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1 **Exploring vaccination coverage and attitudes of Health Care Workers towards**
2 **influenza vaccine in Cyprus.**

3

4 **Abstract:**

5 Seasonal influenza is a major public health problem. Nosocomial influenza is
6 particularly concerning as it may affect patients at high risk for complications.
7 Unvaccinated health care workers (HCWs) are an important source of nosocomial
8 influenza and therefore a priority target group for vaccination. Despite the fact that
9 some European countries have high coverage rates such as UK (76.8% in season
10 2020/21), , others continue to have low coverage rates for influenza vaccines. . This
11 study aims to estimate vaccination coverage in HCWs in Cyprus, an island country
12 located in the Eastern Mediterranean region and describe their attitudes towards
13 influenza vaccination.

14 **Methods:** This is a questionnaire based, nation-wide study assessing flu vaccination
15 coverage in 2019-2020 and attitudes related to vaccination acceptance, of 962
16 HCWs in both public and private health care facilities. Multivariable logistic
17 regression was used to investigate factors associated with flu vaccination status.

18 **Results:** Flu vaccination coverage was estimated as 31.8%. The top two reasons for
19 getting vaccinated were to protect their family (81,4%) and themselves (77.4%). The
20 top two reasons for not getting immunised, besides “no particular reason” (25.7%),
21 included disbelief for vaccine effectiveness (21.5%) and safety (29.3%). The
22 regression model showed that doctors compared to nurses had 10 times the odds of
23 being vaccinated. Other factors positively associated with flu vaccination were
24 encouragement by the supervisor, having sufficient knowledge on flu and flu
25 vaccination and easy access to vaccination. A percentage of 54.8% of participants

26 stated that COVID-19 pandemic strongly or somewhat influenced their decision to
27 get vaccinated.

28 **Conclusion:** Flu vaccination coverage in HCWs in Cyprus is rather low, similar to
29 some other European countries. Barriers and facilitators in this study can be
30 considered in strategies to increase flu vaccination uptake. Such questionnaire-
31 based surveys should be repeated in order to evaluate effectiveness of targeted
32 vaccination campaigns.

33

34 **Keywords:** Health care workers, influenza vaccine coverage, attitudes

35

36 **1.Introduction**

37 Seasonal Influenza is a major public health problem with 3-5 million of people
38 becoming infected every year. It has been estimated that 250,000 to 500,000 people
39 die from the disease and its resulting complications annually (1). Severity and
40 mortality are greater in patients belonging to high-risk groups such as the
41 immunocompromised and people suffering from chronic respiratory, cardiovascular or
42 renal disease (2). Substantial morbidity, absenteeism from work and lost productivity
43 can also occur in non- high-risk group patients contributing significantly to the total
44 burden of the disease. In a study that was published in 2018 the estimated economic
45 burden of influenza to the healthcare system in the USA in 2015 was 3.2 billion USD
46 and when lost productivity was included the economic burden was as high as 11.2
47 billion USD(3). Nosocomial influenza and infection outbreaks in health care facilities
48 can pose a great risk for patients, who usually belong to high-risk groups for
49 complications(4–6). Unvaccinated healthcare workers (HCWs) are an important

50 source of nosocomial influenza. Influenza outbreaks can also cause substantial
51 morbidity to health care providers(2,7,8).

52

53 The World Health Organization (WHO) considers flu vaccination to be the most
54 effective strategy for preventing influenza virus infection and health care providers to
55 be a priority target group for seasonal influenza vaccination. HCWs are at higher risk
56 of influenza infection than the general population and hence pose a higher risk for
57 transmission of the virus to their patients. In addition, influenza infection may also lead
58 to increased absenteeism and disruption of medical services especially during the
59 influenza season. Therefore, vaccination of HCWs protects both HCWs and their
60 vulnerable patients, but also helps to maintain functionality of health care services
61 during time of need. Furthermore, HCWs who choose vaccination are more
62 knowledgeable about vaccination and likely more effective in persuading other people
63 to vaccinate themselves thus improving public acceptance of vaccination (6).

64

65 The World Health Organization in 2003 has set the goal of annual flu vaccination
66 coverage in older age groups and other risk groups to be at least 75% and EU council
67 has adopted this target in 2009 Recommendations on Seasonal Influenza
68 Vaccination(9,10). However, this percentage has not been achieved to date in most
69 countries around the world (6,11). AnECDC survey performed in 12 Member States in
70 2016-17, reported great variation of vaccination coverage among different European
71 countries, ranging from 15.6% in Italy to 63.2% in Belgium (median 30.2%)(11). More
72 recent data show that in some countries such as the UK, vaccination coverage rate
73 have increased even further reaching 76.8% in 2020/2021 while in Greece continue
74 to be lower than expected (38.% in hospitals and 57.9% in primary health center in
75 2019-2020)(12,13)

76

77 The Ministry of Health in Cyprus, as the responsible authority in health matters,
78 following the WHO and ECDC recommendations, designate the HCWs as a priority
79 group for yearly flu Vaccination. Since the establishment of the National Health System
80 in 2019 vaccination has been voluntary and free for all HCWs in the country. For HCWs
81 who work in Public Sector flu vaccination is provided at their work place with annual
82 reminder for the vaccination. For HCWs working in Private Sector free flu vaccination
83 is available at their GP in the General Health System of Cyprus. Some big private
84 hospitals or health organizations may offer flu vaccination for their HCWs also at their
85 places of work.(14)In Cyprus there are no previous data regarding the influenza
86 vaccination coverage among HCWs. This is the first study to assess the vaccination
87 coverage among this population group. The study also explores knowledge, attitudes,
88 and practices related to influenza vaccination among HCWs. It aims to identify reasons
89 for which HCWs choose not to get vaccinated in order to inform a strategy on how to
90 increase vaccination uptake among HCWs. Further to these, the impact of COVID-19
91 pandemic on their decision to be vaccinated by influenza vaccine is also investigated.

92 **2. Methods**

93 *2.1. Study population and design*

94 This is a nation-wide survey, that was conducted among HCWs in Cyprus who worked
95 in private or public sector and either worked in primary or secondary health care
96 services. The survey covered the population residing in the area under the control of
97 the Republic of Cyprus. The survey was conducted between July 2020 and November
98 2020, using a structured questionnaire to determine the vaccination coverage,
99 knowledge and beliefs regarding influenza disease and flu vaccine among HCWs.

100 The questionnaire was distributed both as an online questionnaire and as printed
101 version and participants were carefully instructed to complete it only once. The online
102 questionnaire was developed using the google form platform and was sent by email
103 to every doctor and nurse that are currently working in Cyprus and are registered
104 members in their Professional Associations (Cyprus Medical Association and Cyprus
105 Nurses and Midwives Association). The printed version of the questionnaire was
106 offered to all personnel of the six larger hospitals of the public sector and in 3 out of
107 the 5 larger hospitals of the private sector by the infection control nurses. A total of
108 8581 questionnaires were distributed to HCWs either online or in printed version.
109 Participants were asked not to complete the paper form of the questionnaire if they
110 had already or were planning to complete the online version.

111

112 For the study population of HCWs the definition of HCW according to the Centers for
113 Disease Control and Prevention(CDC) was used, where a Health Care worker is
114 defined as anyone who works in a health care facility center and can potentially be
115 exposed to infectious agents that can be transmitted to and from patients or
116 visitors(15). According to the 2017 Report of Statistical Services of the Republic of
117 Cyprus, in the Government controlled area, there are overall, 5475 HCWs working in
118 the public sector and 4699 HCWs working in the private sector. As far as health care
119 services in Cyprus, there are 9 public hospitals with 1562 beds (six large and 3 smaller
120 ones), and 73 private hospitals with a total of 1406 beds (of which 5 large and the rest
121 are much smaller in bed size). Both sectors, private and public, have structures for
122 primary and secondary health care services(16).

123

124 A sample size was calculated using online Raosoft Size Sample Calculator(17). A
125 minimum sample of 280 participants out of 10174 population of HCWS was calculated

126 to provide an estimate of vaccination coverage with confidence level of 95%, a margin
127 of error of 5% and an expected flu vaccination coverage of HCWs for 2019-2020 set
128 at 24.9% and a minimum sample of 357 participants when the vaccination coverage
129 was set to 40.2%(18). Since this is the first attempt to calculate the annual flu
130 vaccination coverage among HCWs in Cyprus, the latest vaccination flu coverage
131 estimate among HCWs working in hospitals (24.9%) and primary health care
132 centers(40.2%) in Greece was used, since Greece is a neighboring country with
133 common language, religious beliefs and common cultural and social influences(18).

134

135 *2.2. The questionnaire*

136 The questionnaire was a self-administered, anonymous, 2-page structured
137 questionnaire that captured information under the following sections: (1) knowledge
138 regarding influenza illness and flu vaccine, (2) beliefs about flu vaccination according
139 to health belief system, (3) vaccination status for 2019-2020 and reasons for choosing
140 to get flu vaccination or not (4) ease of access of flu vaccination at their workplace (5)
141 demographic characteristics. An English version of the questionnaire is included in
142 the supplementary info.

143

144 The study was approved by the National Bioethics Committee of Cyprus and
145 participants were informed about the purpose of the survey and that their participation
146 was voluntary and anonymous.

147

148 *2.3. Statistical analysis*

149 Statistical analysis was performed using the R statistical software. Microsoft Excel was
150 also used to create some graphs. Descriptive statistics were generated for every
151 question in the survey. The confidence intervals (CIs) for proportion were calculated

152 using an Exact Binomial Test. Chi square test (χ^2) was used for univariable analysis
153 of the effect of each factor on the vaccination status of HCWs. Variables with a p-value
154 of less than 0.15 were considered for inclusion in a multivariable logistic regression
155 model. The vaccination status of HCWs in 2019-2020 was used as the dependent
156 variable of the model, while the independent variables were the different factors that
157 can influence the vaccination status among HCWs. Manual forward variable selection
158 was used to choose the final model.

159

160 **3. Results**

161 The following section includes our results regarding flu vaccination coverage in HCWs
162 and vaccination coverage according to their professional identity (e.g. doctors, nurses)
163 and workplace. In that same section the impact of Covid-19 pandemic on the intention
164 of HCWs to be vaccinated for 2020-2021 was explored. Additionally, the perceptions
165 of HCWs regarding flu vaccination and their behavioural determinants are
166 investigated. Lastly, the factors that are associated with HCWs flu vaccination status
167 are investigated through a multivariable logistic regression model.

168 *3.1. Characteristics of participants and workplace*

169 A total of 962 HCWs responses were obtained. These were composed of 190/962
170 (19.8%) doctors, 538/962 (55.9%) nurses and 207/962 (21.5%) of other health care
171 staff (non-doctors, non-nurses). The characteristics of HCWs that participated in the
172 survey are summarized in Table 1. The vast majority of respondents worked in
173 hospitals, with only 11.4% working in primary health care centers and two thirds of
174 participants were female.

175

176 Table 1. Characteristics of HCWs in the survey (N=962)

Characteristic	N	Percent %	Missing N (%)
<i>Occupational category</i>			27(2.8)
Physicians	190/962	19.8	
Nurses	538/962	55.9	
Administrative personnel	72/962	7.5	
Support staff ¹	81/962	8.4	
Allied health professionals ²	23/962	2.4	
Technical personnel ³	31/962	3.2	
<i>Age</i>			28(2.9)
<35	352/962	36.6	
35-50	359/962	37.3	
>50	223/962	23.2	
<i>Duration(years) of work in healthcare sector or in the present work</i>			35(4.6)
<5	192/962	20.0	
5-10	197/962	20.5	
10-20	267/962	27.8	
>20	271/962	28.2	
<i>Sex</i>			54(5.6)
Female	640/962	66.5	

Male	268/962	27.9	
<i>Workplace</i>			33(3.4)
Primary health care centers	110/962	11.4	
Hospitals	819/962	85.1	

1. Clinical assistants, Patient services assistants, Porters, Students, unspecified
 2. Physiotherapists, Paramedics, Phlebotomists, Health Visitors
 3. Maintenance, repair personnel
-

177

178

179

180

181 3.2. Vaccination of HCWs

182 The average vaccination coverage among health care workers in Cyprus for 2019-
 183 2020 was estimated as 31.8% (95% CI 28.8%-34.9%). Doctors appear to have a much
 184 higher vaccination coverage 68.9% (95% CI 61.8%-75.4%) in comparison to other
 185 HCWs (Nurse's vaccination coverage 20% (95% CI 16.7%-23.7%), other health care
 186 staff vaccination coverage 29.8% (95% CI 24.6%-36.5%))

187 Regarding workplace, people working in hospital Pediatric wards and in Intensive
 188 Care Units had the highest vaccination coverage (43.8% and 38.2% respectively). As
 189 regards Primary Care, the flu vaccination coverage for the year 2019-2020 was the
 190 highest among all the other departments and was calculated to be 46.6% It is
 191 important to notice that the sample from primary care included a higher percentage of
 192 doctors (56.4%) in comparison to the whole sample population (19.8%) and this
 193 maybe an important reason for which the coverage rate in Primary Care was higher

194 than the other departments (Supplementary Table 1). Among 293/962 (8 missing)
195 HCWs vaccinated on 2019-2020, 75 (25.6%) had a medical indication for flu
196 vaccination. Out of total 125/962 persons in our study who had a medical indication
197 for flu vaccination, only 75 (60.0%) chose to be immunized for 2019-2020. A
198 substantial percentage of HCWs (41.5%) in Cyprus never had the flu vaccine.
199 Regarding consistency in vaccination explored in the last five years it was found that
200 only 10.4% of HCWs were vaccinated in all 5 years. From those, 57% were doctors,
201 33% were nurses and 10% other health care staff.

202

203 *3.2.1. Intention of vaccination for 2020-2021 and COVID-19 pandemic*

204 In the question regarding the intention to get the flu vaccine for the next year (2020-
205 2021) 478/950 (50.3%) of HCWs answered that they plan to get vaccinated. In
206 comparison between the two years 278/298 (93.3%) of HCWs who were vaccinated
207 in 2019-2020 planned to get vaccinated also in the coming year (2020-2021) and
208 197/641 (30.7%) who were not vaccinated in 2019-2020 planned to get vaccinated in
209 2020-2021.

210 HCWs were asked how much did COVID-19 pandemic influence their intention to get
211 vaccinated against flu in 2020-21. 270 out of 951 participants (28.4%) stated that
212 COVID-19 was a strong motivation for getting influenza vaccine, while 251 out of 951
213 (26.4%) stated that COVID-19 somewhat influenced their decision. On the other hand,
214 430/951 (45.2%) answered that the pandemic did not affect their decision at all.
215 Among persons who stated that their decision was strongly influenced by the
216 pandemic, 210/267 (78.7%, 3 missing) HCWs planned to get vaccinated for 2021.

217

218 Table 2. Vaccination coverage for year 2019-2020 among different groups of HCWs
219 and departments.

Vaccinated group (N vaccinated/N total)	Vaccination coverage (%)	95% CI
<i>HCWs groups (N=947missing 15)</i>		
All HCWs (301/947)	31.8	28.8-34.9
Doctors (131/190)	68.9	61.8-75.4
Nurses (106/529)	20	16.7-23.7
Other health care staff (61/205)	29.8	23.6-36.5
Missing (3/23)	13.0	2.8-33.6
<i>Hospital departments (N=725 missing 237)</i>		
Primary Care (51/110)	46.4	
Pediatric Department (35/80)	43.8	
ICU/NICU/PICU ¹ (34/89)	38.2	
Internal medicine department (25/91)	27.5	
Emergency Room department (9/37)	24.3	
Surgical department (22/119)	18.5	
Gynecology department (6/50)	12.0	
Other hospital departments ² (63/162)	38.9	

1. Intensive Care Unit, Neonatal Intensive Care Unit, Pediatric Intensive Care Unit

2. Lab, Operating theater, Administration, Hematology department, Cardiology department, Ophthalmology department, School, Orthopedic department, Pulmonology department, Neurology department, Pediatric- Oncology department, Oncology department, other

220

221

222

223 The percentage of presenteeism (presented at work while having influenza like
224 symptoms) for HCWs in Cyprus was calculated to be 42.6% (405/950) and 66.2%
225 (263/397 missing 8) of them were not vaccinated for the year 2019-2020.

226

227 *3.2.2. Perceptions of HCWs regarding flu vaccination. Behavioral determinants.*

228 Exploring the reasons for choosing or not the flu vaccine among HCWs is very
229 important, since it can help us to better understand and address the problem of low
230 vaccination coverage among them. In Figure 1 we summarize the reasons for
231 choosing vaccination for the 301 HCWs who stated that they received flu vaccination
232 during 2019-2020.

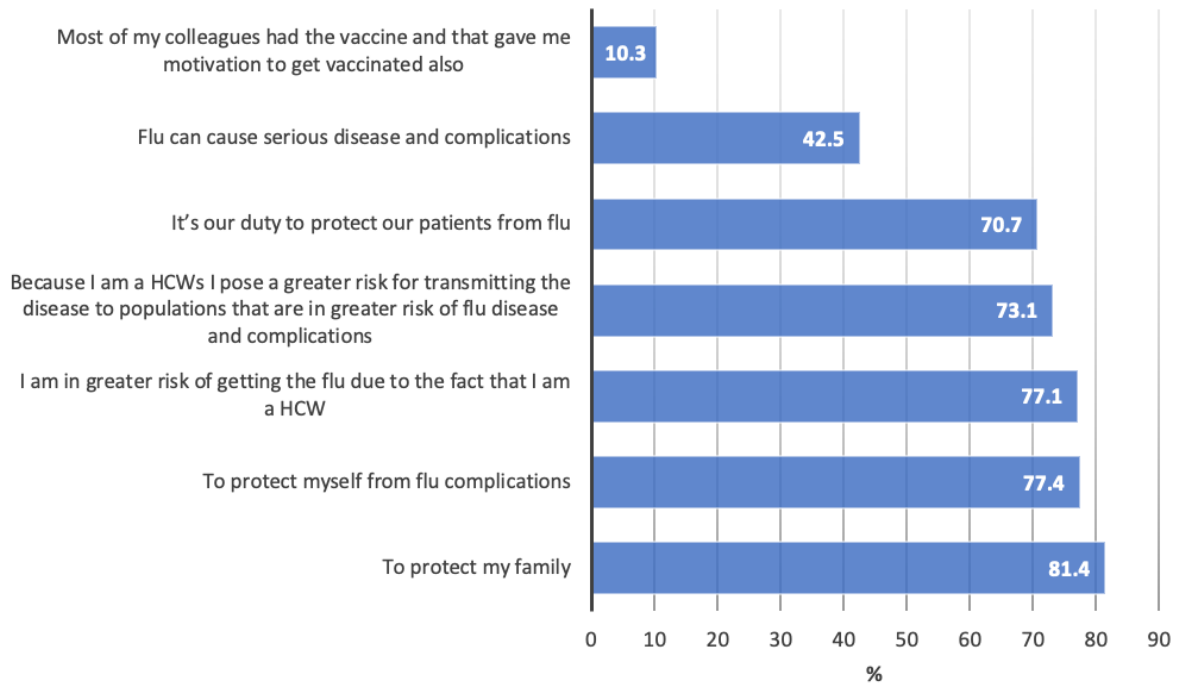
233 *3.2.2.1 Reasons for choosing to get the flu vaccination*

234 The top three reasons for choosing vaccination were to protect their family and
235 themselves as well as because they believe that HCWs are at greater risk of getting
236 the flu. These reasons were closely followed by choosing vaccination in order to
237 protect their patients which was mentioned by 70.7% of the participants.

238 Between female and male participants there were different reasons for choosing
239 vaccination. In male HCWs the main reasons for getting vaccination were firstly
240 because they believed they were in greater risk of getting the flu and secondly because
241 it was their duty to protect their patients. The female participants were more concern
242 about protecting their family and their selves from flu complications (Supplementary
243 Figure 1). As regards the different work groups, doctors most frequently chose to get
244 vaccinated because they considered themselves at greater risk of getting the flu and
245 because it was their duty to protect their patients. In the other two groups the most
246 common reasons were to protect their family and themselves (Supplementary Figure
247 2). As regards Primary Care the most common reasons for getting vaccinated were

248 their duty to protect their patients and because of their greater risk for getting flu
249 (Supplementary Figure 3).

250



251

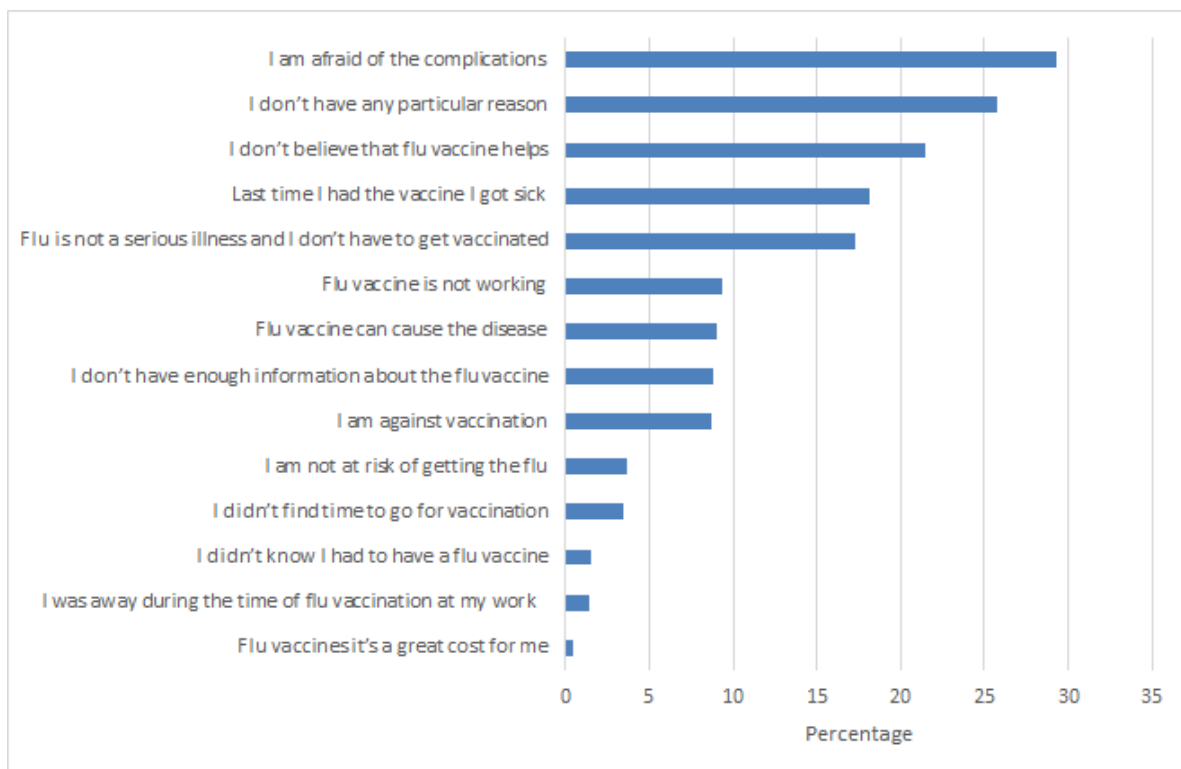
252 Figure 1. Reasons for receiving flu vaccination for HCWs who chose to get
253 vaccinated on 2019-2020 (N=301)

254

255 3.2.2.2 Reasons for choosing not to get vaccinated

256 The reasons for choosing not to be vaccinated for the 646 HCWs who did not get the
257 flu vaccine in the 2019-2020 are depicted in Figure 2. Among them, 166 (25.7%)
258 stated that they chose not to get vaccinated for no apparent reason. Other frequent
259 reasons included their disbeliefs for the safety and effectiveness of flu vaccine and
260 also their belief that flu is not a serious illness.

261 Between males and females the two most frequent reasons in both groups were
262 possible side effects and also for no particular reason (Supplementary Figure 4). As
263 regards different professional groups, the fear for complications was the most
264 common reason among doctors and other HCWs, while nurses most commonly were
265 not vaccinated for no particular reason (Supplementary Figure 5). In Primary Care
266 sector, the most common reasons for not choosing flu vaccination were for no
267 particular reasons, the fear of complications and because they did not consider flu
268 as a serious illness(Supplementary Figure 6).



269

270 Figure 2. Reasons for not undergoing flu vaccination of HCWs who didn't choose to
271 get vaccinated on 2019-2020 (N=646)

272

273 Table 3. Univariable analysis of the association of several potential factors with flu
 274 vaccination status of HCWs for the year 2019-2020 (Chi squared test), (N = 947,
 275 missing 15)

	Vaccination coverage % (N vaccinated/N total)	X ² P Value
<i>Worktime duration(years)</i>		<i><0.001</i>
<5	27.7% (53/191)	
5-10	31.8% (62/195)	
10-20	24.0% (63/263)	
>20	44.2% (117/265)	
Unknown	18.2% (6/33)	
<i>Age (years)</i>		<i><0.001</i>
<35	22.7% (79/348)	
35-50	32.0% (113/353)	
>50	46.4% (102/220)	
Unknown	26.9% (7/26)	
<i>Sex</i>		<i>=0.109</i>
Female	30.8% (195/634)	
Male	36.0% (95/264)	
Unknown	22.4% (11/49)	
<i>Level of Education</i>		<i><0.001</i>
Primary education	22.7% (5/22)	
Secondary education	27.4% (20/73)	
Academic degree	26.8% (109/407)	
Post-graduate degree	35.9% (132/386)	
Doctorate	61.9% (26/42)	
Unknown	25.7% (9/35)	
<i>Work group</i>		<i><0.001</i>
Nurses	20.0% (106/529)	
Doctors	68.9% (131/190)	
Other HCWs	29.8% (61/205)	
Unknown	13.0% (3/23)	
<i>Ease of access</i>		<i><0.001</i>

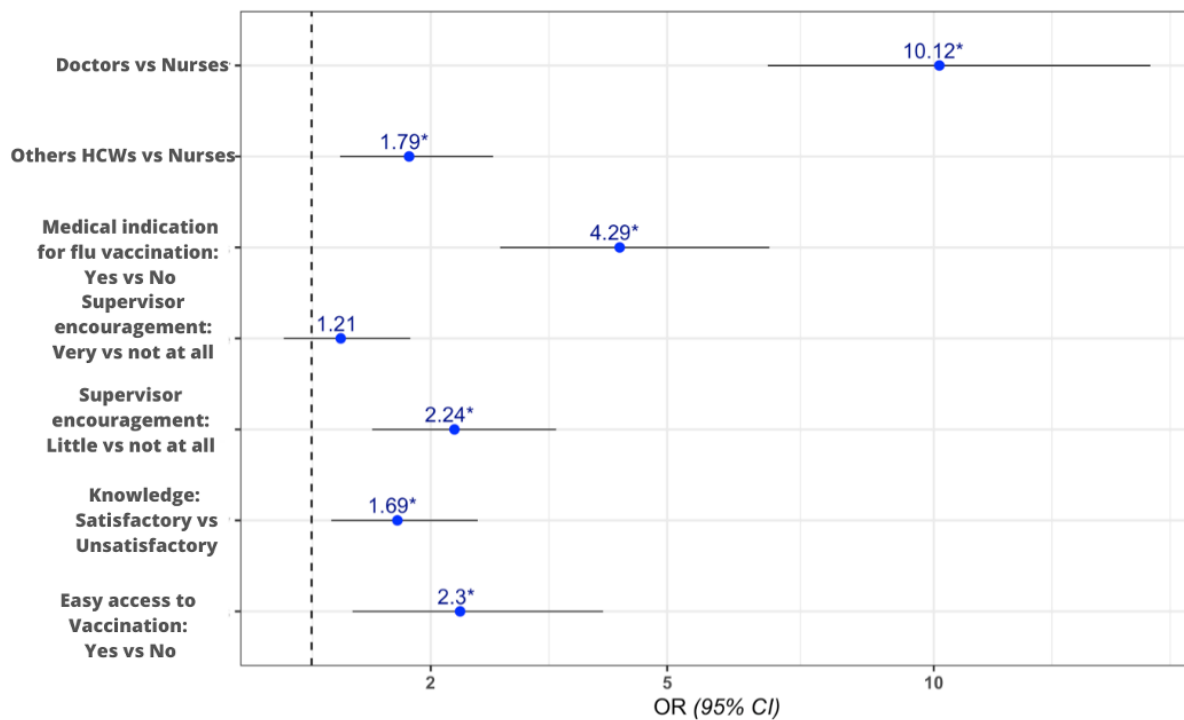
Yes	33.9% (253/725)	
No	25.0% (30/120)	
Do not know / unknown	17.6% (18/102)	
<i>Free Vaccine</i>		<i><0.001</i>
Yes	34.5% (264/778)	
No	44.4% (24/54)	
Do not know / unknown	17.6% (18/102)	
<i>Reminder for vaccination</i>		<i>=0.003</i>
Yes	34.4% (249/724)	
No	26.5% (40/151)	
Do not know/unknown	16.7% (12/72)	
<i>Supervisor encouragement</i>		<i><0.001</i>
Very	45.7% (113/247)	
Little	29.1% (103/354)	
Not at all	25.6% (83/324)	
Unknown	9.1% (2/22)	
<i>Training-information</i>		<i><0.001</i>
Yes	39.7% (188/474)	
No	24.4% (87/357)	
Do not know / unknown	22.4% (26/2116)	
<i>Medical indication for vaccination</i>		<i><0.001</i>
Yes	60.0% (75/125)	
No	27.9% (215/770)	
Do not know / unknown	21.2% (11/52)	
<i>Level of education regarding flu and flu vaccination</i>		<i><0.001</i>
Satisfactory	36.2% (248/686)	
Unsatisfactory	20.5% (53/258)	

278

279 Table 3 shows the results of the univariable analysis, investigating the association
280 between several risk factors and HCWs flu vaccination status. All factors had a p-
281 value of less than 0.15 and were therefore considered for inclusion in the multivariable
282 analysis.

283 *3.2.3. Multivariable analysis*

284 The final multivariable logistic regression model showing factors associated with
285 HCWs flu vaccination status is shown in Figure 3. Compared to nurses, doctors and
286 HCWs of other groups had 10 times and 1.8 times the odds of being vaccinated
287 against flu, respectively. Additionally, those with a medical indication for flu vaccination
288 had 4 times the odds of being vaccinated compared to those with no medical
289 indication. In terms the effect of the level of supervisor encouragement, compared to
290 those who received no encouragement, those who received a lot of encouragement
291 had 2 times greater odds of being vaccinated. Furthermore, those who had satisfactory
292 knowledge regarding flu and flu vaccination had 1.7 times greater odds of being
293 vaccinated compared to those with unsatisfactory knowledge. Satisfactory knowledge
294 was defined as a score greater than six correct answers out of eight questions,
295 regarding flu and flu vaccination, while unsatisfactory knowledge was defined as a
296 score of five or less correct answers. Lastly, those with easy access to flu vaccination
297 had 2.3 times greater odds of being vaccinated compared to those who did not have
298 easy access. Easy access is defined as the case where the staff was offered the
299 influenza vaccine at their place of work.



300

301 Figure 3. Multivariable logistic regression of factors affecting decision of HCWs to get
 302 vaccinated.

303

304 **4. Discussion**

305 This is the first study to estimate the flu vaccination coverage and investigate factors
 306 associated with the decision to receive flu vaccination among HCWs in Cyprus. We
 307 have conducted a nation-wide survey, including almost 10% of all HCWs in Cyprus
 308 and have estimated that only 1 in 3 HWCs (31.8%) were vaccinated against influenza
 309 in 2019-2020. This coverage is considered low, especially compared to the WHO and
 310 EU Council goal for seasonal influenza vaccination uptake of 75% in older age groups
 311 and other risk groups (9,10). Nevertheless, our estimate is similar to the median
 312 coverage among HCWs from 12 countries in Europe which was recently estimated to
 313 be 30.2% ranging from 15.6% to 63.2% (11). Consistency in vaccination was also
 314 explored for the last five years in our country and showed that only 10.4% (100/962)

315 of HCWs were vaccinated for all 5 years. Consistently vaccinated for all five years
316 were 57/190 (33%) doctors, 33/529 (6.2%) nurses and 10/205 (4.9%) other health
317 care staff who participated in the study. Crucially, almost half (41.5%) of the HCWs
318 reported to have never received a flu vaccine during their career which is very
319 worrying.

320

321 Substantial differences in vaccination uptake between different groups of health care
322 professionals were observed in our study. Doctors were more likely to get vaccinated
323 than nurses and allied health care professionals. This was also noted in a number of
324 other studies and it was suggested that vaccination campaigns for enhancing
325 vaccination uptake, should be profession-oriented and specific(19,20). These
326 differences between the groups of HCWs is believed to be due to different attitudes
327 between them. Those are different beliefs regarding increased risk for influenza,
328 effectiveness and safety of the vaccine, or the severity of influenza infection, with
329 doctors being more informed and therefore more aware of the risks of the disease
330 (21,22). More enhanced and intensive education of nurses and other health care staff
331 on the seriousness of the disease and on the benefits of flu vaccination may prove
332 beneficial in increasing awareness and therefore result in an increase in vaccination
333 uptake. Satisfactory knowledge of education regarding flu illness and flu vaccination
334 was found to have positive effect on vaccination coverage in our study also.

335

336 Perceived barriers against flu vaccination in our study were similar to those reported
337 in other studies. Some of these barriers are difficult to address. The most commonly
338 reported barriers against flu vaccination were the fear of adverse effects and mistrust
339 of the effectiveness of the vaccine. The next most common reason was the belief that
340 flu is not a serious illness and therefore vaccination is not required for prevention.

341 Studies have noted similar barriers as in our study, as they detected fear and mistrust
342 of the vaccine regarding adverse reactions, safety and effectiveness to be the main
343 barriers to vaccination. In addition, lack of knowledge regarding influenza
344 transmission, serious complications and seriousness of the disease were also
345 reported to drive resistance to vaccination. Other barriers reported in the literature to
346 play a role in flu vaccination included organizational and institutional barriers such as
347 vaccine inaccessibility and difficulty to obtain the vaccine (19,23). On the contrary, in
348 our study these barriers did not present to be a big problem since the largest part of
349 HCWs had easy access to free flu vaccine within their institution and were informed in
350 time for the initiation of vaccinations. Only 3.4% of HCWs who did not get the vaccine
351 said that they did not find time to go for vaccination and 1.4% of HCWs said that they
352 were away during vaccination time. An interesting finding in our study, on behaviors
353 and beliefs regarding flu vaccination is that the second most common reason for not
354 accepting vaccination was for no particular reason. One out of 4 HCWs who did not
355 choose to get vaccinated did not have any apparent reason, showing a total lack of
356 concern regarding flu and flu vaccination making it difficult to know how to manage
357 this specific group of HCWs. Also one out of 10 HCWs who did not choose to get the
358 vaccine said that they are against vaccination in general. Both of these vaccination
359 barriers are very difficult to address.

360

361 Regarding reasons for vaccine uptake, the most commonly reported one was to
362 protect family members, which interestingly was more commonly reported than
363 reasons relating to protecting oneself. Protecting their patient was also a commonly
364 reported motivation for receiving vaccination. On the contrary, in a review of studies
365 on attitudes and predictors in 2009, Hollmeyer et al found that the main reason for

366 accepting of influenza vaccination in HCWs was self-protection followed in
367 considerable distance by “protection of patients”, “protection of family members or
368 colleagues”(19). Additionally, in a review and meta-analysis by Vasilevska et al. in
369 2014, consideration of self-protection and desire to protect family and friends
370 appeared to be the main determinant of HCWs for accepting the influenza
371 vaccination(24).

372 Summarizing the positive predictors for receipt of influenza vaccination in HCWs in
373 this study, a multivariable logistic regression analysis of factors revealed that health
374 care profession category -being doctors or other HCWs besides nurses-, education
375 regarding influenza, ease of access, medical indication increasing the risk for flu
376 complications and encouragement by the supervisor, all had a positive effect on
377 vaccination acceptance. This is aligned with other studies, such as a comprehensive
378 critical appraisal of the literature by Dini et al. in 2018, which indicated that doctors,
379 older age, being affected by a chronic disease, receiving adequate knowledge and
380 information, receiving recommendation from a doctor played major role in vaccination
381 acceptance(25). Moreover, having previously had influenza and past influenza
382 vaccinations were predictors of adherence to influenza immunization(25).

383 Limitations and strengths

384 Due to the voluntary nature of our study, it is possible that people who get flu vaccine
385 were more likely to participate and complete the survey than those who did not choose
386 to vaccinate. Therefore, it is possible that the vaccination coverage calculated might
387 be slightly higher than the true value. In addition, the 2018-2019 flu year was a bad flu
388 year for Cyprus with much higher morbidity and mortality than previous years.
389 Therefore, it is believed that vaccination coverage in the year 2019-2020 might have
390 been higher than normally expected due to that factor. Lastly, the number of HCWs

391 that participated in the survey from some specific departments was small making it
392 impossible to have useful estimates of vaccination coverage in those specific
393 departments, so only a grouped estimate is presented. However, the large number of
394 staff that participated from high-risk departments such as intensive care units,
395 emergency departments, internal medicine wards gave reliable results for these
396 important departments hospitalizing vulnerable patients. In addition to this, the fact
397 that this was a national study with participants from all major public hospitals and most
398 of the large private hospitals in Cyprus, gives the study great strength, particularly for
399 presenting a representative picture of the barriers, as well as facilitators of flu
400 vaccination uptake, and attitudes regarding influenza disease and vaccine among
401 HCWs in Cyprus.

402 Conclusion

403 Vaccination coverage among HCWs in Cyprus is rather low, but is comparable to
404 average coverage reported in ECDC 2016-2017 report for HCWs flu vaccination
405 coverage from 12 European countries. Barriers and facilitators revealed by this study
406 should be taken into consideration when designing strategies to increase flu
407 vaccination uptake among HCWs in Cyprus as well as in other countries. Lastly, it
408 would be beneficial to repeat such questionnaire-based surveys frequently in order to
409 follow trends, as well as assess the success of targeted vaccination campaigns in
410 increasing uptake among these very important categories of workers.

411

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413

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425 All authors made substantial contribution to the manuscript. PC, KM and MS
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427 KD, PG contributed to the collection of data. SM did the analysis and interpretation of
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430

431 Appendix A. Supplementary material

432

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