

Table 2 Participant demographic data

	Members of the public	JPA members	KUH medical staff	NCCHD personnel	JPS members	JSOG members	JSM members
No. addressees	2127	351	1177	751	1012	992	396
No. respondents	1030	182	651	355	390	267	263
Recovery rate (%)	48.8	36.2	55.3	47.3	38.5	26.9	66.4
Median age (years) (range)	41.5 (21–61)	43.0 (19–80)	36.0 (19–62)	35.0 (22–76)	49.0 (25–81)	49.0 (23–80)	48.5 (26–93)
Male/Female ratio (%)	50.7/49.2	20.9/79.1	37.0/62.7	33.0/67.0	63.0/37.0	87.1/12.9	58.2/41.8

JPA, Japan Phenylketonuria Association; JPS, Japan Pediatric Society; JSM, Japanese Society for Mass-screening; JSOG, Japan Society of Obstetrics and Gynecology; KUH, Kurume University Hospital; NCCHD, National Center for Child Health and Development.

responders from the JSOG. Medical personnel respondents consisted of physicians ($n = 1106$), nurses ($n = 324$), laboratory technicians ($n = 36$), pharmacists ($n = 15$), radiologists ($n = 12$), midwives ($n = 3$), dieticians ($n = 3$) and others ($n = 24$). Occupation was not requested for members of the public or the JPA (Table 1).

The responses to questions in each group are given in Table 3. Data on differences between male and female responses are not presented unless described specifically. In Table 3, data are presented for “yes” or “no,” and “agree” or “disagree” responses alone. The remaining answers were classified as “ambiguous” collectively, and are not given in the table.

Question 2

The ratio of members of the public who answered that they knew that NBS was conducted (26.6%) was lower than that of any of the other groups of subjects (question 2a). This ratio was lower in male (13.2%) than in female (40.4%) members of the public.

The leading reasons whereby members of the public had become aware that NBS was conducted (question 2b) were as follows: “because I am engaged in medical service” (56.2%), followed by “because my child(ren) underwent the test” (28.8%). Among 507 female members of the public who responded, 324 (63.9%) answered that they had ever given birth. Of the 324, 183 (56.5%) replied that they had known of NBS. Among these 183, 164 (89.6%) knew of NBS because their babies had undergone the test.

Question 3

The ratio of those who answered that NBS was necessary was 71.7% in members of the public, while it was $\geq 85.7\%$ in the other groups. The ratio of respondents who were opposed to NBS was $< 0.8\%$ in every group.

Question 4

The ratio of respondents who responded positively towards the use of residual DBS to maintain and improve NBS technology was lower in members of the public and medical staff of a general hospital (KUH) than in the groups that were involved in conducting NBS or had benefited from it (patients and their families).

Question 5

The ratio of positive responses toward the use of residual DBS for forensic purpose in members of the public was closer to the ratios in the other groups, when compared to other questions.

Question 6

The ratio of positive responses toward the use of residual DBS to study health problems or medical problems that directly involved themselves or their family (Question 6a) varied from 63.1% (members of the public) to 81.4% (JSM members). In the event that the purpose of DBS use was unrelated to themselves or their family, the ratio was lower in every group, except JSOG members, who gave identical ratios of affirmative answers for both questions (Question 6b).

Question 7

The ratio of responses that were positive towards storage of residual DBS in the event that they might be used for themselves or their family was relatively uniform among all the groups, except members of the public, who had a lower ratio (Question 7a). This tendency was reproduced in responses regarding the event that residual DBS might be used for the benefit of society in general, although the positive response ratio was generally lower in every group, with the exception of JMS members.

In every group the ratio of negative responses was generally higher in questions 6b and 7b than in all the other questions.

Text mining analysis

Three concepts were generated from the clusters of words were that constructed as described in the previous section. The clustered words (shown in parentheses) and concepts deduced from them (shown in brackets following an arrowhead) were as follows: (i) (privacy, administration, information, identity, etc.) > [personal data]; (ii) (agreement, approval, written consent etc.) > [availability of consent]; and (iii) (progress, research, medical science, therapy etc.) > [progress in medicine]. The frequency of usage of words that are relevant to each concept is illustrated in Figure 1.

In brief, words related to the “personal data” concept appeared at approximately the same frequency in each group (Fig. 1a). The usage frequency of words related to the “availability of consent” concept, however, was lower in members of the public and JPA members than in the other groups (Fig. 1b). In contrast, words related to the “progress in medicine” concept were more frequently used in members of the public and JPA members than in the other groups (Fig. 1c).

Discussion

The ratio of members of the public who were aware that NBS was being conducted in Japan was $< 27\%$ (Question 2a). Nearly half

Table 3 Responses

Groups	Members of the public	JPA members	KUH medical staff	NCCHD personnel	JPS members	JSOG members	JSM members	Total
No. respondents	1030	182	651	355	390	267	263	3138
Questions ^a	Answers (%) ^b							
Question 2a (Awareness of NBS)	Yes 26.6 No 73.4	93.4 6.0	84.3 14.7	82.0 17.7	99.0 0.8	99.3 0.4	99.2 0.8	69.9 29.7
Question 3 (Necessity of NBS)	Yes 71.7 No 0.8	99.5 0	85.7 0.8	88.4 0.6	97.9 0.3	97.4 0.4	98.9 0.4	85.8 0.6
Question 4 (Extended use for NBS itself)	Agree 54.4 Disagree 2.8	81.3 0.5	66.8 1.5	73.2 2.0	86.2 2.6	87.4 5.6	90.1 3.8	69.8 2.6
Question 5 (Forensic use)	Agree 74.0 Disagree 1.8	78.6 1.1	82.3 1.8	80.2 2.8	85.9 2.3	87.9 5.2	83.3 2.3	79.5 2.3
Question 6a (Use for own health problems)	Agree 63.1 Disagree 3.6	78.6 2.2	76.5 2.9	76.3 2.5	80.8 4.1	72.3 7.9	81.4 0.4	73.0 3.8
Question 6b (Use for health problems of others)	Agree 53.4 Disagree 8.2	69.8 4.4	70.5 3.8	73.2 3.9	74.6 7.4	72.3 10.5	79.1 0.4	66.5 6.5
Question 7a (Long-term storage for own benefit)	Agree 67.8 Disagree 3.6	79.7 2.7	79.1 2.9	81.7 1.4	80.8 4.4	80.1 6.4	79.8 6.1	76.1 3.7
Question 7b (Long-term storage for benefit of others)	Agree 59.9 Disagree 4.5	70.9 2.7	76.0 3.2	75.5 2.5	77.5 5.0	77.2 8.2	80.6 5.3	71 4.4

^aSynopses of questions are shown in brackets. Please refer to Table 1 for full text of questions. ^bAnswers "yes" or "no" and "agree" or "disagree" alone are indicated. The remaining answers were classified as "ambiguous" collectively, and are not given in the Table.

JPA, Japan Phenylketonuria Association; JPS, Japan Pediatric Society; JSM, Japanese Society for Mass-screening; JSOG, Japan Society of Obstetrics and Gynecology; KUH, Kumamoto University Hospital; NBS, newborn screening; NCCHD, National Center for Child Health and Development.

of the female members of the public who had ever given birth replied that they did not know that NBS was being implemented. This result would imply that briefing on NBS was not provided in enough detail to be remembered by mothers, or was not given at all. This low awareness ratio appears to be closely linked with the lower usage frequency of words related to the "availability of consent" concept in members of the public than in other groups (Fig. 1b).

Approximately 70% of members of the public agreed with the significance and necessity of NBS, when some information on NBS was provided (Question 3). In addition, members of the public used words related to the "progress in medicine" concept most frequently among all the seven groups, when their questionnaire responses were analyzed by text mining (Fig. 1c). All these results indicate that the public is potentially interested in NBS and anticipates benefit from it. Therefore, intensive publicity regarding the purpose and benefit of NBS among the general public, and in particular couples who intend to have children, is expected to be useful.

Approximately 66.8–90.1% of respondents in each group, excluding members of the public, had positive responses toward the extended use of residual DBS to evaluate and improve current NBS technology and to develop new technologies (Question 4). The extended use of DBS, and the duration of storage of residual DBS and associated personal data, are governed by legislation or by recommendations proposed by academic societies in Denmark,⁴ UK,⁵ Australia, New Zealand,⁶ France,¹⁰ The Netherlands¹⁰ and 16 States in the USA.⁸ In Japan, the general guidelines that control the extended use of DBS were set out in 1998.⁹ For routine screening tests, oral or written information is provided to parents in various ways in accordance with this guideline in individual areas. Notification on the storage policy, however, for residual DBS is generally not included in such information. Explicit documentation and publicity regarding storage policy is essential to ensure transparency about the outcomes of DBS and to avoid public confusion about their storage, as was encountered in the Enschede disaster.¹⁰ The articulation of policies regarding storage of human materials and data is strongly recommended in the operation of human biobanks and genetic databases in general, according to a recent OECD recommendation draft.¹¹ Residual DBS are systematically registered and stored nationwide and used for research in Denmark⁴ and the UK.⁵ Purposes of storage are specified in these countries. They are, in brief, later retesting, quality assurance, improvement and development of new NBS programs, and research. Residual DBS are used for research purposes and the system is termed "biobank" in these countries.^{4,5} In laboratories in Japan, the purposes, duration and conditions of storage of residual DBS are diverse.¹² A common purpose of storage is to provide for possible retesting. It is crucial to make the purpose of storage of residual DBS clear in order to first determine the duration and conditions of storage, because the stability of analytes on DBS is largely unknown.⁸ All of these results indicate that presentation to the public, particularly couples of child-bearing age, of appropriate explanatory information on the extended use and long-term storage of residual DBS is necessary. Presentation of information on the NBS

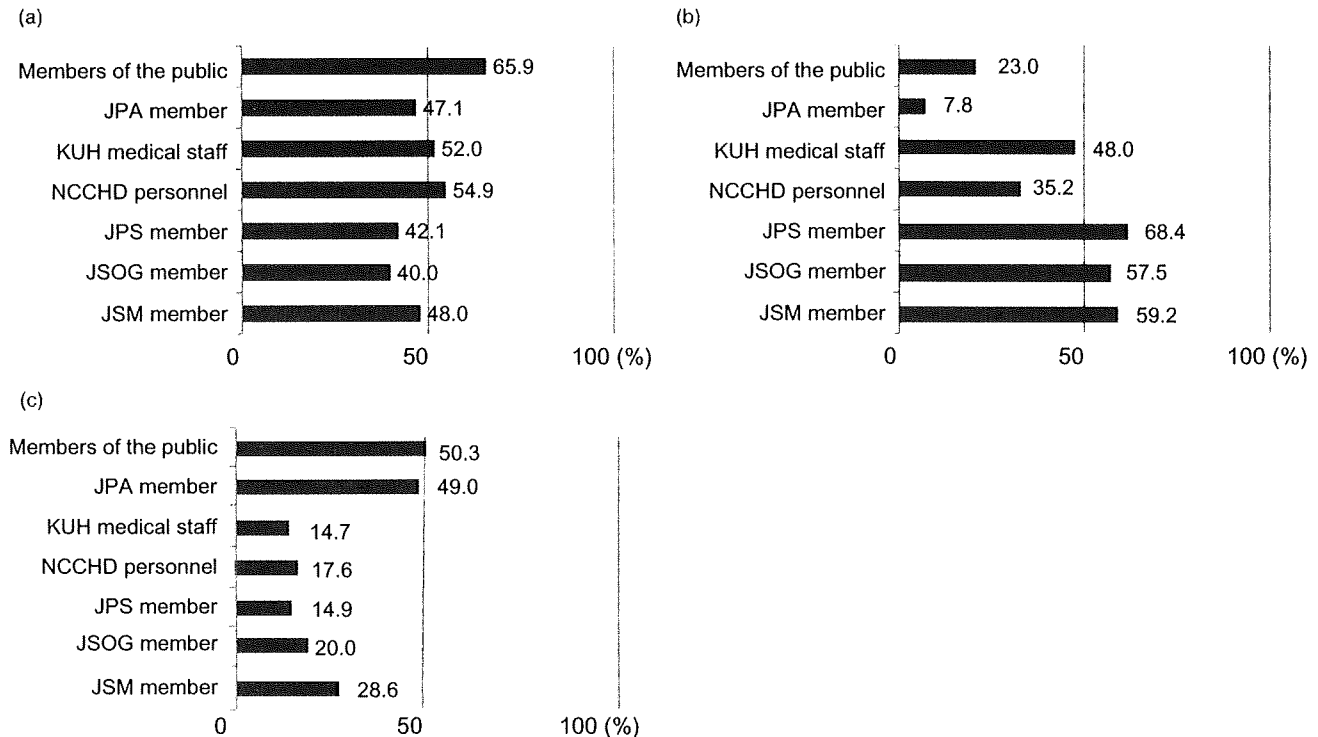


Fig. 1 Usage frequency of words (%) related to the concepts (a) personal data; (b) availability of consent; and (c) progress in medicine. The usage frequency number is defined as the sum of every word that is related to each concept divided by number of comments made for every question. JPA, Japanese Phenylketonuria Association; JPS, Japan Pediatric Society; JSM, Japanese Society for Mass-screening; JSOG, Japanese Society of Obstetrics and Gynecology; KUH, Kurume University Hospital; NCCHD, National Center for Child Health and Development.

program to couples during pregnancy may allow better understanding of the program.¹³

Attitudes toward the use of DBS for forensic purposes were similar among all the groups (Question 5). It remains open whether or not consent for extended use for such a purpose should be included in routine explanatory brochures. Legislation or regulation regarding whether or not a screening laboratory can release stored DBS upon judicial order should also be discussed.

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IV. 研究成果の刊行に関する一覧表

研究成果の刊行に関する一覧表

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