

1 **A Strategy Study on Risk Communication of**
2 **Pandemic Influenza**
3 **——A Mental Model Study of College Students in**
4 **Beijing**

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20

21 **Abstract**

22 Understanding the risk perception of pandemic influenza can

23 improve the risk communication efficiency of the government and
24 ultimately reduce losses caused by the disaster. A mental model
25 interview of 28 individuals who discussed pandemic influenza was
26 analyzed in this paper. The interviewees were college students in
27 Beijing, China who were evaluated to understand their views on the
28 risk perception of pandemic influenza. Referring to the mental model
29 theory, the researchers using Delphi method to identify the key risk
30 factors and concepts to examine the public understanding of these
31 contents; then, the researchers identify the deviations in their
32 understanding so that suggestions and countermeasures have been
33 put forward to enhance the effectiveness of risk communication. Most
34 of the conceptual content was mentioned by most interviewees.
35 However, some interviewees showed misunderstanding including
36 excessive optimism about the consequences of pandemic influenza, a
37 lack of detailed mitigation measures, and negative attitudes toward
38 health education and vaccination. Once faced with threats, this may
39 lead to the failure of risk communication. In Beijing City, the center of
40 domestic and international education, the historical SARS epidemic
41 and this year's seasonal flu peak are all hints of the potential risk of a
42 pandemic outbreak. Beijing's college students' one-sided
43 understanding and misunderstanding of the relevant risk information
44 may increase the risk during an influenza pandemic. The results

45 highlight the necessity for the government to clearly focus on the
46 communication content of the student group, provide an official
47 reference plan for the public and update health education on this topic.

48 **Keywords:** risk communication, pandemic influenza, mental model,
49 health emergency

50

51 **Introduction**

52 Influenza is a highly variable infectious disease that can easily evolve
53 into a pandemic and pose a major threat to people's lives and safety.
54 (1). The corresponding emergency response measures require the
55 active cooperation of the public to produce an effective response.
56 Because of its wide range of impact and potential mortality, effective
57 risk communication will help the public understand the information
58 related to influenza (2). But in fact, our risk communication and health
59 education are still lacking. In January 2018, an article from the micro-
60 blog, named "the middle aged people under Beijing flu", has attracted
61 wide attention. The author, a college student, shared his noticeable
62 blog article which records how his grandfather was infected with
63 influenza and passed away. The article included the whole process of
64 his family's infection and coping with influenza. However, their
65 decisions are mostly erroneous and misleading, because a lacking of
66 understanding of influenza. These issues further illustrate the urgent

67 need to effectively communicate the risk of pandemic influenza to
68 general public in china.

69 When public health emergencies occur, the government often
70 asks experts what the public should know; thus, how to effectively
71 transform scientific knowledge into a concept that can be understood
72 by a useful structure and a nonprofessional background is a key
73 component of an effective risk communication officer (3). Mental
74 Model Theory holds that people's understanding of information and
75 judgment of decision-making are influenced by their own unique
76 mental models. The mental model is a causal belief (3,9,10) that guides
77 the decisions and actions of the world. A person's mental model
78 consists of many factors, including personal experience, acquired
79 learning, analogy and reasoning (3,11,12,13,14,15), which could be a
80 complex system in our mind. The mental model analysis, which
81 combines a qualitative research method of cognitive psychology and
82 communication, shows the cognition of two different groups to the
83 same thing by the form of mind map. It's convenient for us to compare
84 the cognitive differences and characteristics between the two groups
85 in the same thing. For experts and the public, if we can find the
86 deviations in risk perception, we can formulate corresponding
87 communication strategies to correct these deviations. Thus, targeted
88 health education can help one modify their mental model to establish

89 a sense of risk and improve the risk management of influenza. What's
90 more, in China there is no normalized and systematic health education
91 or publicity related to large-scale infectious diseases for general public.
92 Until there is an outbreak of infectious diseases, there will be short-
93 term targeted experts recommend to the public. And compared with
94 other places, colleges and universities as a large number of students
95 concentrated in the key areas, personal health literacy and living
96 habits vary greatly, once the campus flu patients, the risk of large-scale
97 infections is extremely high, and produce a multi-faceted serious
98 consequence. For college students who need to live independently for
99 a long time, it is necessary to study and take care of their personal life
100 at the same time. It is necessary to carry out targeted health education
101 and learn some basic knowledge of influenza pandemic prevention.
102 Our study uses a mental model analysis to find out the cognitive
103 characteristics of college students' risk of pandemic influenza by
104 comparing each student's understanding of expert knowledge and
105 diagnosing which information can improve their decision-making and
106 thus their security (4,5,6,7,8). When a pandemic threatens, proper risk
107 communication will reduce losses. The purpose of this paper is to
108 study the key communication content of students in the influenza
109 pandemic, hoping to provide some reference for the formulation of
110 special emergency plans and health education materials.

111 Our data are based on personal interviews with 28 students from
112 5 universities in Beijing. This study used an open personal interview
113 structure to learn about students' beliefs regarding the risk of
114 pandemics, to explore how people understand the flu and its risks, to
115 identify the reasons for these beliefs and behaviors and to determine
116 views on current risk communication. It is necessary for people to have
117 knowledge to be able to protect themselves from the threat of flu. The
118 content of this study included the degree of knowledge of the experts'
119 risk perception and their understanding of pandemic influenza. It is
120 not necessary for members of the public to know all the details of
121 influenza risk information to make wise decisions.

122 In China, the mental model theory has primarily been applied to
123 team management. There has not yet been any application in the field
124 of health education. Only risk management strategy has been studied
125 from the perspective of public demand. Furthermore, there is no
126 official pandemic preparedness plan for the general public.
127 Consequently, several studies have been performed in this field. Lazarus
128 and others have studied the public mountain flood communication
129 framework in Boulder County, Colorado State (16). Wagner (17) found
130 that the Alps of Bavaria influence the behavior of local floods, and to
131 understand the local environment and conditions, more information
132 on the floods was dependent on previous sources of experience. In the

133 reality, many people still do not understand how real events occurred
134 and managed, such as the 2004 Hurricane Katrina in the United States
135 and the SARS epidemic in China in 2008, even though the government
136 departments responded and disposed of the disaster actively. These
137 findings reveal how the public understands risk information and
138 makes decisions in the face of emergencies. However, most of the
139 topics focus on natural disasters. There is no research on the
140 application of this method in public health risk communication. The
141 researchers hope to use pandemic influenza as an example to see early
142 warning and emergency decision-making in a broader perspective and
143 to determine the degree of understanding and cognition of the risk of
144 pandemic influenza among Chinese college students to aid with
145 government contingency plans and health education materials. This
146 article focuses on those topics.

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148

149 **Materials and Methods**

150 *1. Communication framework and key concepts*

151 To succeed in risk communication, we must have a full
152 understanding of the emergencies and identify relevant risk factors to
153 determine the necessary communication content for general public,
154 and we need to understand which concepts should be grasped by the

155 public. Our study refers to the expert model (flash flood early warning
156 system, FFW model) (18) formed by Morss et al in their study about
157 disaster risk communication in Boulder and we modified the content
158 which is irrelevant to pandemic flu. After that, we organized an expert
159 seminar to revise the framework. Thus, a framework was initially
160 formed, and the researchers summarized the concept of the
161 corresponding framework and initially formed a communication
162 content suitable for the influenza epidemic to adapt to the actual
163 situation in China, including the cause of pandemic influenza,
164 emergency preparedness and strategy, risk information and
165 emergency response for different groups. The basic framework is
166 shown in Figure 1. The arrow in the graph represents the
167 interrelationship between the factors in the framework.

168 In Figure 1, the interaction between direct factors and
169 motivation to promote development leads to the occurrence of
170 pandemic events; the content of communication work is divided into
171 early warning communicators, response decisions and information
172 sources; and mitigation and emergency preparedness includes public
173 action. In this section, different boxes represent the risk factors
174 associated with pandemic influenza.

175
176 **Direct causes of
pandemic influenza**

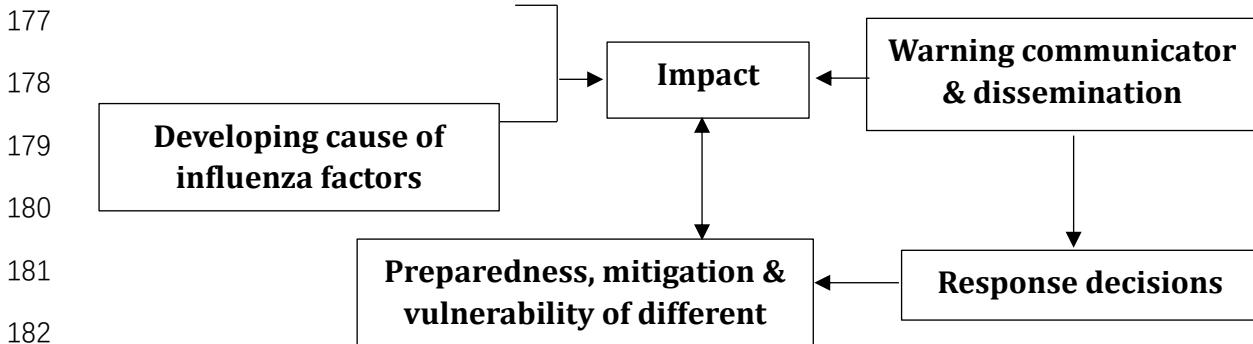


Fig.1 Basic framework of standardized communication for influenza: risk factors. The six boxes in the figure represent the key risk factors that make up a pandemic, and the arrows represent the relationships among the factors.

Next, the researchers performed a literature search and conducted expert seminars in accordance with the contents of the framework, completing the key concepts contained in each part. Finally, we used the Delphi method to amend the content of communication.

2. Sample and interview content

Purpose of mental model interviews is to find out which concepts or beliefs, are “out there” with some reasonable frequency then smaller samples become reasonable. There is no standard method for determining sample size in relevant theories and research practice (3). According to Professor Morgan's monograph and related research examples, the sample size for a mental model interview should be

201 20~30, at which time new information has reached saturation (3).
202 Based on the above research facts, combined with the research design
203 of Lazarus and Morss, the quota sampling method was selected in this
204 study, and the first group of sample size was estimated to be
205 approximately 30 (16,18). Through advertising poster, the
206 researchers recruited 28 interviewees from 5 different universities.
207 In the process of the interview, we will count the frequency of the
208 concepts provided by the interviewees and plot a graph. We will
209 consider increasing the sample until the respondents can no longer
210 provide new information (3). In Figure 2, the frequency of concepts
211 reaches its peak at No.21 interviewee. After that, the amount of
212 information provided by respondents began to decline, which means
213 that it was unlikely that new concept would emerge.

214

215 **Fig. 2 Information saturation trend provided by 28 interviewees.**

216 *The fold line in the figure shows the increasing and decreasing trend of*
217 *information provided by the interviewee. It is formed by connecting the*
218 *points of concept frequency in Fig.3 described in the responses of 28*
219 *respondents.*

220

221 The interview is face-to-face and began with an open question,
222 such as "please tell us about the pandemic". Because this is a public

223 issue, the investigators guided the interviewees to elaborate on their
224 main concepts, followed by providing details of the outbreak,
225 including factors that may lead to a flu, the impact of that. And what
226 mitigation measures should be taken. If the interviewer had
227 experienced any emergencies, they were encouraged to talk about the
228 decision or idea at that time. Finally, the interviewees were asked to
229 make recommendations on the current status of health sector risk
230 communication. After that, the interview results were transcribed,
231 encoded and classified by coding software ATLAS. ti. As long as the
232 interviewee mentioned it, a concept will be compiled, no matter how
233 it is understood. Then, we conducted a quantitative analysis of the
234 results of the compilation, created a statistical chart, observed the
235 degree of attention of the interviewees, and compared those results
236 with risk perception of experts to determine the interviewee's
237 understanding of the related concepts and other features.

238 The questions used in this interview refer to a questionnaire in
239 the study of T. Chen and M. Haklay et al (19). The interview covers the
240 risk factors of the pandemic, the possible impact, the emergency
241 response including the early warning decision, and the individual's
242 experience of the pandemic. The results of the interviews were coded
243 simultaneously by 2 researchers. Then, the classification consistency
244 index (Holsti reliability) of the coder was calculated (20), which

245 fluctuated between 0.624-0.965, and the average reliability statistic
246 was 0.749. According to the study of Boyatzis and Burrus, the coding
247 reliability of trained different coders ranges from 0.74-0.80 (21);
248 therefore, the reliability of the coder was within the normal range and
249 displayed good consistency.

250

251

252 **Results**

253 **1. Expert consultation results**

254 **Table 1 Coordination coefficient of expert consultation**

Category	Statistical Indicators		
	W	χ^2	P
1 st round of consultation	0.291	555.371	<0.001
2 nd round of consultation	0.324	298.623	<0.001

255

256 There were 2 rounds of expert consultation, with a feedback rate
257 of 100% per round of questionnaires. The 18 experts who participated
258 in the questionnaire investigation were from the National Health
259 Bureau, the national centers for disease control and prevention (CDC),
260 the Beijing CDC, the health education center and the Provincial Health
261 Bureau; some professors in related fields were also included. The
262 average working life of these experts was 10 years, and they had very

263 good professionalism in the field of health emergency. The value of
264 authority coefficient is 0.885 (>0.70), it indicates that the study has a
265 good expert score (22,23,24). In the first round of expert consultation,
266 the coordination coefficient of each item was 0.291($P<0.001$), and in
267 the second round of expert consultation, the coordination coefficient
268 was 0.324($P<0.001$), which was better than the first round and which
269 indicates that opinions of the experts have agreed. Then, we calculate
270 the mean and variation coefficient (CV) of each concept, and those
271 concepts with a $CV>25\%$ and $mean<2.5$ were deleted (25). The other
272 concepts were modified according to the expert opinion. Finally,
273 combined with the personal interview results, we created a
274 communication framework for influenza pandemic, as shown in Figure
275 3, that includes the main misunderstandings and the analogies used by
276 the interviewees. The analogies were not coded in our interview.
277 Because this part is to understand what personal experiences or
278 similar concepts respondents will use when understanding the
279 concept of influenza, which may not be familiar to them, so as to
280 provide a reference for risk communication and health education
281 materials. Expert consultation does not involve open questions
282 because they are always able to provide professional advice from a
283 scientific point of view. Figure 3 refers to the format of the FFW model
284 drawn in the study of Lazarus et al. In accordance with the risk factors

285 in Figure 3, the corresponding key concepts are written and were sent
286 to experts for consulting; thus, the final influenza pandemic
287 communication framework is obtained.

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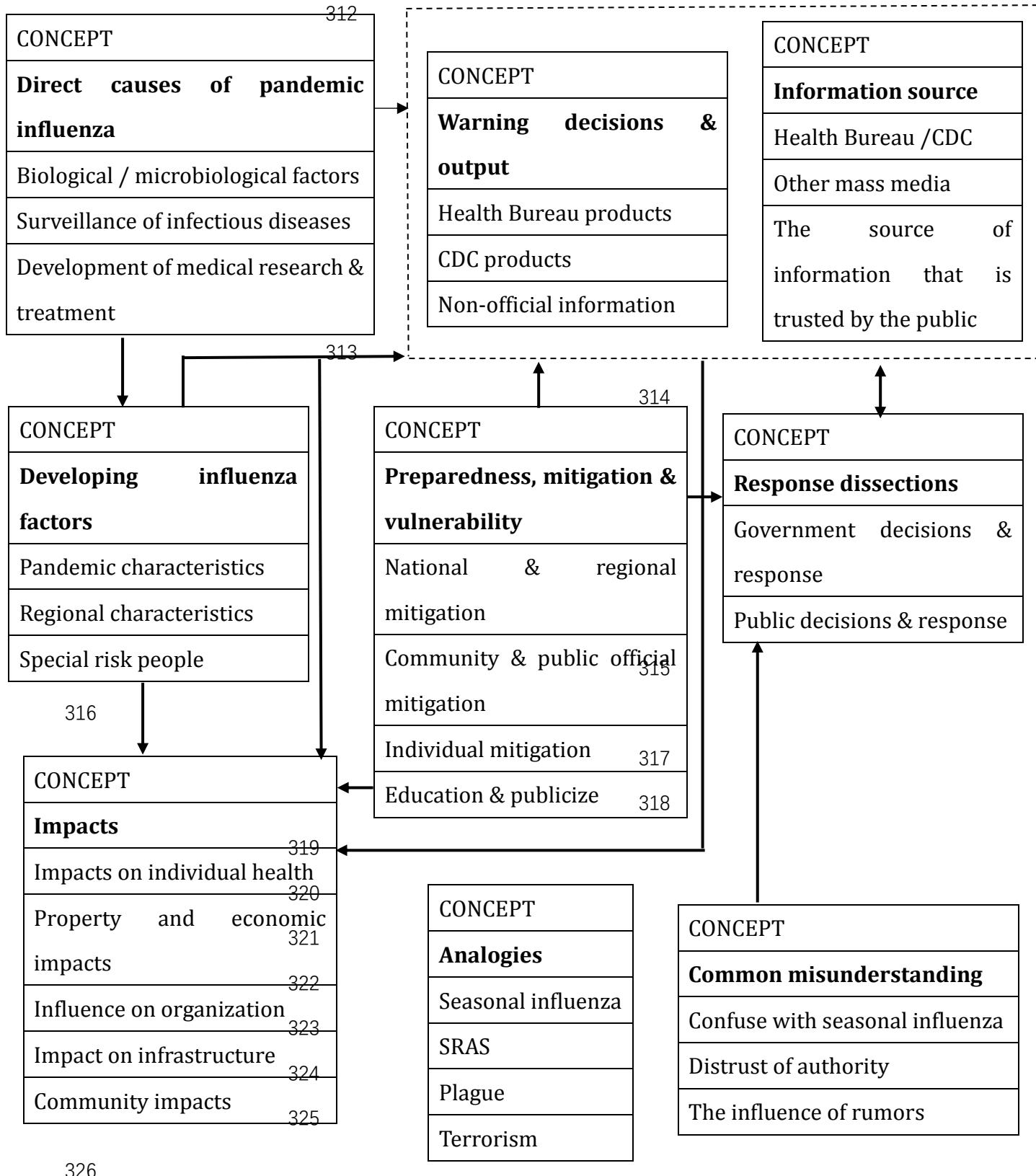
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327 **Fig.3 Communication framework of pandemic influenza.** The
 328 framework is composed of six main conceptual dimensions, the main

329 *concept is the bold label and the 2nd-level concept in the box is the part.*

330 *More detailed concepts in the framework are omitted, see the coding*

331 *manual in appendix. The whole framework contains 79 concepts, and the*

332 *arrowhead represents the influence relationship of each part. The*

333 *analogy part is listed separately to describe the events associated with*

334 *the interviewees.*

335

336 **2.Ruslts of mental model interview**

337 **2.1 Overall situation**

338 The percentage of interviewees that mentioned a concept item

339 was counted by the researchers. In addition, this study used a stacked

340 bar chart to show the number of concepts mentioned by the 28

341 interviewees (Figure 3). As shown in the graph, we distinguish the

342 concept of different attributes in terms of dimensions (risk factors).

343 The depth of the mental model of each interviewee (the number of

344 concepts mentioned by an interviewee) can be visually distinguished

345 by the richness of the color, and we can see which dimensions of the

346 expert's risk perception the public is highly aware of and in which

347 areas the public lacks awareness. Furthermore, the length of the bar

348 graph reflects the number of concepts mentioned in the dimension: a

349 taller bar graph reflects more relevant concept items mentioned by the

350 interviewees and a deeper degree of understanding of the related

351 content. For example, interviewees 12, 16 and 21 knew more about the
352 emergency response decisions during the pandemic, whereas
353 interviewee #24 was less aware in this regard.

354

355 **Fig. 4 variability in number of concepts mentioned by different**
356 **interviewee.** *The straight bars in the graph represent the number of*
357 *concepts in Fig.3 that can be described by each interviewee. Different*
358 *colors represent the corresponding conceptual categories. The more*
359 *colors a respondent has in the bar, the higher the range of understanding*
360 *of Fig.2 framework he may has.*

361

362 Figure 4 reveals the differences in thinking about the risk of and
363 coping with the influenza pandemic among different groups. Even with
364 a higher education level, each college student interviewee displayed a
365 significant difference in the depth and detail of their mental model.
366 Some of the interviewees' mental models appear particularly "scarce"
367 (such as interviewee #2 and 25). Almost all interviewees discussed
368 less information than the risk perception of experts. Only one
369 interviewee (interviewee #9) mentioned concepts that reflected
370 almost all parts of the communication framework in Figure 2. The
371 other students did not put forward much more new concepts in the
372 interview. Their conceptual descriptions reflect the concern for

373 specific content and common cognitive deficiencies and
374 misunderstandings. The following sections discuss these most
375 outstanding features of the interview answers.

376

377 *2.2 The formation and development of the pandemic*

378 **Table 2 The discussion of related items**

Concept	Frequency	Ratio
Virus mutation	11	39%
Virus infectious force	5	17%
Drug resistance of virus	4	14%
Vaccination & related research	2	7%
Disease surveillance network	9	32%
Lack of immunity	4	14%
International dissemination	9	32%
Mobile population density	13	46%
Health emergency capacity	4	14%

379

380 The interaction of multiple factors may affect the formation and
381 development of pandemic influenza. Some factors are shown in Table
382 2, 39% of the interviewees believed that influenza virus variation was
383 an important cause of the pandemic. These interviewees used

384 statements such as "new virus", "virus mutation", "an unknown virus",
385 etc. Additionally, 32% of the interviewees referred to disease
386 surveillance, which included "*poor supervision of the source of*
387 *infection*" and "unchecked work", and they were more inclined to use
388 terms to express their views (for example, "gene mutation", "isolation
389 treatment", "infrared surveillance", and "take the body temperature").
390 46% of the interviewees mentioned characteristics related to the
391 international spread of the pandemic. Interviewee #6 mentioned:
392 "*foreign virus carriers from foreign places into Beijing*", and interviewee
393 # 9 mentioned "*many are due to alien invasive species, or foreign people*
394 *bring them to our country.*" However, there are some interviewees
395 believed that climate factors could lead to flu cases because they
396 confused pandemic influenza with seasonal flu, such as interviewee #7,
397 who answered "*when the seasons change, people catch cold easily and*
398 *catch cold. If they do not pay attention, a pandemic will happen if they*
399 *don't do that.*" Many interviewees (46%) also mentioned the impact of
400 population density, including densely populated places and more
401 floating cities with higher risk areas for influenza. For example,
402 interviewee #11 said, "*first of all, (there) is an infected person, and if it*
403 *is not checked properly, then the person may go to some crowded*
404 *shopping malls, public places, or schools, and there may be a lot of*
405 *similar cases in the next few days.*" Interviewee #17 stated that "... my

406 *hometown, a small city, but if it happens, it may take strict measures like*
407 *the SARS epidemic.*" Other factors that were mentioned less frequently
408 (by less than 17% of the interviewees) included virus resistance, viral
409 power, avian influenza immunity, and a human lack of immunity to
410 new viruses.

411 In addition, the interviewees also discussed the process and
412 development of influenza in light of many factors, some of which were
413 described in greater detail. For example, interviewee 12 described the
414 following situation: "*In one or two days, 3-4 patients with the same*
415 *symptoms came to the hospital, and then more and more patients will*
416 *emerge... News will also come out to report, what public places have been*
417 *taken by some carriers, and what have been done, such as those that*
418 *came before planes. The events may become clearer and clearer. After*
419 *that, there may be government departments coming out, some routine*
420 *inspections that are usually not available, and your units or schools will*
421 *take some actions.*" However, some of the interviewees also gave a fairly
422 brief overview, stating that "*pandemic influenza is the result of a new*
423 *virus, the result of the continuous flow and spread of the infected people*
424 *without control*" (interviewee 3).

425 Compared to the experts, the mental models of many of the
426 students interviewed contained only part of the communication
427 framework. Although some key elements were mentioned by most of

428 the interviewees, other important factors were rarely mentioned or
429 misunderstood by the interviewees. For example, interviewee #16
430 believed that the flu was "*foodborne diseases*" and "*caused by drugs*".
431 For individuals infected with influenza, no one discussed the impact of
432 some vulnerable groups on the development of the pandemic, and
433 there was no further detailed description of the virus variation.
434 Although people do not need to know the details of all the risk factors
435 related to pandemic influenzas, these items present in the
436 communication framework are still an important cause of the
437 pandemic influenza. A full understanding of this information can help
438 people to evaluate risk level in the environment, including which
439 situations may lead to infectious diseases and where there is a greater
440 risk of epidemics.

441

442 **2.3 The impact and consequences of a pandemic**

443 **Table 3 The discussion of related items**

Concepts	Frequency	Ratio
Severe symptoms of the general cold	4	14%
Causes death	8	29%
Unable to work	6	21%
Social medical burden	9	32%

Damage to key posts in the organization	3	11%
Absenteeism for employees	1	4%
Impact on public infrastructure	13	46%
Mass transmission	4	14%
Panic within the community	6	21%

444

445 As for the cognitive aspect of the pandemic, the interviewees
446 mentioned the many possible effects of influenza. However, in these
447 general categories, there were some differences in the impact of
448 influenza mentioned among the interviewees. As shown in Table 3,
449 approximately 29% of the interviewees discussed the fatality of the flu,
450 but only 14% of the people described the serious symptoms that could
451 occur after the infection, such as interviewee #5: "*...if there goes a*
452 *pandemic, it would be more than common cold. Runny nose and sneezing*
453 *or, maybe, pneumonia?*" None of the interviewees mentioned any
454 complications related to influenza infection. Even if a real pandemic is
455 only comprised of common symptoms of fever and fatigue,
456 complications such as pneumonia, myocarditis, bronchitis, etc. are the
457 real causes of death in some vulnerable patients (26) (27). Therefore,
458 although most of the interviewees understood that the flu can have
459 serious health threats, they did not understand how people die as a

460 result of the flu. These misunderstandings may be related to some
461 interviewees' subjective and one-sided understanding of the
462 pandemic and the lack of targeted health education. For example,
463 interviewee #10 said, "*That is, people usually don't pay attention to
464 clothes, then they catch a cold. It is quite a normal situation every year.*"

465 Most interviewees also discussed the social and economic impact
466 of the pandemic, and 46% of the interviewees referred to the negative
467 impact of schools, shops, public transport and other infrastructure
468 during the pandemic, such as interviewee #14: "*schools may shut
469 down... The shops outside may be closed because of this disease, and the
470 economy may be seriously affected because everyone will hide at home.*"

471 Most of the types of infrastructure, of which transportation was
472 mentioned the most frequently, were generally quoted as examples of
473 people during the SARS or bird flu period, such as interviewee #11
474 stated: "*everyone is not going out at the time of the outbreak...wearing
475 a mask if you have to go.*" 32% of the interviewees were worried about
476 overburdened hospital patients during the pandemic. Some of the
477 interviewees (28%) have also been associated with disastrous
478 consequences, including the impact of the pandemic on the community,
479 suggesting that they recognize the possibility of a broader and indirect
480 impact of the pandemic. According to interviewee #16, "*For a long
481 time... Our life may be threatened, many people steal food, drugs, and be*

482 *locked inside their house...not just the direct impact, it will definitely*
483 *bring other serious problems.*" Although the relevant concepts in the
484 communication framework were mentioned, the interviewees pay
485 more attention to consider about the possible impact of a pandemic on
486 the organization or community, they fail to understand the serious
487 damage that pandemic influenza could cause to individual health, nor
488 is it fully aware of the characteristics of the pandemic itself in all its
489 periods.

490

491 Surprisingly, 30% of the interviewees believed that a negative
492 impact of a flu pandemic would be minimal or more positive, and
493 almost all of them said, "*fells like the pandemic is far away from me.*"
494 According to interviewee #23, "*Is a kind of epidemic disease, but*
495 *speaking of cold and flu, what is generally not a major disease, easier to*
496 *treat the feeling, plus the pandemic, it is only a larger scope of infection,*
497 *right?*" Moreover, "*it's not a problem to suffer a pandemic... the SARS*
498 *also created a great electric business, maybe, the world needs to be*
499 *rearranged*" (interviewee #22). The content reflects that some
500 students still do not pay much attention to public health and their own
501 health. More people choose to passively wait and accept the strategies
502 and measures taken by the school or the state government; they lack
503 the initiative to understand the relevant information and take

504 preventive actions. In addition, the lack of targeted publicity and
505 education may also be a reason for the blind optimism of these
506 interviewees. For example, interviewee 3 stated that "*(it will) find a*
507 *way to deal with it at last. I don't care much about this. I'm young and*
508 *strong after all.*"

509

510 **2.4 The countermeasures of the pandemic**

511 **Table 4 The discussion of related items**

Concept	Frequency	Ratio
Clinical treatment & cadaver handling	10	36%
Virus surveillance	9	32%
Disinfection in public places	7	25%
Vaccine preparation	7	25%
Anti-influenza drugs	5	18%
Professional and technical training	2	7%
Education and consultation	16	57%
Social isolation	20	71%
Wear a special mask	14	50%
Wear a special mask	8	29%

512 Coping strategies in Table 4 are essential to pandemic emergency

513 work and an important part of the communication framework in
514 Figure 2. 29% of interviewees mentioned the importance of personal
515 hygiene habits, such as wearing masks and isolating patients, but there
516 are not many people who provided detail regarding these aspects. A
517 few interviewees described these strategies on the government,
518 organization, and individual levels. Most of them referred to "*masks*"
519 and "*be far away from the cough*" in the relevant open description, and
520 mentioned details of whether to use a special mask or separate the
521 patient from the family, etc. There was no mention of personal
522 protective measures. For example, interviewee #6 said: "*if it is more*
523 *serious, wear a mask, and then the hospital will be more nervous about*
524 *the flu, and there should be nothing else.*" Another 18% of the
525 interviewees believed that there was no need to isolate the suspected
526 patients, such as interviewee #19: "*You cannot go to the hospital first,*
527 *because most of the cases are not true flu, to the hospital may really be*
528 *isolated, so look first.*" For the government's decision-making, 57% of
529 the interviewees mentioned health education and counseling. Most of
530 them willing to accepted the necessary emergency response; over 1/4
531 of the interviewees referred to influenza surveillance, public
532 disinfection, and hospital treatment. These answers demonstrate that
533 the students with better educational backgrounds have a certain
534 understanding of the government's coping strategies and have a high

535 degree of potential coordination, but there were some mistakes and
536 lack of understanding in the concept of the most effective protection
537 decisions that an individual can make. However, although vaccination
538 is the most effective way to prevent flu, only 2 of the interviewees said
539 they were willing to receive the flu vaccine, and the other interviewees
540 said they would not vaccinate themselves if they were not compulsory.
541 "*There is no need for voluntary vaccination*" (interviewees 3 and 17),
542 "*some vaccines may have side effects...it will hurt me.*" (interviewee 26)
543 and "*the vaccine seems to prevent ordinary flu, and there is no special
544 vaccine for bird flu.*" (interviewee #12).

545 Notably, interviewee #9. who come from Hong Kong, were able to
546 relatively fully describe the individual and government contingency
547 strategies and discussed their own personal experience of avian
548 influenza in Hong Kong in addition to the elaborating on the entire
549 process of emergency work. For example, he mentioned, "... *all the
550 rumors about poultry industry will quickly corrected, and poultry killing
551 is very efficient. The response of the government's Department (Ministry
552 of prevention) is very sound, and we know how to check the body
553 temperature, wash hands, and a lot of protection will be done. We have
554 confidence in the epidemic prevention system of Hong Kong.*" He also
555 stressed that "*the individual should understand the knowledge of
556 influenza*", and "*to understand the extent of the risk of their own area.*"

557 This response fully embodies the maturity and perfection of the Hong
558 Kong government in the risk communication of emergencies and the
559 higher risk awareness and compliance of the compatriots in Hong
560 Kong; moreover, this interviewee has sufficient understanding of the
561 government's emergency disposal process, the measures that can be
562 taken and how the people can help; thus, the related communication
563 and publicity strategies are worth to refer.

564

565 *2.5 The acquisition of risk information and public suggestion*

566 **Table 5 The discussion of related items**

Concept	Frequency	Ratio
Fully believe in self-media	2	7%
Complete negation of self-media	5	18%
Dialectical view of self-media	14	50%
Be willing to participate in publicity	8	29%
Refusing to participate in publicity	20	71%
Access to information from the authority	12	43%
Access to information from	14	50%

other mass media		
Obtaining information from	13	46%
other trusted sources		
Differences between	4	14%
pandemic and seasonal		
influenza		
Understand the influence of	7	25%
rumor		
Authority distrust	6	21%

567

568 The risk of pandemic influenza can be reduced by timely warning,
569 access to correct information, and attitude toward communication and
570 interest in the face of threats. As shown in Table 5, 50% of the
571 interviewees had a certain information identification ability; 43% of
572 the interviewees chose to obtain their information on pandemic risk
573 from the official channels. All the interviewees were willing to take
574 several methods to search for risk information including using the
575 Internet. In addition, a considerable proportion of interviewees would
576 also choose other information access methods for personal preference,
577 such as "go to the library to consult the literature" (interviewee 1) and
578 "*ask my doctor friend*" (11). As a whole, the students' trust in the
579 government was generally high. In case of emergencies, they would

580 first turn to the authority of the government and would choose a
581 variety of ways to obtain relevant information on the pandemic to help
582 themselves to make decisions. However, although first-hand influenza
583 warning and decision support information come from the CDC, very
584 few of the interviewees (10%) were able to clarify what types of
585 communicators can provide help and provide detailed description on
586 this topic, including what types of early warning information are
587 available, where the information is, and how the information is
588 transmitted. People have only mastered the general concept, such as
589 interviewee #11: "*...go to the official website or WeChat (to) find how to*
590 *prevent.*" As for health education and publicity, most of the
591 interviewees said that they would not take the initiative to participate
592 in similar activities. The reasons were "*traditional lectures are boring*",
593 "*the publicity manual was not attractive*", etc. And it just like
594 interviewee #25 said, "*I think all of them are theoretical knowledge, and*
595 *you are also the same on the Internet. If they can tell us something that*
596 *you need to deal with when an event comes, it would be better.*"

597 At the end of the interview, the researchers asked the
598 interviewees for suggestions regarding future risk communication.
599 Most of the interviewees were satisfied with the current government's
600 work and have positive attitude towards the emergency plan of the
601 official guide form, they were more focused on "*the details of the*

602 *emergency work*" (mentioned by 25% of the interviewees) and "*hope*
603 *to get official plan*" (mentioned by 21% of the interviewees). For
604 example, interviewee 20 says that: "...*the way must be change, not as*
605 *before, because the flu is not like a normal cold, people will not pay much*
606 *attention to it. Communication, whether it is a family or school, it is best*
607 *to have some specific suggestions, such as how to wash hands and*
608 *disinfection, everyone can refer to themselves to do it.*"

609

610 2.6 Interviewees' personal experience and analogies

611 During the interview, the interviewees showed certain
612 characteristics on the macro concept of pandemic influenza. A total of
613 32% of the interviewees cited "SARS" and "avian flu", for example,
614 interviewee# 9 said, "*the disease like H1N1, it should be a pandemic.*"
615 "*Similar to it, there will be less people in the street, the economy will be*
616 *paralyzed, the hospital will be slower and people are confused.*"

617 Additionally, 17% of the interviewees compared a flu pandemic to the
618 "Black Death" during the history of Europe, such as interviewee 23:
619 "*The black death, the plague and so on. At that time, leprosy established*
620 *leprosy villages. On a large scale, I think SARS is not big enough. The*
621 *pandemic that I define here will be larger and more harmful.*" Most
622 interviewees were more connected and described the common cold or
623 seasonal flu, with a limited descriptive vocabulary. For example,

624 interviewee #17 stated that "*the pandemic is possible, the flu, and many*
625 *people may be involved, which is involved, but first of all these people are*
626 *the common cold.*" 17% of the interviewees mentioned the effects of
627 haze pollution and environmental damage, which were not involved in
628 our communication framework. Another 2 interviewees believed that
629 the pandemic influenza was a "*terrorist attack*" and believed that a
630 pandemic was uncontrollable, for example, "*the flu is unavoidable*"
631 (*interviewee #28*) or "*someone destined to get sick*" (*interviewee #12*).
632 Interviewee #9 described pandemic influenza as "*the decay of the*
633 *human's mind - if we do not treat the people and things around us, our*
634 *evil will bring flu, and that is the retribution we have suffered*"; this
635 view was a result of his religious beliefs.

636 These statements illustrate how personal experience affects
637 mental models and their environment. In the absence of influenza
638 knowledge and other directly related knowledge, interviewees may try
639 to combine their understanding with all available personal
640 experiences to fill the gaps in the information. As the research of
641 Visscher et al indicates, the actions taken by people in the face of
642 unknown risks are first based on relatively familiar personal
643 experiences, the impact of risk media coverage and common-sense
644 education, which are often used to estimate the severity and
645 consequences of events and to take into account the impact of

646 unknown risks and consequences (28). However, exaggerated
647 associations or analogies can be misleading in interpreting risk factors
648 and coping strategies. For example, in the study of flash floods risk
649 communication by Lazarus et al., some of the interviewees planned to
650 provide flood control sandbags for each family to make every effort to
651 block the flood outside their house, after viewing the photos of
652 Hurricane Katrina (16). The over-speculation of emergencies may
653 result in negative effects on real threats, including the stealing of daily
654 necessities and vinegar, which occurred in the SARS period
655 (mentioned by 7 of the interviewees).

656

657

658 **Discussion**

659 In general, there was a clear difference in the breadth and depth
660 of the overall understanding of the pandemic-related information and
661 communication framework among each student interviewed. As
662 expected, in the context of communication framework, most of the
663 students' mental models were not as rich as those of the experts, and
664 they were more concerned with the key information necessary to
665 make individual decisions in the interpretation of risk information (i.e.,
666 when to act and in the form of the pandemic: "Now, what kind of
667 impact will it cause, and what kind of protection measures can protect

668 me?"") Most public interviewees only referred to the key concepts in
669 the communication framework, but without a detailed description, or
670 in an inaccurate or unclear manner; therefore, these gaps may reduce
671 the ability of people to manage their own behavior and their
672 compliance with expert opinions. Compared to the communication
673 framework in Figure 2, the interviewees used personal experience and
674 analogies to produce more related concepts to establish the
675 information base they needed to make decisions.

676 *3.1 The causes of misunderstandings*

677 As soon as the human body get infected by flu virus, the related
678 symptoms includes high fever (up to 39 degrees centigrade or higher),
679 muscle aches, etc., accompanied by dry cough and severe fatigue, and
680 complications in the heart and lung systems, particularly in those with
681 low immunity. Among the elderly, infants and young children, this is
682 also an important cause of potential lethality (29). The interview
683 results show that some students do not pay enough attention to the
684 impact of pandemic influenza and remain blind and optimistic,
685 particularly regarding its potential lethality, serious complications,
686 and the identification of vulnerable populations. The trust in the
687 country's sound epidemic prevention system, the desalination of the
688 history of the epidemic, and the lack of targeted health education are
689 the main reasons for the over-optimism of the interviewees.

690 Consequently, the students who have the wrong risk perception will
691 estimate themselves as "strong young people" or "enough
692 understanding of the flu". Once the flu is outbreak, it may also bring
693 misleading information to other individuals in their social circle,
694 which will affect their emergency decisions. In particular, for those
695 who have experienced influenza pandemic without being negatively
696 affected, luck may cause them to have a more positive response to
697 future pandemics (30).

698 Secondly, although the H1N1, H5N1, and other influenza
699 outbreaks have been derived from the new virus from mutation, the
700 repetition of the old virus and the prevention of the flu season still risk
701 becoming a pandemic (26). Therefore, for college students, paying
702 attention to the prevention of common seasonal influenza and
703 simultaneously being able to distinguish the key differences from the
704 pandemic can effectively improve the level of personal risk cognition.
705 Among the interviewees, we found that some students were still
706 confused about the concepts of pandemic and seasonal influenza: they
707 believed that a pandemic is the mass spread of seasonal influenza or
708 that a pandemic is an almost impossible "super calamity", when in fact
709 a pandemic cannot be completely avoided. Moreover, a pandemic is
710 often unpredictable and generally involves international diffusion.
711 Therefore, it is important to understand that the pandemic is not far

712 away from us. We must pay attention to our own prevention during
713 the flu season and have a certain understanding of the symptoms of an
714 abnormal cold, particularly when traveling abroad; otherwise, the
715 patient may mistake their symptoms for a common flu. Medication has
716 delayed the timing of diagnosis and treatment, resulting in serious
717 consequences.

718 Finally, about the vaccination, our interviewees have negative
719 views about that. Only 2 of the 28 interviewees mentioned the
720 importance of the vaccine and had a history of active vaccination, and
721 the reasons mainly focused on the conventional "I feel good and don't
722 need vaccination", "not knowing about the importance of vaccine", and
723 "Doubts about the safety of vaccines". In fact, the extremely low
724 vaccination rate of influenza vaccines in China, the low vaccination
725 rate is a long-standing problem. Therefore, our risk communication at
726 present seems inadequate in promoting the necessity of vaccination,
727 and the public is not aware of the importance of the vaccine for
728 influenza prevention or the misperceptions caused by its one-sided
729 understanding of the pandemic, as discussed in 2.4. In the
730 investigation of the willingness of the elderly to be vaccinated, Geng
731 Shaoliang (31) found that the main sources of influenza and related
732 knowledge in the elderly were family, relatives, friends and television,
733 and the most trusted means of knowledge were doctors. There are

734 cracks in clinical and public health knowledge, and clinicians lack
735 knowledge on the importance of vaccination. Many doctors have
736 reservations regarding vaccinating the elderly, and the rate of
737 influenza vaccination for medical staff is not sufficiently high.
738 Therefore, the correction of this misunderstanding is important for
739 both college students and because it can promote the dissemination of
740 inoculation knowledge of young students in the family, thus promoting
741 the inoculation rate of the recommended group (the elderly and young
742 children).

743 *4.2 The defect of individual mental model*

744 As discussed in section 2.5, in the absence of relevant knowledge
745 and information, the interviewees applied personal experiences and
746 analogies to make up the foundation of their mental model and to help
747 themselves understand the risk of the pandemic. Understanding
748 differences in causality between risk factors can also lead to important
749 differences in risk perception and coping between individuals (32).
750 Many students only know a few general concepts and have not yet
751 formed a complete emergency preparedness mode of thinking in
752 communication framework, knowing what you can do during the
753 pandemic, but not much about what to do and what is truly meaningful.
754 For example, although almost all interviewees mentioned wearing
755 masks and bringing in patients in time for medical treatment, the most

756 basic measures can be limited in the presence of a real pandemic,
757 which is only a result of a personal experience analogy (compared to a
758 cold or related disease). The expert opinion indicates that in the period
759 of the pandemic, suspected patients should first undergo home
760 isolation observation to avoid causing infection while receiving
761 medical treatment or engaging in activities, and relatives and friends
762 should avoid contact with them as much as possible. In addition, most
763 interviewees have only basic concepts (the government, the health
764 department) regarding the types of communicators, who provides the
765 relevant risk information, how to access these channels, etc. These
766 overly broad understandings may limit their ability to identify critical
767 information quickly or influence their knowledge of certain
768 information under the threat of serious flu, particularly when their
769 usual sources of information or communication channels are not
770 available or the necessary information is not provided, such as the
771 presence of a new influenza virus. In a short period of time, officials
772 are unable to give exact messages or be out of protection from the
773 spread of information. Public trust in official authority may be reduced.
774

775 *4.3 The traditional publicity requires improvement*
776 As a young generation, college students enjoy new things, with the
777 rapid and diversified development of the current social information

778 dissemination mode. Therefore, emergency workers must change the
779 form and content of influenza health education. Students prefer health
780 education with new forms and systematic content. The appeal of
781 traditional lectures and guideline book full of scientific word is far less
782 attractive, and it is hoped that the government will "reduce the over
783 generality of the description" and "release relevant data to increase
784 persuasion" in future communication work. Foltz's research confirms
785 that it is necessary to use a variety of mechanisms in the risk
786 communication of emergencies. People with nonprofessional
787 backgrounds tend to think in more specific terms, their vocabulary is
788 less expansive, and subtle expressions cannot be well understood.
789 They are easily attracted by bright colors and charts. Complex text
790 information transmission will make people feel tired and irritable (33).
791 If possible, 2 student interviewees also suggested that students can
792 organize practical exercises, such as self-sterilizing in family homes or
793 dorms, which they think is more helpful to deepen the impression and
794 understand some of the self-protection measures used to cope with
795 the pandemic.

796 For advice on pandemic influenza health education and risk
797 communication, we should let students know which government
798 departments can help them. The study results of Garrett et al. show
799 that information consistency is the decisive factor in understanding

800 and perceive personal risk. In terms of communication effectiveness,
801 multiple sources of consistent messages are usually more effective
802 than messages from a single source or with different contents. The
803 earlier the warning people receive and the greater the threat of
804 information, the greater the possibility that people take active
805 preventive measures (34). Based on the results of this study, the
806 students have a certain ability to identify unofficial risk information.
807 The probability of being affected by rumors at the early stage of the
808 pandemic was not significant. If the official information publishers of
809 the pandemic are able to understand them, they can obtain relevant
810 information according to their own needs and improve their official
811 information, creating a degree of trust in the authority. Therefore, the
812 government department can refer to the communication content
813 proposed by the research institute to incorporate the risk information
814 required by the student group into influenza warnings and
815 information communication, including the relevant situational
816 information and the proposed measures, and maintain the consistency
817 of multiple communication messages. These messages can be used not
818 only for the notification of influenza warnings but also for the warning
819 of influenza to provide support for follow-up long-term public health
820 education.

821

822 Conclusion and Proposal

823 As an emergency communicator, the goal of government is to
824 integrate the expertise of medicine, epidemiology, behavior, and
825 statistics into the information and concepts that can be understood by
826 the public. Although the current related studies are mostly descriptive,
827 the quantitative evidence-based assessment of the risk
828 communication of emergencies may occur with the standardization of
829 the practice and the expansion of the ability to determine whether the
830 message is transmitted to the designated group and the extent to
831 which the population will apply and understand the information. After
832 SARS, China put significant attention on the prevention and control of
833 large-scale infectious diseases. However, studies of risk
834 communication remind improved. Through personal interviews, our
835 researchers explored the "risk cognition boundary" of Beijing college
836 students regarding pandemic influenza and clarified how students
837 understand information on the pandemic and what they are most
838 concerned about. Although they may know a bit about the SARS
839 epidemic in history, there are many problems regarding the potential
840 risk of pandemic influenza in the future, which our communicators
841 must pay attention to and solve.

842 Unlike many other catastrophic events, the pandemic influenza
843 does not directly affect the normal operation of university. Although

844 the related hardware facilities will not be damaged by the disaster.
845 College students, who leave home for a long time to live independently,
846 will be hard to continue with their studies and take care of their lives
847 simultaneously under the threat of sudden flu outbreak. Therefore, a
848 college pandemic influenza plan is necessary. In addition, as a risk
849 communicator, the government department releases related risk
850 information on pandemic influenza in the form of a reference plan. It
851 can effectively bridge the gap between the public and experts on the
852 understanding of influenza risk information and ensure the
853 effectiveness of communication for the long and short term.

854 According to the study result we suggested that pandemic risk
855 communication should focus on the following aspects: ① influenza
856 virus variation (particularly the influenza A virus) and seasonal
857 influenza have the potential to evolve into a pandemic, and the
858 prevention of common influenza cannot be ignored; ② the impact of a
859 pandemic is often unprecedented; influenza virus infection can be fatal,
860 but it also results in serious complications in addition to severe cold
861 symptoms; ③ influenza vaccination has a positive effect on the
862 prevention of a pandemic and should be actively administered,
863 particularly in young children with low immunity and elderly people;
864 and ④ for suspected patients, the first preventative measure is home
865 isolation, and the protection of the family members is important

866 because it is very dangerous to keep in close contact with them. The
867 key to improving the ability to handle public health emergencies is to
868 master the common sense of influenza preparation and the correct
869 personal response and to understand the degree of risk in the region
870 and the individual's pandemic response plan. In addition, to help
871 people understand information and enhance the compliance of certain
872 coping strategies, we can try to provide some "rules of thumb" (35)
873 from experts to help the public to infer the conclusion of the unknown
874 disease. Moreover, the local health and epidemic prevention
875 department, as an authoritative communicator and decision-maker,
876 can also give schools certain support for health care during the
877 pandemic, such as the use of the network for remote health education
878 or local radio or television stations to guide the students to respond to
879 the work.

880 In order to solve the key gap in public understanding of the risk of
881 pandemic influenza and the response to protection. In emergencies,
882 people can observe the reality of the epidemic but do not know how to
883 find more information about warnings. It is necessary to apply various
884 ways and mechanisms to run publicity. We suggest that the
885 government strengthen the application of new media such as micro-
886 blog and WeChat to adapt to the preference of information acquisition
887 for young people and release early warning information quickly and

888 promptly. Second, in the form of publicity, traditional lectures can be
889 gradually changed to new formats, such as public service films, songs,
890 and situational construction experience. These examples can apply
891 visual and auditory stimuli, not only to provide a new method of
892 communication to the audience but also to avoid the
893 misunderstanding of the information. Scenes created by a video can
894 enhance the personal experience and facilitate the referencing of the
895 analogy to the individual in a risk event, allowing them to make the
896 right risk assessment and response behavior.

897

898

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904

905

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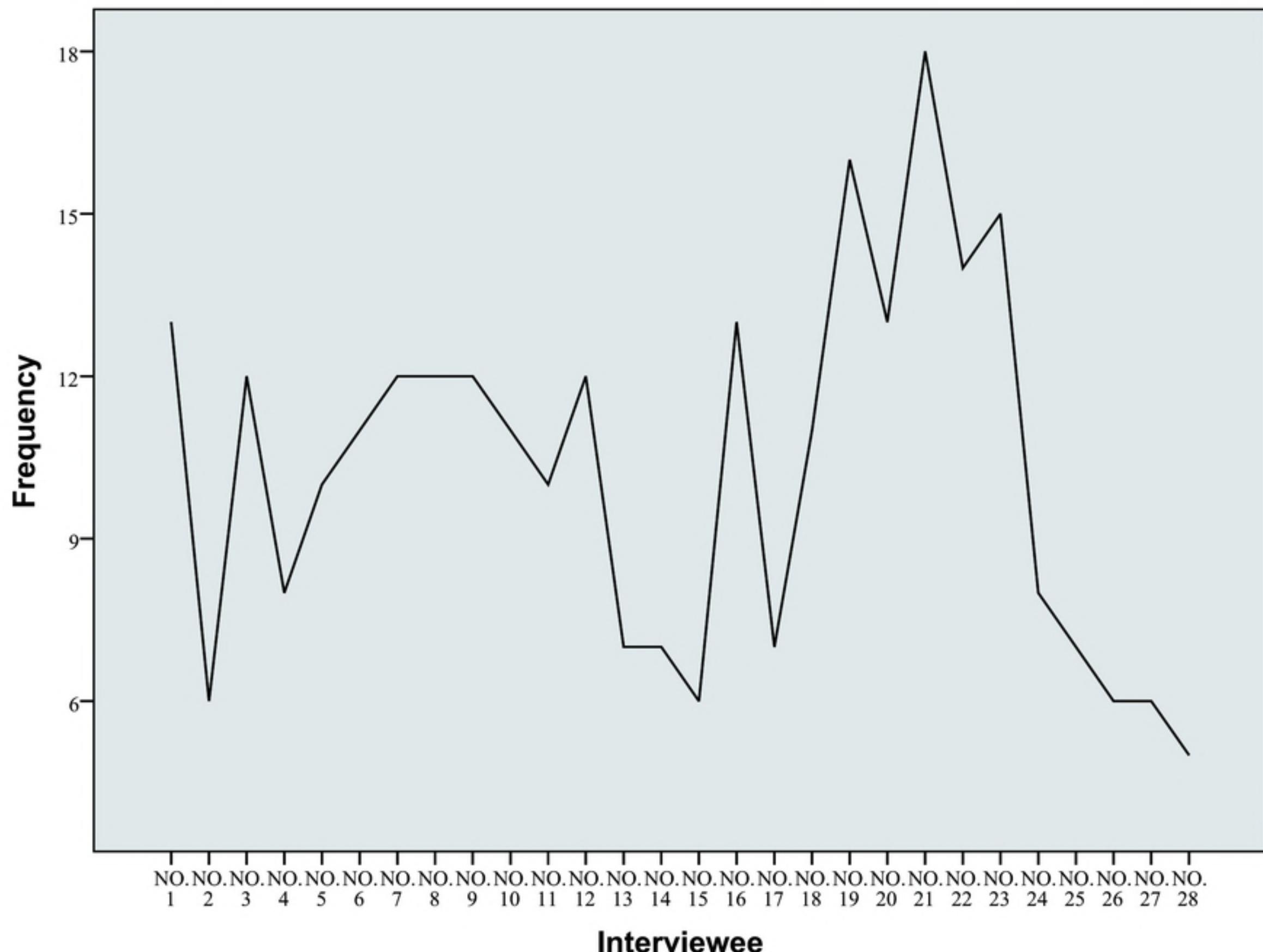


Fig.2

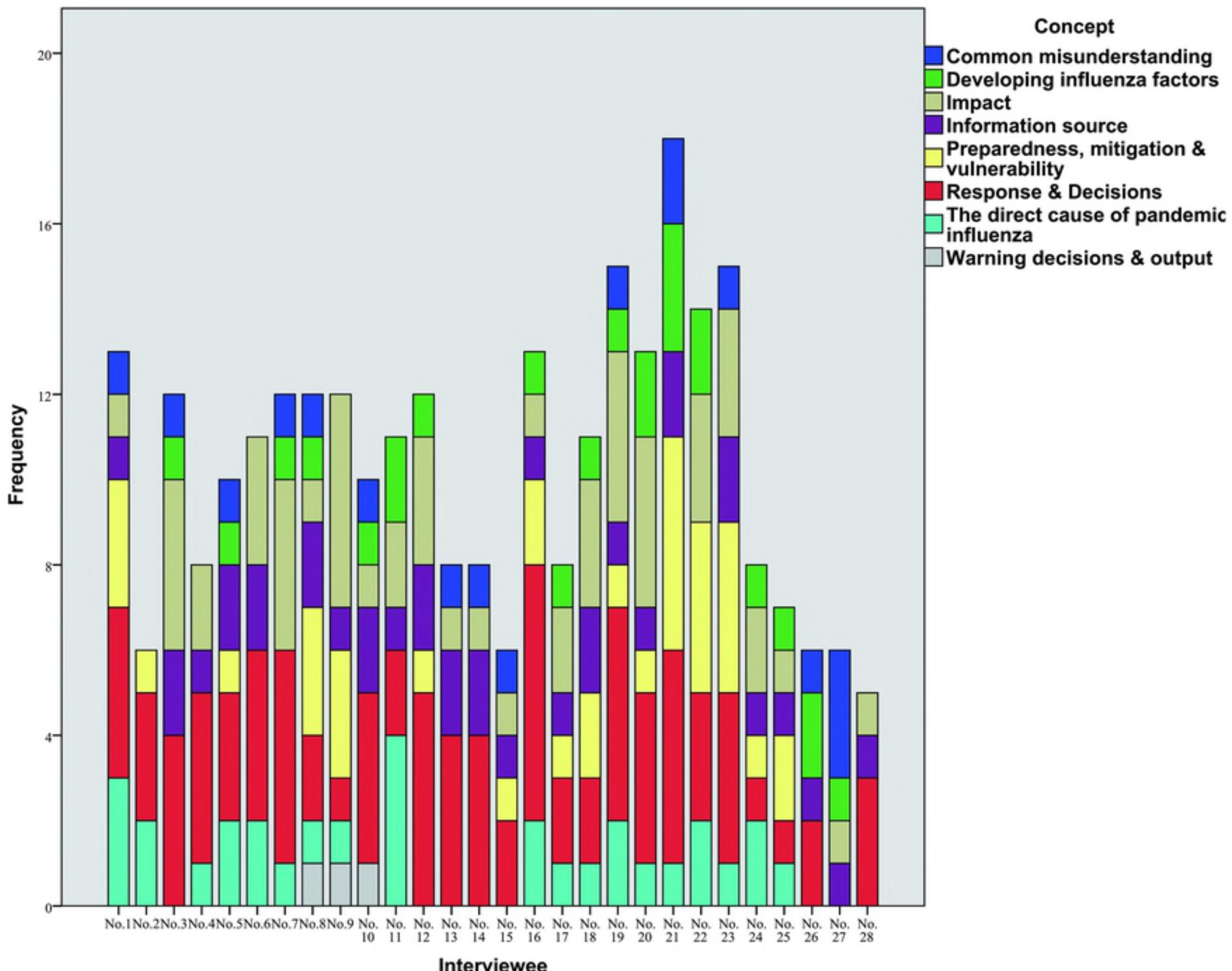


Fig.4