

COVID-19 Vaccination in Patients with Cancer

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Research Article

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1 *Article*

2 **COVID-19 Vaccination in Patients with Cancer**

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29

30 **Running head:** COVID-19 Vaccination in Patients with Cancer

31 **Abstract**

32 **Background:** Patients with cancer are concerned about the effects of the COVID-19 vaccination.

33 **Methods:** We conducted an online survey on the COVID-19 vaccination status and side effects
34 among patients with cancer in Japan between August 8 and 14, 2021. We included 1182 female
35 patients with cancer aged 20–70 years and registered on an online patient website.

36 **Results:** Of the patients, 944 had breast cancer, 216 had gynecological cancer, 798 were
37 undergoing drug/radiation therapy, and 370 were in follow-up therapy. At the time of the survey,
38 885 patients had already received at least one dose. Of these, 580 had also received their second
39 dose. The incidence rate of side effects was equivalent to previous reports. In patients with breast
40 cancer, problems such as the onset or worsening of lymphedema or axillary lymphadenopathy
41 metastasis requiring differential diagnosis were encountered following vaccination. A total of 768
42 patients were concerned about the vaccine at some point, and 726 consulted with their attending
43 physicians about the timing or side effects of the vaccination. Of the 110 patients undergoing
44 chemotherapy or radiation therapy, 75 adjusted the timing of the vaccination based on their therapy.
45 The cross-analysis revealed that 81% of those who consulted their physician had received at least
46 one dose of the COVID-19 vaccination compared with 65% of those who had not consulted their
47 physician.

48 **Conclusion:** Consulting with a physician about the COVID-19 vaccination was found to alleviate
49 the concerns of patients with cancer and encourage them to get vaccinated.

50
51 **Mini-abstract:** Consulting with a physician about the COVID-19 vaccination was found to
52 alleviate the concerns of patients with cancer and encourage them to get vaccinated.

53
54 **Key words:** cancer; COVID-19; vaccine; online questionnaire; doctor–patient communication

55 **Introduction**

56 The coronavirus disease 2019 (COVID-19) spread from Wuhan, China, across the whole world; in
57 Japan, multiple states of emergency were declared. Second, third, and fourth waves have occurred,
58 and there is no end in sight. However, COVID-19 vaccination has begun in Japan and has gradually
59 caught up with other countries. While authorities search for ways to encourage vaccination, it is to
60 be expected that patients who are receiving, or have recently received, cancer treatment may harbor
61 worries about both the risk of infection and the vaccination itself. Many points are still unclear
62 regarding COVID-19 vaccination of patients with cancer, including the worries patients have and
63 the potential side effects. To remedy this situation, we conducted an online survey of female
64 patients with cancer about their COVID-19 vaccination status and attitudes toward vaccination.

65

66 **Materials and Methods**

67 The participants in this study were women with cancer registered with the online support group,
68 Female-Specific Cancer Patient Support Community Peer Ring [1]. This is an online community
69 for women diagnosed with breast cancer, ovarian cancer, or cervical cancer. The group's focus is
70 peer support via social media. There are currently about 10,000 members, and the site is widely
71 used by patients unable to participate in support groups in person due to side effects from treatment
72 or location. Numerous surveys are conducted via the group's app.

73 We used the mailing list of this community to distribute emails entitled, "Factual
74 Investigation into the Impact of COVID-19 on Cancer Treatment" to members, with surveys
75 attached. We also posted the surveys on timelines on social media. We have previously conducted
76 two investigations into the impact of COVID-19 on cancer treatment, investigating and reporting
77 on matters such as the impact of COVID-19 on hospital visits and treatment after cancer diagnosis,
78 changes in daily life or working status, participation in regular cancer screening, self-reported

79 changes in health, and the incidence of depression and anxiety disorders. This third online survey
80 was on the topic of COVID-19 vaccination after cancer diagnosis and took place between August
81 8, 2021, and August 14, 2021. We received responses from 1182 participants.

82 This study has been approved by the Ethics Review Board of Ichinomiya Nishi Hospital.
83 The data collected in the surveys was anonymized so as not to include any personal information
84 and the participating patients agreed when they replied to the purpose of this study and to the
85 disclosure of the results. Informed consent was obtained from all individual participants included
86 in the study.

87

88 **Results**

89 The majority of respondents were in their 40s or 50s. The age distribution, living situation, cancer
90 types, stage of cancer, and current treatment of our sample are all shown in Table 1.

91 A total of 726 (61%) participants consulted with their attending physicians about COVID-
92 19 vaccination. Of those, 420 (58%) discussed the timing of vaccination, 173 (24%) discussed the
93 pros and cons of vaccination, 193 (27%) discussed the side effects and points of caution, and 163
94 (22%) discussed other matters, such as the injection site or underlying conditions besides cancer
95 (Fig. 1). Further, 21 (3%) of the patients who consulted with their physicians were instructed to
96 refrain from vaccination for reasons such as a history of allergies or decreased neutrophil levels
97 due to ongoing chemotherapy.

98 Insert Figure 1

99 The vaccination status of the participants was as follows: 34 (3%) had no intention of being
100 vaccinated, 114 (10%) intended to be vaccinated but had not yet made plans, 114 (10%) had
101 scheduled vaccinations, 305 (26%) had already received their first dose, 580 (49%) had already
102 received their second dose, and 35 (3%) had not yet decided whether to be vaccinated (Fig. 2).

103 Insert Figure 2

104 The participants who did not intend to be vaccinated gave the following reasons: “A history
105 of allergies,” “Concerns about delayed cancer treatment due to side effects,” and “Safety concerns
106 about the vaccine.” Patients who planned to be vaccinated or had already been vaccinated gave the
107 following as reasons for vaccination: “To prevent myself or others from being infected” (990
108 patients, 89%), “Because I believe the vaccines are effective in preventing the spread of the
109 COVID-19 infection” (580 patients, 52%), “Because my attending physician or other medical staff
110 suggested I take the vaccine” (208 patients, 19%), “Because friends or family suggested I take the
111 vaccine” (78 patients, 7%), and “Because the national and local governments are actively
112 promoting it” (68 patients, 6%) (Fig. 3).

113 Insert Figure 3

114 Cross-analysis of vaccination status and whether patients consulted with their attending
115 physicians showed that 81% of patients who consulted with their attending physician had received
116 at least one dose, whereas 65% of patients who had not consulted with their attending physician
117 had received at least one dose (Fig. 4).

118 Insert Figure 4

119 Cross-analysis of vaccination status and treatment status, found the treatment status of
120 patients who had already been vaccinated or had made plans to be vaccinated to be as follows: 53%
121 were receiving hormone therapy, 10% were receiving chemotherapy, 2% were receiving radiation
122 therapy, and 31% were in follow-up therapy (Fig. 5).

123 Insert Figure 5

124 Among the patients undergoing drug/radiation therapy (110), 75 had adjusted the timing of
125 their vaccination based on their treatment schedule (Fig. 6). Specifically, schedule adjustments
126 were made based on the possibility of fever or bone marrow suppression, such as leaving a gap of

127 a few days or a week before and after scheduled chemotherapy or arranging to be vaccinated after
128 radiation therapy (Fig. 7).

129 Insert Figure 6

130 Insert Figure 7

131 Among the breast patients with cancer, 540 (76%) avoided receiving the vaccination in the
132 arm on the side of the breast cancer, 128 (18%) received the injection in their nondominant arm,
133 regardless of which side the cancer was, three (0.4%) received the injection in their dominant arm
134 regardless of which side the cancer was, 10 (1%) changed sides between the first and second doses,
135 receiving injections in both arms, whereas 28 (4%) received the injection somewhere other than
136 their upper arm, such as in the thigh (Fig. 8). The patients who had been vaccinated or had plans to
137 be vaccinated were administered vaccines made by Pfizer (783 patients, 78%), Moderna (204
138 patients, 20%), and AstraZeneca (one patient, 0.1%). In 11 patients (1%), it was unclear which
139 vaccine they received or planned to receive. Side effects experienced included fever, swelling at
140 the injection site, and fatigue. There was a general tendency toward more side effects after the
141 second dose (Figs. 9 and 10).

142 Insert Figure 8

143 Insert Figure 9

144 Insert Figure 10

145 There were multiple reported instances of patients becoming worried that side effects of the
146 vaccination such as prolonged bone pain or headaches might be signs of metastasis. In breast
147 patients with cancer, there were also cases with prolonged axillary lymphadenopathy that had to be
148 screened to differentiate it from lymph node metastasis, as well as cases where the onset or
149 worsening of lymphedema was observed, requiring additional treatment (Fig. 11).

150 Insert Figure 11

151 A total of 768 (65%) participants reported concerns related to vaccination. 616 (80%) were
152 concerned about side effects, 159 (21%) were concerned about the impact of side effects on cancer
153 treatment, 179 (23%) were concerned about the spread of COVID-19 due to delayed vaccination,
154 and 149 (19%) reported other concerns (Fig. 12). Among other concerns, worries about the
155 worsening of lymphedema among patients with breast cancer and about the safety of the
156 vaccination or the long-term impact on the body were prevalent.

157 Insert Figure 12

158 To acquire information about vaccination, 326 participants (28%) consulted medical
159 institutions or doctors from whom they were receiving treatment, 29 (2%) consulted websites of
160 hospitals or other medical institutions, 144 (12%) consulted other websites, 612 (52%) attained
161 information from TV or newspapers, 265 (22%) attained information via word-of-mouth through
162 acquaintances or friends, 108 (9%) attained information via social media, 320 (27%) consulted
163 websites of government agencies such as local government or the Ministry of Health, Labor, and
164 Welfare, and 113 (10%) consulted other sources (Fig. 13).

165 Insert Figure 13

166 The survey included an open-ended question about what participants would like to know
167 about vaccination. Besides answers pertaining to more general topics such as “the effectiveness of
168 the vaccines against mutant strains” or “the future spread of infection,” there were also many
169 cancer-specific responses such as “data about the frequency of cases, death rates, and severe case
170 rates among patients with cancer,” “data about the effectiveness of the vaccines in patients with
171 cancer,” and “about the impact of the vaccines on lymphedema.”

172

173 **Discussion**

174 The spread of COVID-19 has already affected cancer treatment worldwide and, in these
175 unprecedented circumstances, anxiety about COVID-19 among patients with cancer is extremely
176 high. In a previous study, we found that over 90% of patients were anxious about catching the virus,
177 and this anxiety was affecting their actual cancer treatment [2].

178 Other studies have reported fears of decreased survival rates among patients with cancer
179 associated with the COVID-19 pandemic [3], whereas others have reported severe COVID-19
180 cases among cancer patients [4]. With COVID-19 vaccination programs becoming widely available,
181 take-up of the vaccination should be encouraged even among patients with cancer undergoing
182 treatment. However, there is a deficiency of information about COVID-19 vaccinations and cancer.

183 *Vaccination Status*

184 Our survey also gathered data on participants' vaccination status. Of those surveyed, 75% had
185 received at least one dose (cf. 50.3% in Japan as of August 18, 2021) [5] and 49% had received
186 two doses (ibid. 38.8% in Japan). This indicated that the vaccination rate of women diagnosed with
187 cancer was higher than that of the domestic adult population.

188 The results showed that 61% of patients had consulted their attending physician about the
189 COVID-19 vaccination. Cross-analysis of whether participants had consulted with their physicians
190 and their vaccination status showed significantly higher vaccination rates among patients with
191 cancer who had spoken to their physicians than those who had not. Direct conversation with
192 attending physicians about the timing of the vaccination and its advantages and disadvantages
193 appeared to be linked to reduced anxiety and decisions about the timing of the vaccination, as well
194 as higher vaccination rates.

195 *Vaccination Timing*

196 We found that 68% of patients undergoing chemotherapy or radiation therapy had timed their
197 vaccinations so as to keep their treatment days and vaccination days separate and prevent overlap
198 of treatment days and the period in which the patient expected to experience vaccination side effects.

199 Several guidelines have been issued regarding cancer treatment and vaccination. In Japan,
200 the Japan Cancer Association, Japan Society of Clinical Oncology, and the Japanese Society of
201 Medical Oncology have jointly published a Q&A on cancer treatment and vaccinations [6], which
202 is also advocated by the National Comprehensive Cancer Network's guidelines [7].

203 Although vaccination is recommended before or after surgery, the guidelines of the Royal
204 College of Surgeons in the UK [8] do not recommend postponement of planned surgery or changing
205 surgery dates to accommodate vaccination. Since fever is a vaccination side-effect, which may last
206 from one to two days up to a week, a few days to a week between the vaccination and surgery is
207 sufficient for the purposes of distinguishing whether fever is surgery-related or a vaccination side-
208 effect [8].

209 Vaccination is considered a positive action even during cancer treatment; including
210 radiation therapy [9]. However, there is currently no data about the best way for patients with cancer
211 to time vaccinations around treatment. Discussing vaccination timing with the attending
212 radiotherapist and, where possible, aiming to receive vaccinations during weekends, when patients
213 have no radiation therapy to avoid treatment during the period of possible fever immediately after
214 vaccination is preferable.

215 Various academic societies have advocated the safety of the COVID-19 vaccination when
216 undergoing pharmacotherapy, including chemotherapy, as shown in Table 2 [7,10–13]. All suggest
217 that vaccination is preferable in patients with no history of allergy to any of the components of the
218 vaccine.

219 *Side Effects*

220 Approximately 80% of our survey respondents who had or intended to receive vaccination had
221 received the Pfizer vaccination. The frequency of postvaccination side effects such as fatigue and
222 fever was higher after the second dose than the first, though this has already been established in
223 previous reports [14].

224 Both Pfizer's BNT162b2 package leaflet and the Centers for Disease Control and
225 Prevention (CDC) in the US recommend vaccination in the deltoid muscle [15,16].
226 Lymphadenopathy as a side-effect occurs in less than 1% of people when the deltoid muscle is used
227 as the vaccination site [15]. In cases where surgery and radiation therapy involve the axillary lymph
228 node, as in breast cancer, vaccination in the contralateral side of the deltoid muscle or thigh is
229 recommended [17].

230 This study identified patients who were left anxious due to suspected recurrence of cancer
231 metastasis in the axillary lymph node due to lymph node swelling after upper arm vaccination. The
232 Society of Breast Imaging suggests that, since axillary lymph node swelling after vaccination can
233 be confused with cancerous metastasis, an interval of 4–6 weeks after vaccination should be
234 allowed before imaging examinations such as CT scans [18]. Vaccination timing should be taken
235 into consideration in patients with cancer as scheduling adjustments may lead to delays in treatment
236 if the timing of examinations after diagnosis overlaps with vaccination.

237 It is not yet clear whether COVID-19 vaccination increases the risk of lymphedema but
238 there were respondents in this study who both developed lymphedema and who experienced
239 worsening of existing lymphedema after vaccination. Onset or exacerbation of lymphedema after
240 vaccination should be taken into consideration, particularly in patients with a history of
241 lymphedema. Altering the vaccination area to the arm contralateral to the affected side or the thigh
242 is thought to be preferable in such cases. Patients at risk of lymphedema, those who have undergone

243 axillary dissection, and those who have received radiation therapy should discuss the possibility of
244 lymphedema as well as the timing and site of their vaccinations with their oncologist in advance.

245 *Vaccination Anxiety and Information Literacy*

246 In this study, 65% of the respondents reported experiencing anxiety about vaccination, revealing
247 that many patients with cancer have concerns not just about COVID-19 infection but also about the
248 vaccination. When respondents were asked how they had obtained information about vaccinations,
249 52% had relied on television and newspapers more than physicians and medical institutions, while
250 others had relied on word-of-mouth and social media. There have been reports of mental health
251 issues arising from excessive continued exposure to COVID-19 information on social media
252 [19,20]. There is an impetus not just for medical professionals, but for society as a whole, to
253 disseminate and utilize accurate medical information.

254 *Limitations*

255 This study was limited by unclear patient demographics as some respondents' user profiles were
256 private. As this study was conducted on social media, there may also be issues of authenticity.
257 Future research will need to collect and analyze data from a more reliable source that provides clear
258 information about patient demographics.

259 In this study, we were able to determine the COVID-19 vaccination status of patients with
260 cancer and gain insight into the attitudes and feelings of this demographic regarding the vaccine.
261 More people will be inoculated again in the third round of vaccinations, yet there is presently no
262 prospect of bringing the infection under control, meaning an extension of the anxiety felt by patients
263 with cancer. The results of this study indicate that it is necessary to establish support systems that
264 can provide peace of mind to patients with cancer facing vaccination and cancer treatment.

265

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268
269 **Data Availability Statement:** Original images and CSV files may be obtained from the
270 corresponding author upon request.

271
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274 19th Japanese Society of Medical Oncology Annual Meeting (February 2022, Osaka).

275
276 **Conflict of Interest:** The authors declare no competing interests.

277
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Table 1. Patient characteristics (N = 1182)

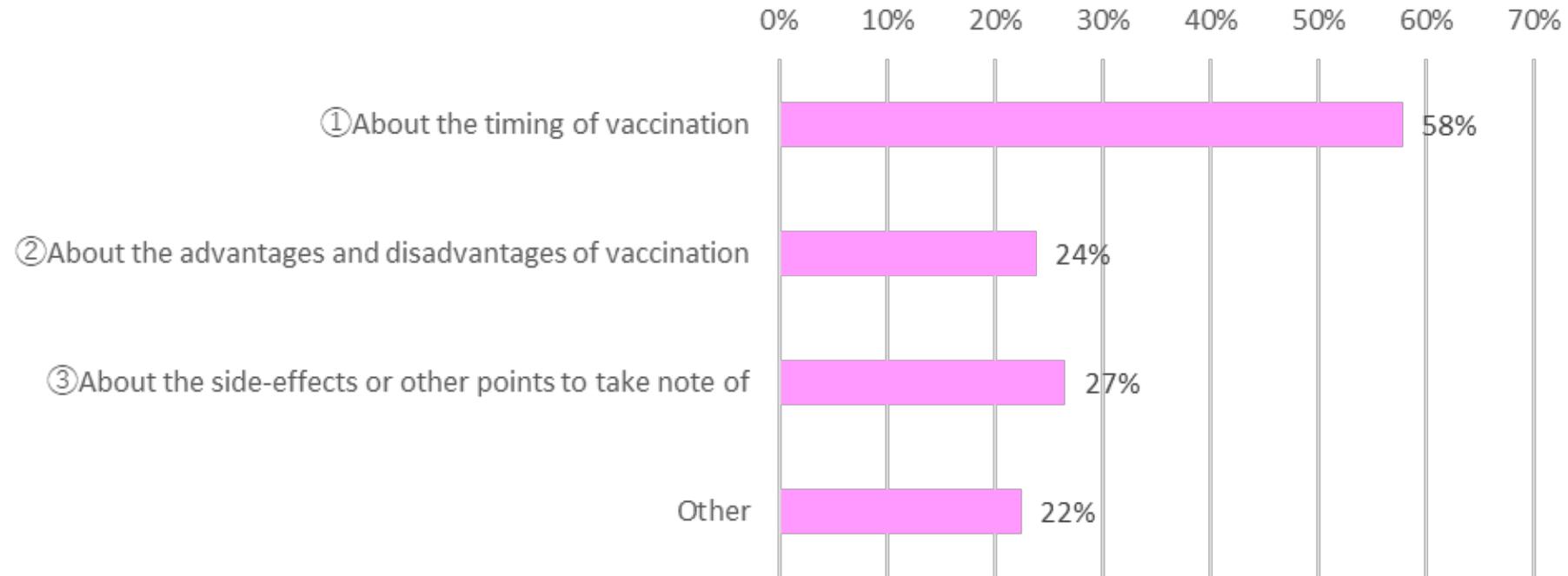
		No. of patients (%)
Age in years	20s	4 (0.3)
	30s	94 (8)
	40s	467 (40)
	50s	520 (44)
	60s	86 (7)
	70s	6 (1)
	No response	5 (0.4)
Households	Single-person	154 (13)
	Two or more	1028 (87)
Type of cancer	Breast cancer	944 (80)
	Cervical cancer	41 (3)
	Endometrial cancer	82 (7)
	Ovarian cancer	93 (8)
	Others	22 (2)
Cancer stage	0 (DCIS)	71 (6)
	I	458 (39)
	II	403 (34)
	III	153 (13)
	IV	69 (6)
	Unknown	28 (2)
Cancer treatment	Before treatment	13 (1)

Neoadjuvant chemotherapy	27 (2)
Adjuvant chemotherapy	126 (11)
Radiation therapy	20 (2)
Endocrine therapy	625 (53)
Inserting expander in breast	35 (3)
Follow-up	370 (31)

Table 2. Guidelines of academic societies on COVID-19 vaccination during cancer drug therapy

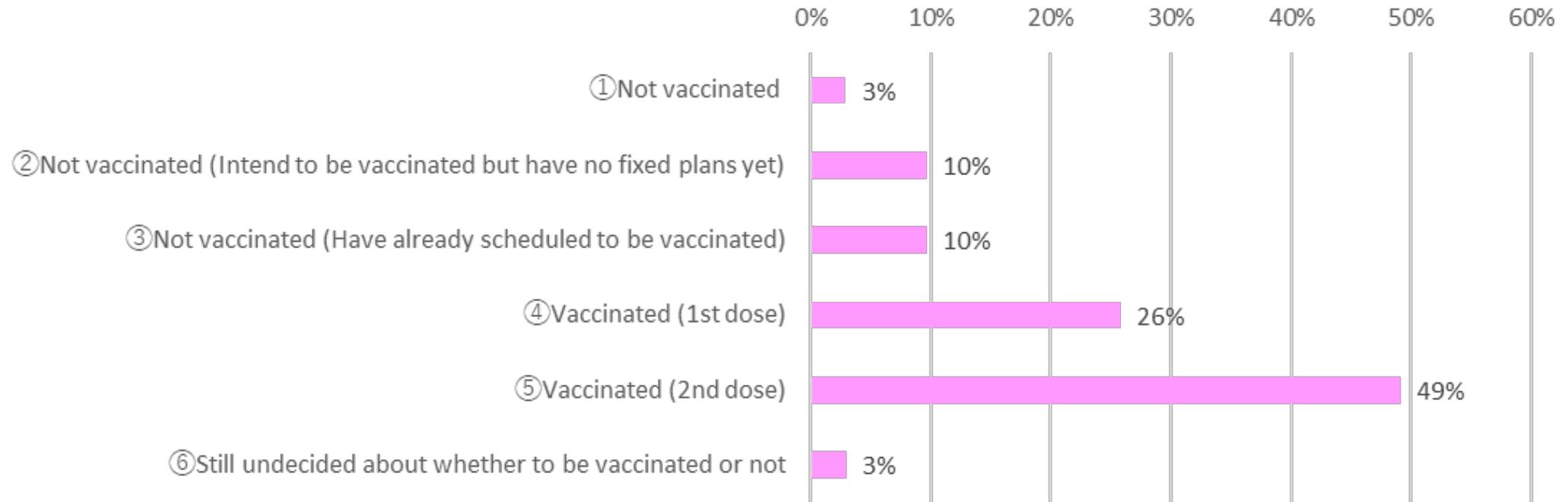
NCCN [7]	Most people with cancer should get the vaccines as soon as they can
ESMO [10]	Considering the data for vaccines other than for COVID-19, vaccine effectiveness and safety is expected to be similar to nonpatients with cancer. Effectiveness varies depending on individual circumstances, but the benefits of vaccination are expected to significantly outweigh the risks. Ideally, the vaccine should be taken before cancer treatment, but it is also acceptable to take it during treatment if treatment has already begun
ASCO [11]	Patients receiving cancer treatment may also be vaccinated. To avoid reducing the effectiveness of the vaccine, vaccination in the interval between administration of anticancer drugs may be considered
AACR [12]	It is recommended that patients receiving cytotoxic anticancer drug treatment and immunotherapy be vaccinated preferentially
NCI [13]	Patients with cancer may also be vaccinated. However, the possibility that vaccine effectiveness will be reduced for patients in an immunosuppressive state cannot be rejected, so patients should continue to take sufficient precautions against infection even after vaccination

Fig.1 Content of Discussions About COVID-19 Vaccination With Attending Physicians



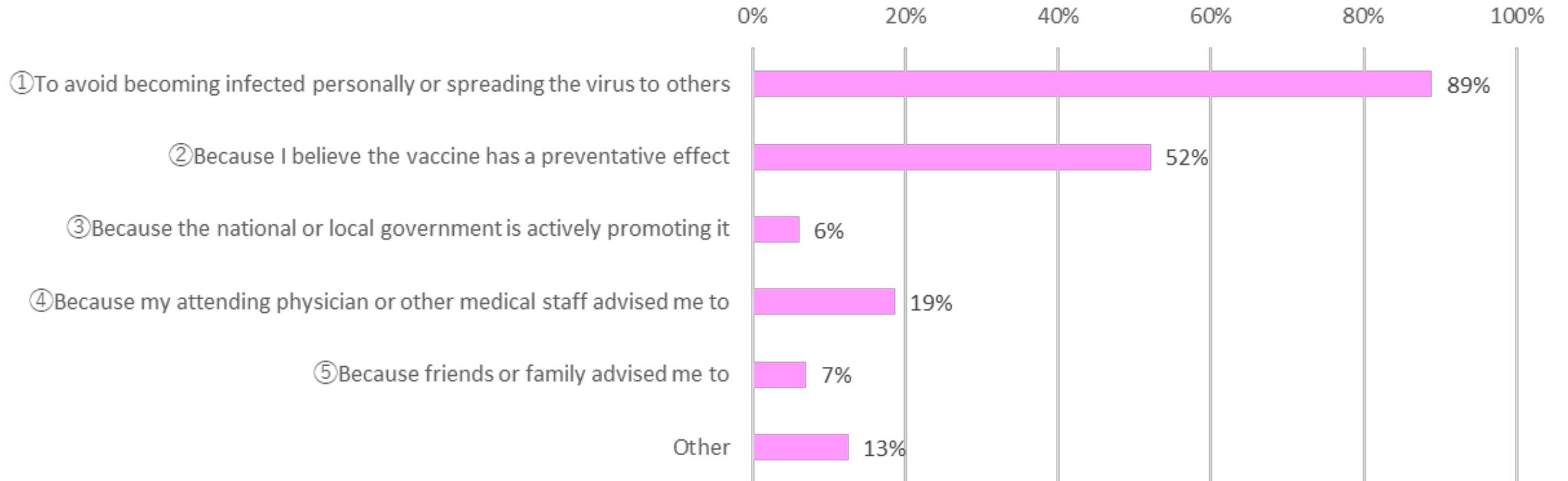
Number of responses n=726

Fig.2 COVID-19 Vaccination Status



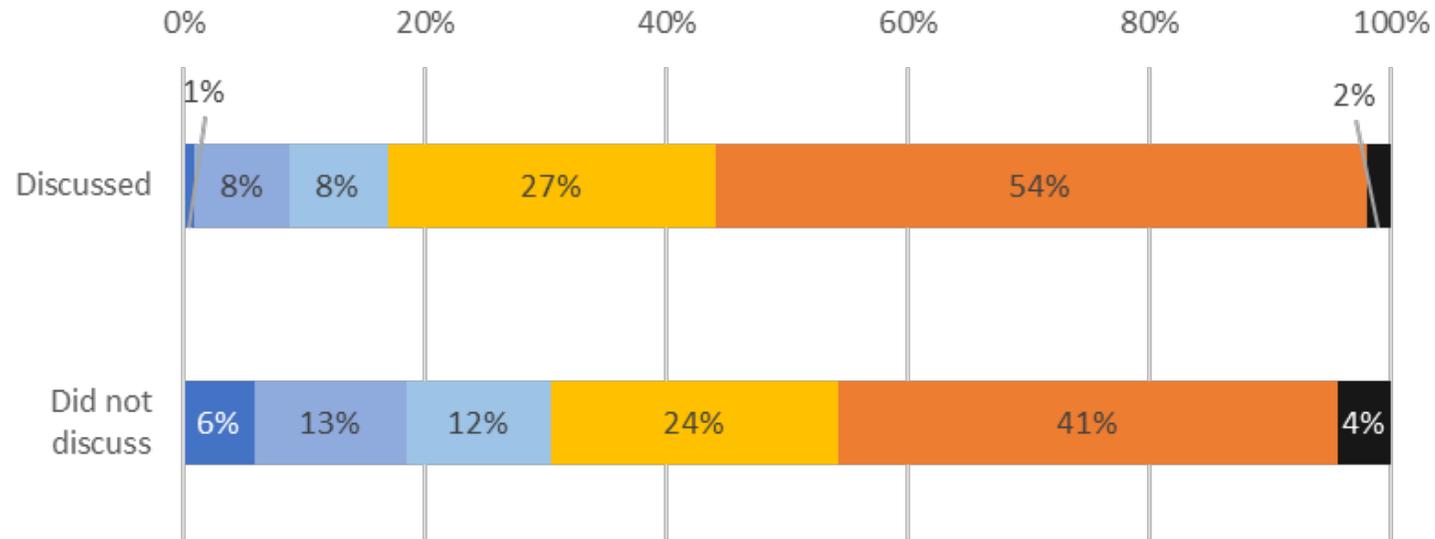
Number of responses n=1,182

Fig.3 Reasons for Vaccination among Vaccinated Patients and Patients With Plans to Be Vaccinated



Number of responses n=1113

Fig.4 Cross-Analysis of COVID-19 Vaccination Status and Whether Patients Consulted with Their Attending Physicians



- ① Not vaccinated
- ② Not vaccinated (Intend to be vaccinated but have no fixed plans yet)
- ③ Not vaccinated (Have already scheduled to be vaccinated)
- ④ Vaccinated (1st dose)
- ⑤ Vaccinated (2nd dose)
- ⑥ Still undecided about whether to be vaccinated or not

Fig.5 Cross-Analysis of COVID-19 Vaccination Status and Treatment Status

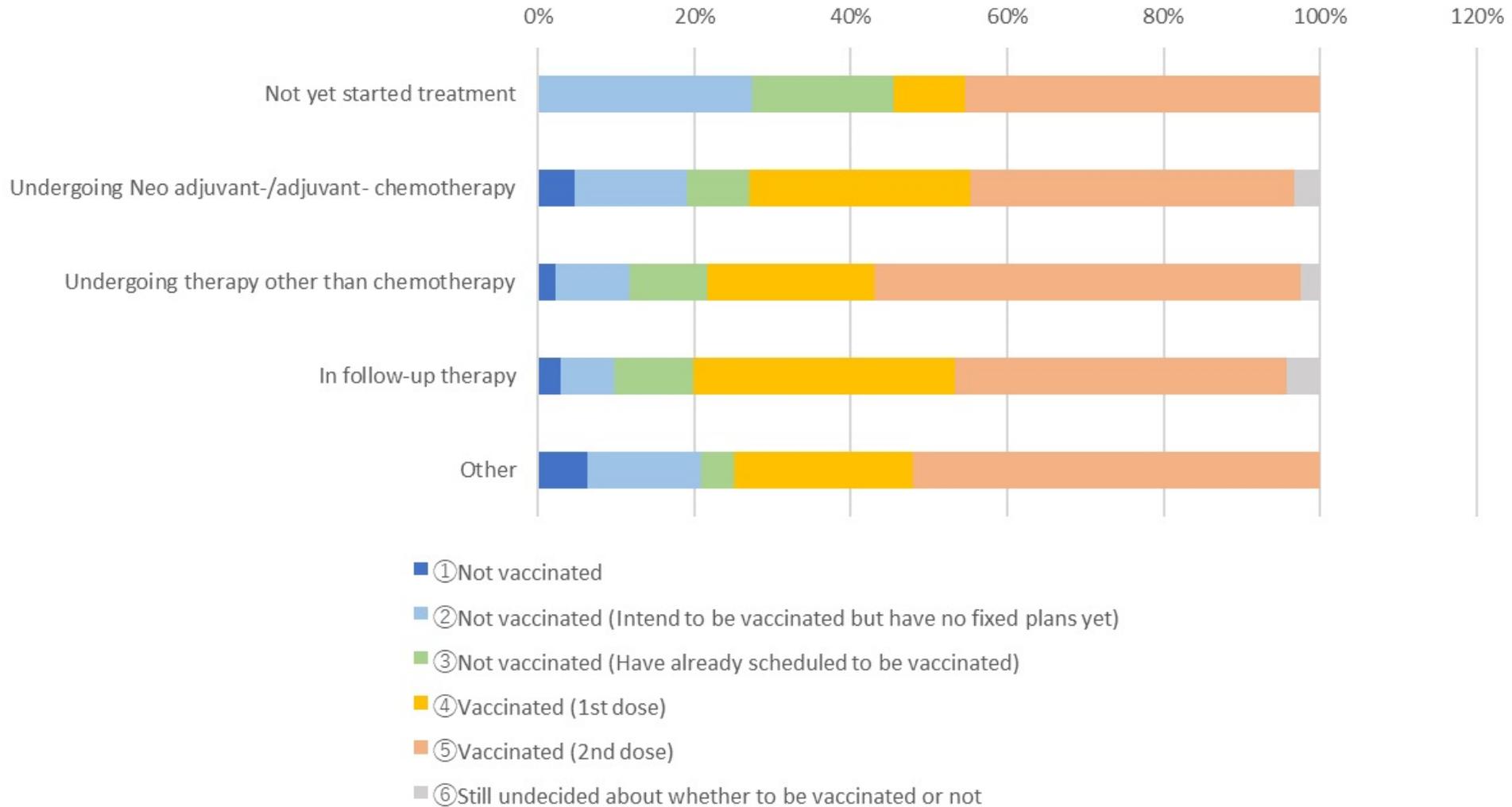
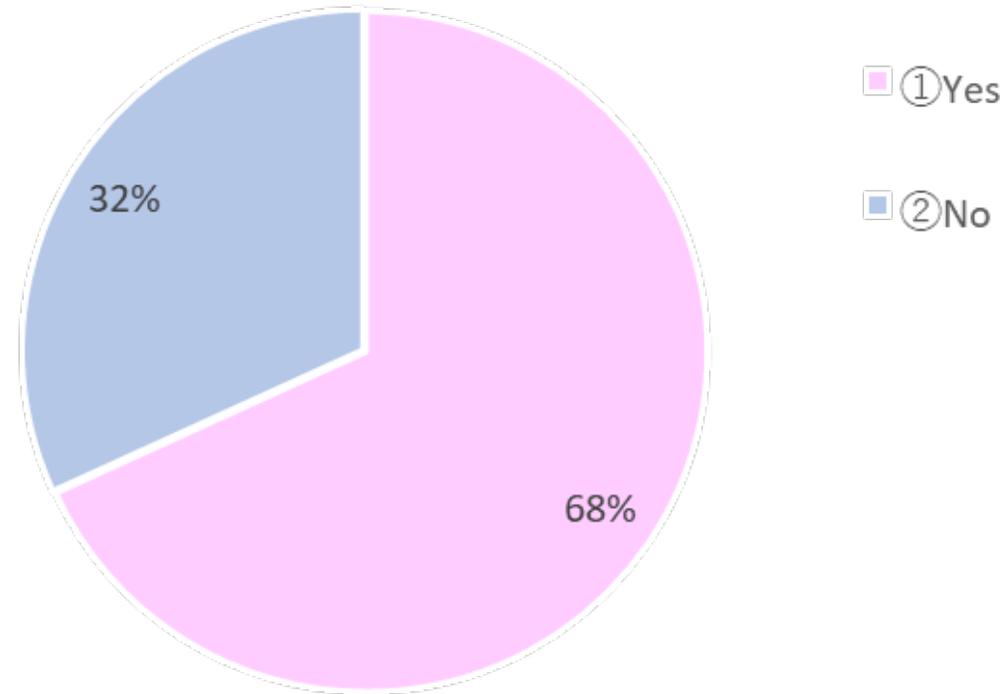


Fig.6 Fraction of Patients Who Adjusted Vaccination Timing Based on Their Treatment Schedules



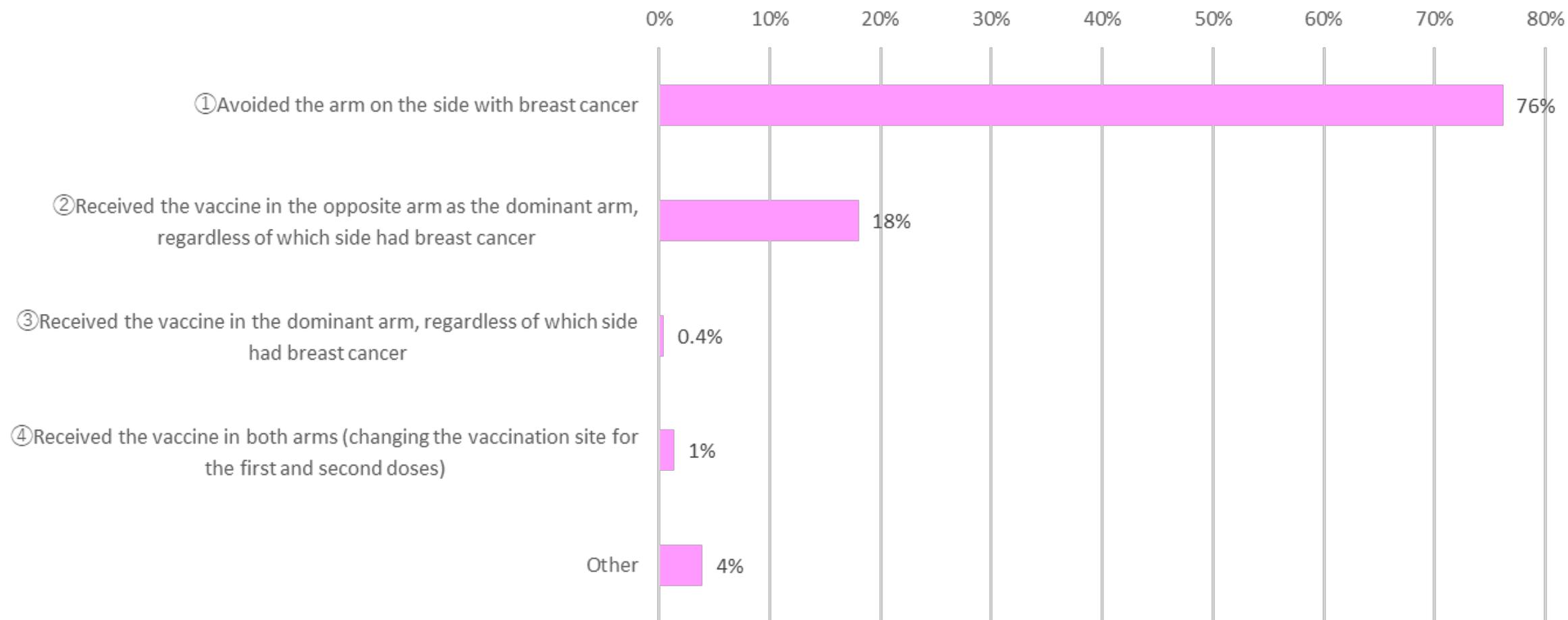
Number of responses n=110

Fig.7 Specific Adjustments Made

Number of responses n=75

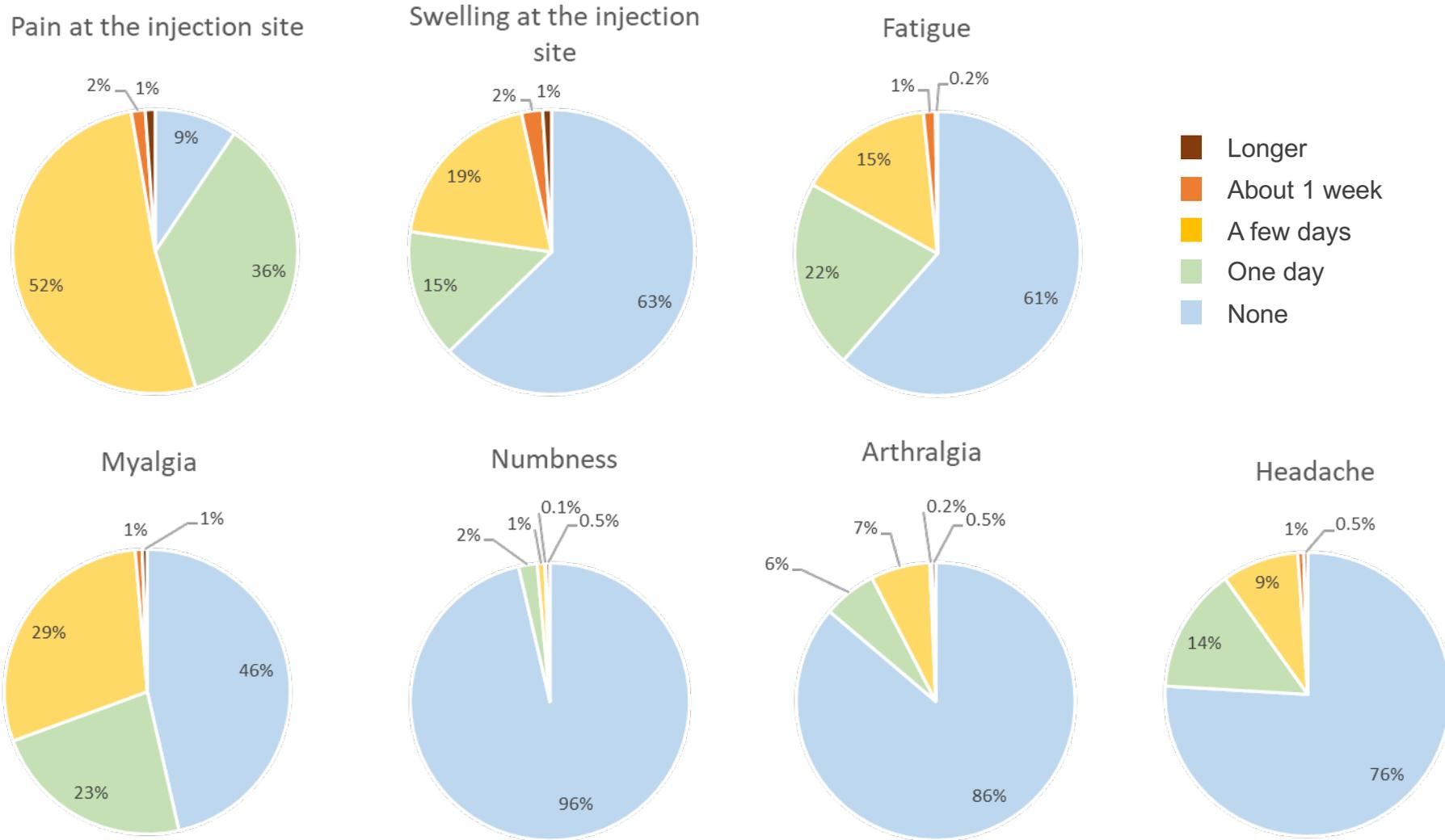
<p>Arranged to be vaccinated during the interval between administration of anti-cancer drugs</p>	<ul style="list-style-type: none"> ▪ Received the vaccine right around the midpoint of the interval between the days of anti-cancer drug administration ▪ Attending physician scheduled the vaccination to be a week after anti-cancer drug administration ▪ After anti-cancer drug administration, avoiding the following week, received the vaccine the week after that, then anti-cancer drugs were administered the following week ▪ Chose the 3rd week after anti-cancer drug; selected the Pfizer vaccine to match the anti-cancer drug course
<p>Changed the treatment schedule of chemotherapy because of vaccination</p>	<ul style="list-style-type: none"> ▪ Spread out the interval of chemotherapy to 4 weeks, allowing at least one week before and after vaccination
<p>Avoided being vaccinated when white blood cell count was lowered from anti-cancer drugs</p>	<ul style="list-style-type: none"> ▪ Arranged to be vaccinated when immune function returned after anti-cancer drug administration ▪ Avoided overlapping with the period of myelosuppression
<p>Avoided vaccination on the same day as molecular targeted drugs were administered</p>	<ul style="list-style-type: none"> ▪ Allowed at least one week after the administration of molecular targeted therapy ▪ Was advised by chemotherapy doctors/nurses to avoid the three days before and after molecular targeted drug administration, and to arrange to be vaccinated early the next week after drug administration. (Administration every three weeks) ▪ Avoided the day of herceptin monotherapy, but received the vaccine (both 1st and 2nd doses) two days after treatment
<p>Avoided administering anti-cancer drugs during the week of vaccination</p>	<ul style="list-style-type: none"> ▪ Avoided administering anti-cancer drugs on the week of vaccination ▪ Allowed about one week after chemotherapy before vaccination
<p>Since chemotherapy could not be paused, received the vaccine on a Friday, so it would work out even if there were side-effects</p>	<ul style="list-style-type: none"> ▪ Since it was during radiation therapy, decided to be vaccinated on Friday, fearing a fever ▪ Received the vaccine after irradiation on Friday in order to be able to rest well for two days after vaccination
<p>Received the vaccine on a different day from family</p>	<ul style="list-style-type: none"> ▪ Taking anti-cancer drugs orally. Allowed one week from the next hospital visit (avoiding the possibility of becoming unable to see a doctor due to fever); Also chose a different vaccination from family

Fig.8 Inoculation Sites

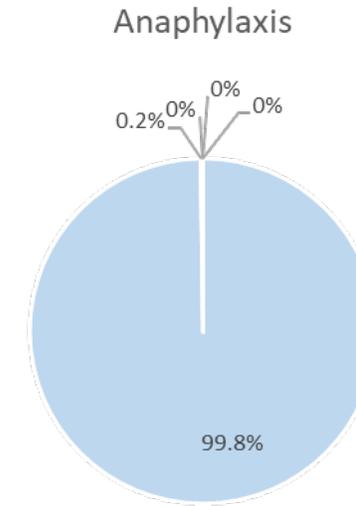
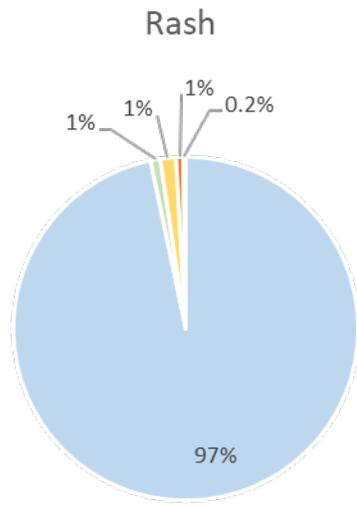
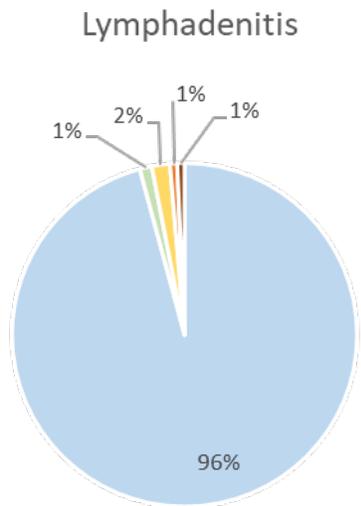
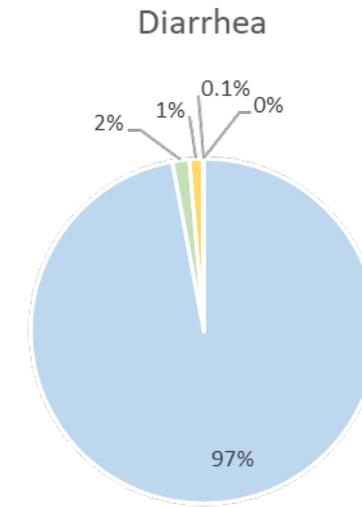
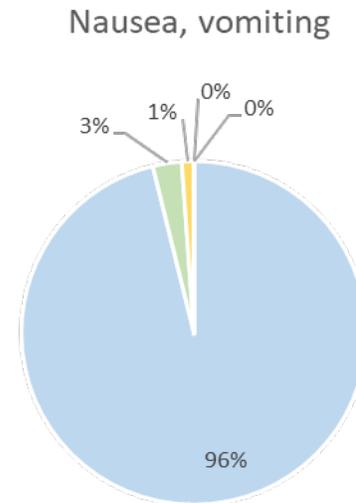
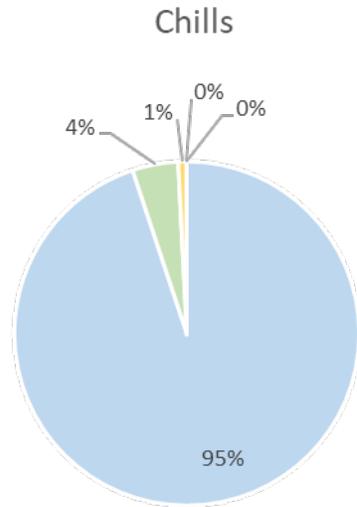
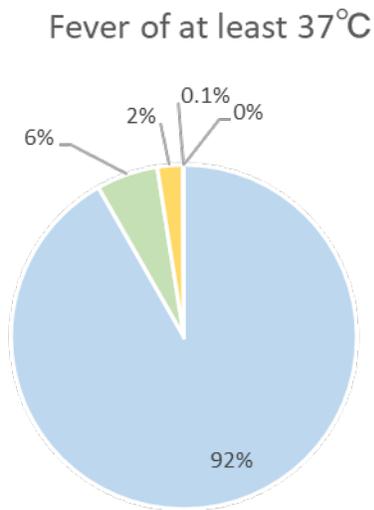


Number of responses n=709

Fig.9 Side-Effects (For the 1st Dose)



Number of responses n=885

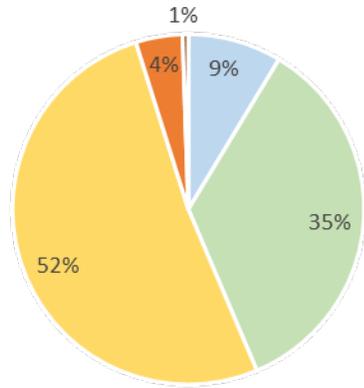


- Longer
- About one week
- A few days
- One day
- None

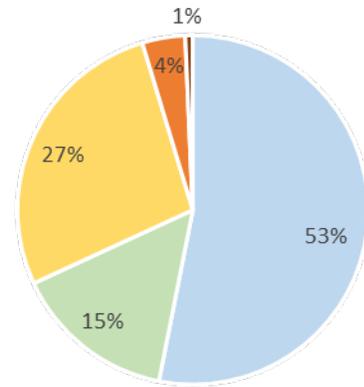
Number of responses n=885

Fig.10 Side-Effects (For the 2nd Dose)

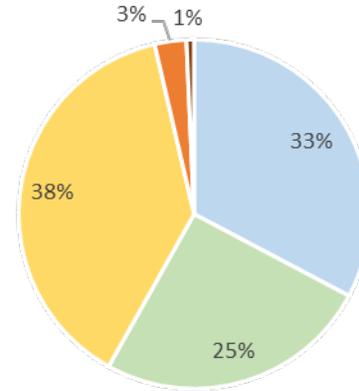
Pain at the injection site



Swelling at the injection site

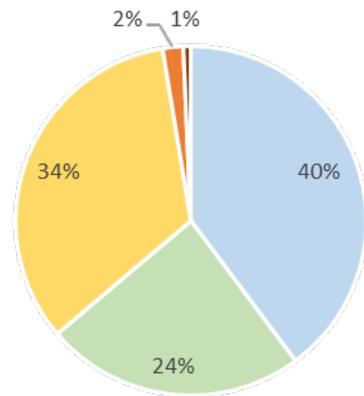


Fatigue

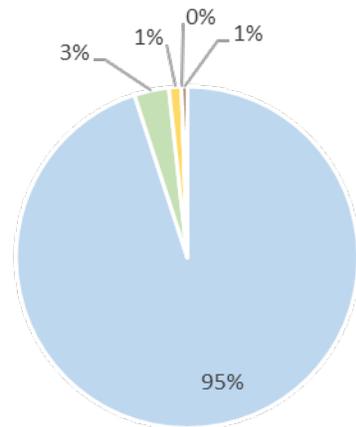


- Longer
- About 1 week
- A few days
- One day
- None

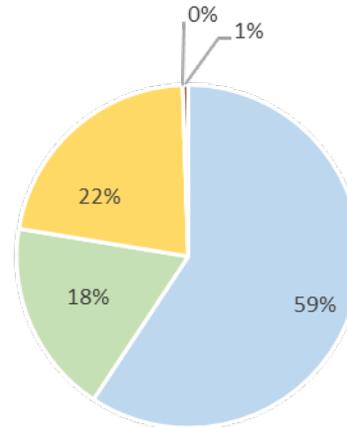
Myalgia



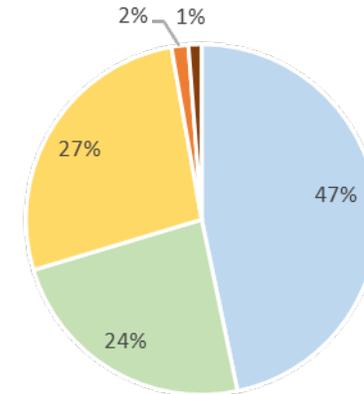
Numbness



Arthralgia

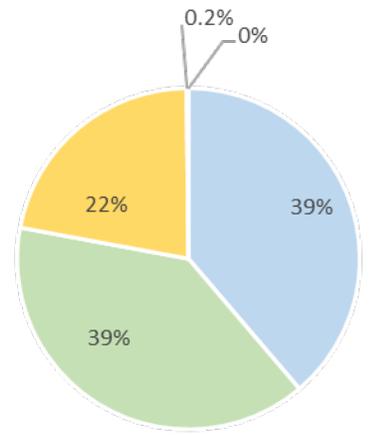


Headache

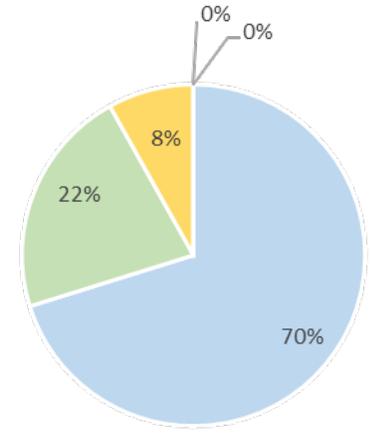


Number of responses n=580

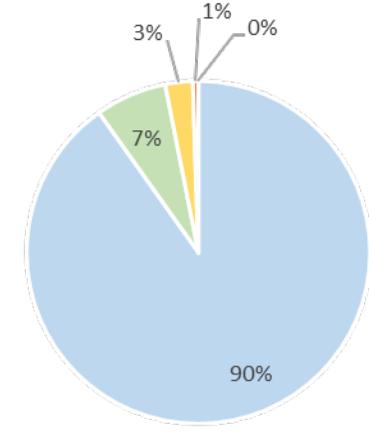
Fever of at least 37°C



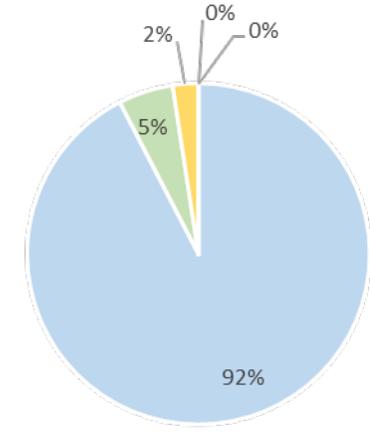
Chills



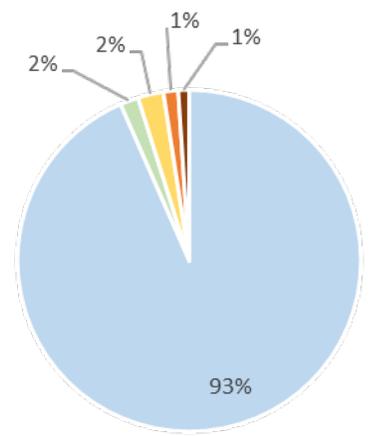
Nausea, vomiting



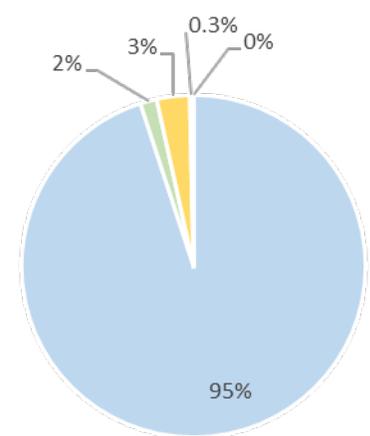
Diarrhea



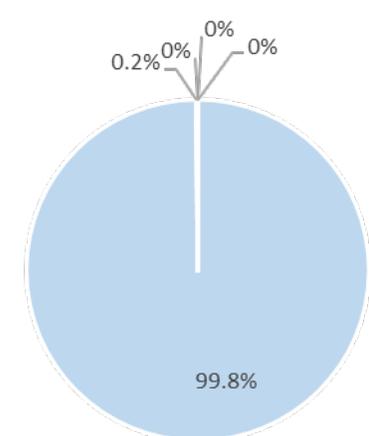
Lymphadenitis



Rash



Anaphylaxis

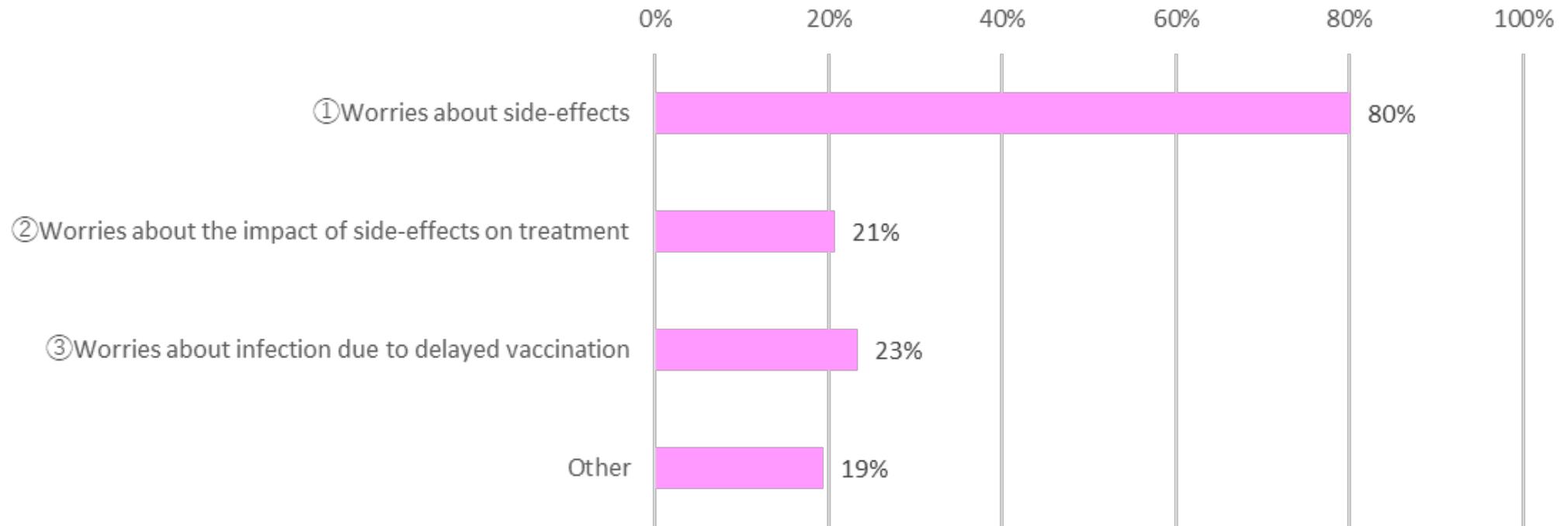


Number of responses n=580

Fig.11 Worries Caused by Side-Effects After Vaccination *Free Response

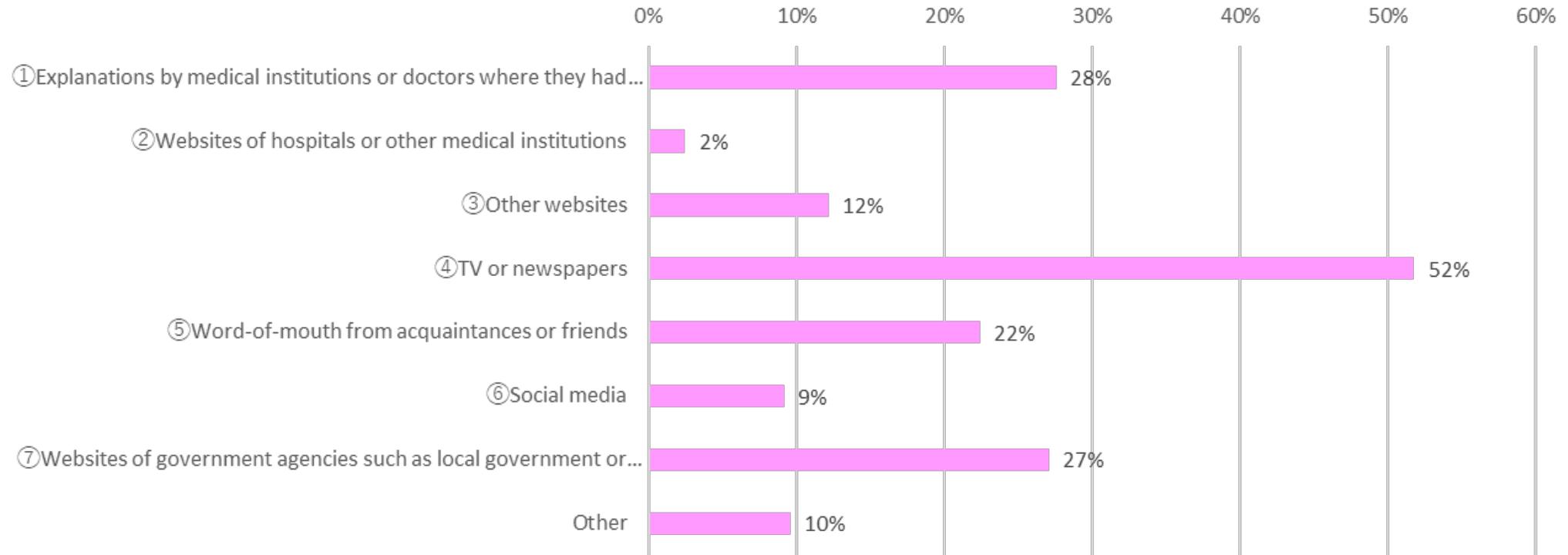
Onset or worsening of lymphedema	<ul style="list-style-type: none"> • Despite having already undergone lymph node dissection for breast cancer and receiving the first dose of the vaccine in the left arm, opposite the cancer side, I got lymphedema in my right arm, on the cancer side, two days later. I'm having a difficult time. • I received the vaccine on the healthy side, but the lymphedema on the cancer side got worse. The swelling of the lymphedema that had been stable for the past few years got worse by the day, becoming numb the following week, and I suffered from a heavy feeling and pain. I had no choice but to receive conservative treatment. • I currently sleep on my side, keeping the cancer side up, but since the pain after receiving the injection was strong I unintentionally ended up sleeping on the other side, causing the lymphedema to worsen.
Impediments to daily life and housework	<ul style="list-style-type: none"> • Being unable to raise my arm up disrupted my daily activities. • Since I had a 38.8° C fever, I was unable to go out shopping, etc. • After the second dose, I was bedridden and unable to do housework because of side-effects of muscle pain and chills.
Impact on work	<ul style="list-style-type: none"> • I was told by my attending physician that I would be given the vaccine in the opposite arm from the operation, meaning that I was vaccinated in my dominant arm. Later, the pain in my shoulder was dreadful, severely impeding my ability to work. • I left work early because of the side-effects, and my boss changed my shift for me.
Worries about impact on hospital visits or treatment	<ul style="list-style-type: none"> • It means being imaged while the lymphedema is swollen. I'm worried that it will be mistaken for a relapse or metastasis. • I had prolonged nausea and vomiting and was unable to take tamoxifen. • Since I couldn't take a break from the radiation therapy, even though I had a fever the day after receiving the vaccine, I still had to go to the hospital. It was quite difficult.
Impact on cancer treatment or surgery	<ul style="list-style-type: none"> • Since I received the second dose about one week after the operation, it was scary because I didn't know if the pain in my body and the fever were because of the operation or a side-effect of the vaccine. • My neutrophil count decreased rapidly, so I had to suspend taking my medicine. • It was difficult to tell the difference between the side-effects of the anti-cancer drugs and the vaccine.
Feeling worried	<ul style="list-style-type: none"> • There was something like an odd feeling of worry, and I was unable to sleep. • Since I took the vaccine on the same day as my family, I worried about how long the side-effects of my other family members would continue.
Worries about metastasis	<ul style="list-style-type: none"> • I experienced extreme pain three days after the first dose in my left rib. Since the pain was like a broken bone, I was checked for bone metastasis, but there was nothing out of the ordinary. • There's a lingering mild headache and nausea, and I worry about whether it's brain metastasis.

Fig.12 Concerns Related to Vaccination



Number of responses n=768

Fig.13 Method of Obtaining Information About Vaccination



Number of responses n=1182

*See attached materials for specific names, etc.