clinical and scientific relevance of research.

Appendix 1

Overview of Some Demographic Data of 16 HD Families, with Tested and Untested Siblings, Who Participated in the Study

Family	Family size	Siblings who participated in the study, ranked according to age[1]
1	4	M36 M38 ( ) **F45–**
2	4	**M51+** M55 A A
3	5	( ) A F47 M48 **F50+**
4	2	**M40+** M53
5	6	F32 A **F36–** ( ) ( ) M41
6	3	F28 ( ) **F43–**
7	3	**F32–** M38 F39
8	4	( ) **F34–** F47 **M48+**
9	2	**F36+** F44
10	4	M22 ( ) ( ) **F36–**
11	3	( ) F34 **F35+**
12	6	F23 ( ) ( ) ( ) **F33–** F35
13	3	F22 F25 **F26+**
14	3	( ) **M21–** M25
15	4	F28 ( ) A **F40–**
16	4	F44 ( ) **M47+** M52

[1] The first part of the code (F/M) refers to the sex of the sibling, the second part to the age. A code in bold refers to a tested person; the sign after the code refers to the test result (+ = carrier; – = non-carrier of the HD gene). ( ) refers to a sibling of the family who did not participate in our study. 'A' points to an affected sibling.

Appendix 2

Summary of Demographic Variables of Tested and Untested Siblings, Who Participated in the Study, Belonging to 16 HD Families

	Tested siblings n = 17	Untested siblings n = 23
Sex		
Male	5 (29)	10 (43)
Female	12 (71)	13 (57)
Age		
Mean	37.2	38.3
SD	10.4	8.4
Education		
<High school	1 (6)	2 (9)
High school	6 (35)	13 (57)
>High school	10 (59)	8 (35)
Marital status		
Stable relationship	15 (88)	20 (87)
Single	2 (12)	3 (13)
Children		
Yes	9 (53)	17 (74)
No	8 (47)	6 (26)

Figures in parentheses are percentages.

Appendix 3

Pairwise Comparison of Perceived Impact of the Risk on Daily Life

Family	Untested sibling	Tested sibling
1	General influence	On personality and reproductive decisions
3	No influence	On personality and reproductive decisions
4	No influence	On partner relation and reproductive decisions
5	On personality	On reproductive decisions
6	On personality	On reproductive decisions
7	No influence	On reproductive decisions
10	No influence	On personality
11	On partner relation and reproductive decisions	On personality
12	On partner relation	On reproductive decisions
13	On reproductive decisions	On reproductive decisions
14	No impact	On starting a relationship
16	On reproductive decisions	On reproductive decisions

Full data are missing for 4 families.

References

1 Harper P: Huntington's disease. London, Saunders, 1996.
2 Gusella JF, Wexler NS, Conneally PM, Naylor SL, Anderson MA, Tanzi RE, Watkins PC, Ottina K, Wallace MR, Sakaguchi AY, Young AB, Shoulson I, Bonilla E, Martin JB: A polymorphic DNA marker genetically linked to Huntington's disease. Nature 1983;306:234–238.
3 Huntington's disease Collaborative Research Group: A novel gene containing a trinucleotide repeat that is expanded and unstable on Huntington's disease chromosomes. Cell 1993;72:1–20.
4 International Huntington Association and World Federation of Neurology: Guidelines for the molecular genetics predictive test in Huntington's disease. Neurology 1994;44:1533–1536.
5 Evers-Kiebooms G: Predictive testing for Huntington's disease in Belgium. J Psychosom Obstet Gynaecol 1990;11:61–72.
6 Decruyenaere M, Evers-Kiebooms G, Boogaerts A, Cassiman JJ, Cloostermans T, Demyttenaere K, Dom R, Fryns JP, Van den Berghe H: Predictive testing for Huntington's disease: Risk perception, reasons for testing and psychological profile of test applicants. Genet Couns 1995;6:1–13.
7 Decruyenaere M, Evers-Kiebooms G, Boogaerts A, Cassiman JJ, Cloostermans T, Demyttenaere K, Dom R, Fryns JP, Van den Berghe H: Prediction of psychological functioning one year after the predictive test for Huntington's disease and impact of the test result on reproductive decision making. J Med Gen 1996;33:737–743.
8 Bloch M, Fahy M, Fox S, Hayden MR: Predictive testing for Huntington disease. II. Demographic characteristics, life-style patterns, attitudes, and psychosocial assessments of the first fifty-one test candidates. Am J Med Gen 1989;32:217–224.
9 Craufurd D, Dodge A, Kerzin-Storrar L, Harris R: Uptake of presymptomatic predictive testing for Huntington's disease. Lancet 1989;ii:603–605.
10 Tibben A, Niermeijer RM, Roos RC, Vegter-Vandervlis M, Frets PG, Van Ommen GJ, Van de Kamp JJ, Verhage F: Understanding the low uptake of presymptomatic DNA-testing for Huntington's disease. Lancet 1992;340:1416.
11 Tyler A, Ball D, Craufurd D: Presymptomatic testing for Huntington's disease in the United Kingdom. Br Med J 1992;304:1593–1596.
12 Wiggins S, Whyte P, Huggins M, Adam S, Theilman J, Bloch M, Sheps SB, Schechter MT, Hayden MR: The psychological consequences of predictive testing for Huntington's disease. N Engl J Med 1992;327:1401–1405.
13 Quaid KA, Morris M: Reluctance to undergo predictive testing: The case of Huntington disease. Am J Med Gen 1993;45:41–45.
14 Codori AM, Hanson R, Brandt J: Self-selection in predictive testing for Huntington's disease. Am J Med Gen 1994;54:167–173.
15 Kessler S: Predictive testing for Huntington disease: A psychologist's view. Am J Med Genet 1994;54:161–166.
16 Rosenstock IM: The health belief model and preventive health behavior. Health Educ Monogr 1974;2:354–386.
17 Janz NK, Becker MH: The health belief model: A decade later. Health Educ Q 1984;11:1–47.
18 Orbell S, Sheeran P: Health psychology and uptake of preventive health services: A review of 30 years' research on cervical screening. Psychol Health 1993;8:417–433.
19 Leventhal H, Safer MA, Panagis DM: The impact of communications on the self-regulation of health beliefs, decisions and behavior. Health Educ 1983;10:3–29.
20 Barron F: An ego-strength scale which predicts response to psychotherapy. Cons Psychol 1953;17:327–333.
21 Van der Steenstraten I, Tibben A, Roos RA, Van de Kamp JJ, Niermeijer MF: Predictive testing for Huntington disease: nonparticipants compared with participants in the Dutch program. Am J Hum Genet 1994;55:618–625.
22 Shaw MW: Testing for the Huntington gene: A right to know, a right not to know or a duty to know? Am J Med Gen 1987;26:243–246.
23 De Wert G: Predictive testing for Huntington disease and the right not to know. Some ethical reflections; in Evers-Kiebooms G, Fryns JP, Cassiman JJ, Van den Berghe H (eds): Psychosocial Aspects of Genetic Counseling. March of Dimes, Birth Defects. New York, Wiley-Liss, 1992, vol 28, pp 133–138.
24 Van der Ploeg HM, Defares PB, Spielberger CD: Handleiding bij de zelfbeoordelingsvragenlijst: Een Nederlandstalige bewerking van de Spielberger State Trait Anxiety Inventory. Lisse, Swets & Zeitlinger, 1980.
25 Graham JR: The MMPI. A Practical Guide. New York, Oxford University Press, 1987.

26 Schreurs PJ, Van de Willige G, Tellegen B, Brosschoot JF: De Utrechtse Coping Lijst. Omgaan met problemen en gebeurtenissen. Lisse, Swets & Zeitlinger, 1988.
27 Siegel S, Castellan NJ: Nonparametric statistics for the behavioral sciences, ed 2. New York, McGraw-Hill, 1988.
28 Miller S: Monitoring versus blunting styles of coping with cancer influence the information patients want and need about their disease. Cancer 1995;76:167–177.
29 Miller S, Brody DS, Summerton J: Styles of coping with threat: Implications for health. J Pers Soc Psychol 1988;54:142–148.
30 Kessler S: Psychological aspects of genetic counseling. VII. Thoughts on directiveness. J Genet Couns 1992;1:9–17.
31 Lamport AT: Presymptomatic testing for Huntington chorea: Ethical and legal issues. Am J Med Genet 1987;26:307–314.
32 Lazarus RS: The costs and benefits of denial; in Breznitz S (ed): The Denial of Stress. New York, International Universities Press, 1983, pp 1–30.
33 Tibben A: What is knowledge but grieving? On psychological effects of presymptomatic DNA-testing for Huntington's disease; thesis, Rotterdam, 1993.
34 Weinstein ND: Optimistic biases about personal risks. Science 1989;246:806–820.
35 Norem JK, Cantor N: Defensive pessimism: harnessing anxiety and motivation. J Pers Soc Psychol 1986;51:1208–1217.
36 Cantor N, Norem JK: Defensive pessimism and stress coping. Soc Cogn 1989;7:92–112.
37 Kessler S, Bloch M: Social system responses to Huntington disease. Fam Process 1989;28:59–68.
38 Glew R, Huson SM, Rosser E, Jones L, Klimes I: Presymptomatic tests for Huntington's disease: Factors influencing the decision not to test during pretest counselling. Poster presented at the 5th European Meeting on Psychosocial Aspects of Genetics, Rome, 1996.
39 Evers-Kiebooms G, Swerts A, Cassiman JJ, Van den Berghe H: The motivation of at risk individuals and their partners in deciding for or against predictive testing for Huntington's disease. Clin Genet 1989;35:29–40.
40 Jacopini AG, D'Amico R, Frontali M, Vivona G: Attitudes of persons at risk and their partners toward predictive testing; in Evers-Kiebooms G, Fryns JP, Cassiman JJ, Van den Berghe H (eds): Psychosocial Aspects of Genetic Counseling. March of Dimes, Birth Defects. New York, Wiley-Liss, 1992, vol 28, pp 113–117.
41 Simpson SA, Besson J, Alexander D, Allan K, Johnston AW: One hundred requests for predictive testing for Huntington's disease. Clin Genet 1992;41:326–330.
42 Hans MB, Koeppen AH: Huntington's chorea. Its impact on the spouse. J Nerv Ment Dis 1980;168:209–214.
43 Bloch M, Hayden MR: Opinion: Predictive testing for Huntington disease in childhood: Challenges and implications. Am J Hum Gen 1990;46:1–4.
44 Evers-Kiebooms G, Swerts A, Van den Berghe H: Partners of Huntington patients: Implications of the disease and opinions about predictive testing and prenatal diagnosis. Genet Couns 1990;1:151–159.
45 Kessler S: The spouse in the Huntington disease family. Fam Syst Med 1993;11:191–199.
46 Kessler S: Forgotten person in the Huntington disease family. Am J Med Gen 1993;48:145–150.
47 Demyttenaere K, Evers-Kiebooms G, Decruyenaere M: Pitfalls in counseling for predictive testing in Huntington disease; in Evers-Kiebooms G, Fryns JP, Cassiman JJ, Van den Berghe H (eds): Psychosocial Aspects of Genetic Counseling. March of Dimes, Birth Defects. New York, Wiley-Liss, 1992, vol 28, pp 105–112.
48 Fox S, Bloch M, Fahy M, Hayden MR: Predictive testing for Huntington disease. I. Description of a pilot project in British Columbia. Am J Med Genet 1989;32:211–216.