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1 **Public perceptions of the association between drug effectiveness and drug novelty in**
2 **France during the COVID-19 pandemic**

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20 **Abstract**

21 During the COVID-19 pandemic, public debates overtly addressed the promises of new
22 innovative treatments. Many of these debates pitted those who advocated for the
23 development of new treatments by pharmaceutical companies against those who favored
24 the repositioning of existing drugs. Our study explored perceptions of the association

25 between drug novelty and effectiveness as well as perceptions of the role of the
26 pharmaceutical industry in drug development. Data were collected in January 2021 from a
27 quota sample of the French population aged 18–75 years (N = 1,000) during the second
28 round of the “Health Literacy Survey 2019” (HLS₁₉). We tested the hypothesis that
29 individuals with a high level of familiarity with the health care system and those with a high
30 level of trust in institutions are more likely to agree that new drugs are more effective than
31 old ones and that drug development should be driven by the pharmaceutical industry. A
32 quarter (25%) of respondents agreed that new drugs are always more effective than old
33 ones. Agreement with this statement was stronger among respondents with a high level of
34 familiarity with the health care system (as measured by the Navigational Health Literacy
35 score, OR 3.34 [2.13-5.24]) and among those with a high level of trust in pharmaceutical
36 companies or politicians. A high level of trust in pharmaceutical companies was reported by
37 42% of respondents, and 43% agreed that drug development should be driven by the
38 pharmaceutical industry. Respondents who agreed that new drugs are always more effective
39 than old ones were almost four times more likely to agree that drug development should be
40 driven by the pharmaceutical industry (OR 3.85 [2.76-5.39]). A better understanding of public
41 attitudes towards new treatments is needed to elucidate individual preferences in health care
42 and their consequences on health behavior.

43 **Introduction**

44 During the COVID-19 pandemic, the development of new treatments, including vaccines,
45 became a global priority(1,2). Innovative treatments were designed, manufactured, and
46 tested at an accelerated pace. They were also overtly discussed in the media as they
47 became available, sometimes even before their efficacy was robustly validated in clinical
48 trials. Some of the innovations that garnered media attention include mRNA vaccines and
49 the monoclonal antibodies administered to former president Donald Trump for his COVID-19
50 disease. Public debates on how to find a suitable cure pitted two camps against each

51 other(2–4). On the one side were those who advocated for the development of new
52 treatments (such as remdesivir(5)) by pharmaceutical companies. On the other were those
53 who favored the repositioning of existing drugs on the grounds that they are massively
54 available at low cost and that their safety has already been demonstrated. In the particular
55 context of France, the controversy over the effectiveness of hydroxychloroquine against
56 COVID-19 increased the demand for the drug, which carried the risk of adverse
57 effects(6,7) and led to drug shortages for other indications(8). The following question was
58 thus brought to the forefront of public debates: Are new drugs more effective than old ones
59 for the treatment of COVID-19? Insofar as public perceptions of the association between
60 drug novelty and drug effectiveness affect health behavior and drive medical innovation – as
61 illustrated by the issue of vaccine hesitancy(9,10) – it is important that we better understand
62 these perceptions.

63 The success of modern medicine has largely hinged on the development of medical
64 technologies and on their diffusion in the general population. As a result, medical innovation
65 has become central to how modern medicine is perceived and discussed in the
66 media(11,12). Expectations for better and more effective treatments, which underpin health
67 and innovation policies(13), are based on trust in scientific and technological
68 progress(14,15). To fulfill those expectations, most modern democracies have adopted what
69 can be described as the standard model of innovation in medicine. According to this model,
70 academic and clinical researchers and actors of the pharmaceutical industry must
71 collaborate to achieve new effective therapeutic solutions under the regulation of state
72 agencies(16–19).

73 The standard model of innovation, however, is increasingly being criticized, both within the
74 medical profession and in the public space. Studies have demonstrated that novelty does
75 not equal better effectiveness, with only 25% of tested drugs showing increased therapeutic
76 effect(20). Both the “me-too” marketing model (i.e. the commercialization of a drug that is
77 similar to a pre-existing drug) and economic incentives to market new products appear to

78 have affected the relationship between drug effectiveness and drug novelty(21). The
79 acceleration of drug approval by regulatory agencies, in particular through mechanisms like
80 the Orphan Drug Designation and PRIME programs put in place by the European Medicines
81 Agency, have weakened the requirement for proof of effectiveness(22). In this context,
82 physicians have begun publicizing the fact that new drugs are not necessarily better than old
83 ones and that their higher prices are not always justified(23). Biomedical research, especially
84 when it is clearly driven by the pharmaceutical industry(24), is regularly criticized in the
85 public space, with some pointing out the unknown adverse effects of new drugs or
86 vaccines(25) and others highlighting potential conflicts of interest(26,27). In particular, the
87 rising cost of innovative oncological treatments has been criticized as unjustified in view of
88 gains in effectiveness that could be considered as marginal or minor(28–30). Unfortunately,
89 while public criticisms can contribute to a better regulation of the pharmaceutical
90 industry(31), they can also reinforce science-related populism(32).

91 The publicity given to medical controversies is not without consequences, as was made
92 clear during the COVID-19 pandemic. The violent debate over hydroxychloroquine had a
93 marked impact on health behaviors and attitudes(33,34) and on the production of scientific
94 knowledge. Traditional strategies for conducting clinical research were called into question,
95 slowing down enrollment in clinical trials such as Discovery (NCT04315948) and Recovery
96 (NCT04381936). The debate also had lasting consequences on public health policy in
97 countries such as Brazil, precluding the adoption of much-needed prevention strategies(35).
98 As such, it raised broader questions regarding the role of science and research in
99 society(36).

100 Although medical innovation is central to promises of progress in health, few public health or
101 social sciences studies have explored public perceptions of the association between drug
102 novelty and drug effectiveness. The few available data on the topic appear contradictory.
103 Some studies have shown that branded drugs are perceived more favorably than generic
104 ones(37), with a specific effect of labelling a treatment as 'new'(21). Others have found that

105 older drugs tend to be perceived as safer and more effective than new ones, except in the
106 case of some innovative oncological treatments(38). On a different note, a study on patient
107 preferences has suggested that perceptions of novelty are associated with specific
108 psychological characteristics(39). Studies focusing on the food industry have shown that
109 trust in institutions has a positive impact on perceptions of new food products(40). However,
110 given the specificities of the health sector, public perceptions of innovation in other domains
111 can hardly be extrapolated to it(41). Most social science studies examining public
112 perceptions of innovation have focused on attitudes towards science in general and not
113 towards the medical sector. Nevertheless, these studies do provide context for perceptions
114 of medical innovation, with some stressing the effect of overall trust in institutions and others
115 highlighting the pervasiveness of suspicion of corporate influence in medicine(26,42). Again,
116 vaccine hesitancy again provides a perfect illustration of these issues(43).

117 Our study aimed to explore perceptions of the association between drug novelty and
118 effectiveness from a social science perspective. Data were collected from a representative
119 sample of the French population via an online survey in January 2021. More specifically, we
120 tested the hypothesis that positive perceptions of medical innovation correlate with greater
121 acceptance of the standard model of innovation underlying medical institutions (H1).
122 Following our main hypothesis H1, individuals with a high level of familiarity with the health
123 care system and those with a high level of trust in institutions (doctors, scientists, politicians,
124 and/or pharmaceutical companies) are more likely to agree that new drugs are more
125 effective than old ones and that drug development should be driven by the pharmaceutical
126 industry. Two subsidiary hypotheses were tested, namely that individuals with a more direct
127 and practical experience of the health care system due to illness or ageing (H2a) and those
128 with low socio-economic status (H2b) are less likely to believe that drug novelty and drug
129 effectiveness are associated. Given the ongoing pandemic and massive media exposure of
130 biomedical research(3), we also tested the hypothesis that COVID-19 has had a specific
131 effect on perceptions of the association between drug effectiveness and drug novelty (H3).

132 **Methodology**

133 Design and sample

134 Data were collected the first week of January 2021 from a sample of the French population
135 aged 18–75 years (N = 1000) as part of the second round of the cross-sectional online
136 “Health Literacy Survey 2019” (HLS₁₉ - International Health Literacy Population Survey 2019-
137 2021 from M-POHL). The questionnaire administered during the second round of the survey
138 contained questions – on household income and on perceptions of the role of the
139 pharmaceutical industry in drug development (see *infra*) – that were not in the questionnaire
140 administered during the first round (in June 2020). We made sure that there were no
141 significant differences in responses to the questions that were common to both
142 questionnaires.

143 Participants were selected from a nationally representative French household research
144 panel developed by the survey research firm IPSOS (Paris, France). A total of 23,813
145 individuals were initially invited by email to fill out the questionnaire. Quota sampling was
146 used to match the French general population with regards to gender, age, area of residence
147 (rural vs. urban) and population density in the region of residence (as per official census
148 data). The largest difference between theoretical quotas and our sample was –1.3% for rural
149 area of residence (21.1% of the effective sample compared to 22.4% of the theoretical
150 sample). Collected data were weighed according to participants’ demographic profile to
151 match the French general population – which explains why the number of respondents is
152 sometimes written with decimals. The study was approved by the Ethics Committee of the
153 French national biomedical research Institute INSERM (CEEI, IRB 00003888, 2020/04/04).

154 Data collection

155 Participants responded to the online self-administered questionnaire after providing informed
156 consent. The questionnaire focused on five main topics: (1) demographic characteristics

157 (gender, age, level of education, region of residence, household income, financial difficulties,
158 occupation, current health condition); (2) health literacy, health information-seeking behavior,
159 and ability to navigate the health care system; (3) perception of and familiarity with clinical
160 research; (4) trust in institutions (doctors, scientists, politicians, and/or pharmaceutical
161 companies); and (5) knowledge and concerns about the COVID-19 epidemic. The first two
162 topics were shared with HLS₁₉ European survey when the last three were specific to the
163 French survey.

164 The present study focuses specifically on responses to the following two statements: “New
165 drugs are always more effective than old ones” and “Drug development should be driven by
166 the pharmaceutical industry.” Response options were “Completely agree,” “Somewhat
167 agree,” “Somewhat disagree,” and “Completely disagree.”

168 Statistical Analysis

169 Several variables were recoded to ensure comparability and interpretability: “Educational
170 level” was recoded into three groups and “age” was recoded into four groups. Four-point
171 scales were dichotomized into “yes” vs. “no” for the following variables: “trust in doctors,”
172 “trust in politicians,” “trust in scientists,” “trust in pharmaceutical companies,” and “fear of
173 COVID-19.”

174 To measure familiarity with the health care system, we used the pre-existing Navigational
175 Health Literacy (Navigational HL, or NHL in this article) index proposed by Griese et al.(44).
176 This self-assessed measure draws on the 12-item version of the European Health Literacy
177 Scale (HLS-EU). In our study, each item of the NHL index was dichotomized into two
178 responses: “easy” (value 1) and “difficult” (value 0). The final score was calculated by
179 summing up the values obtained for each item. Participants were divided into quartiles

180 ranging from Q1 (low navigating skills) to Q4 (high navigating skills). The consistency of our
181 results was checked using the Health Literacy scale(45).

182 The association between variables was measured using Pearson's correlation coefficient for
183 numeric variables and the chi-square test for categorical variables. Estimated proportions
184 were interpreted based on the margins of error provided by IPSOS, which ranged from 1.4 to
185 3.1 points.

186 Two binomial logistic regression analyses were performed to identify the (adjusted) factors
187 that influenced perceptions of the association between drug novelty and drug effectiveness
188 and perceptions of the role of the pharmaceutical industry in drug development. The
189 analyses were carried out using a main effect model with purposeful selection of
190 variables(46). First, we selected variables showing univariate association with a $p=0.20$ and
191 entered them in the binomial regression model. Second, we removed non-significant
192 variables from the model (threshold value of $p=0.05$). Lastly, we re-entered each removed
193 variable in the model and tested it for significance. Statistical analyses were performed using
194 Python (Pandas 1.3.4 – Scipy 1.7.2 – Statsmodel 0.13.1).

195 **Results**

196 *Perceptions of the association between drug novelty and drug effectiveness*

197 A quarter (25%) of respondents agreed that new drugs are always more effective than old
198 ones, with only 3% agreeing completely.

199 Perceptions of the association between drug novelty and drug effectiveness were correlated
200 with familiarity with the health care system (**Table 1**). Indeed, 45% of respondents with a
201 high NHL score agreed that new drugs are always more effective than old ones, compared

202 to 16% of those with a low NHL score. Agreement was stronger among younger
203 respondents (33%) and among respondents situated at the two ends of the income scale
204 (34% for low household income and 37% for high household income). It was also stronger
205 among respondents with a high level of trust in politicians or pharmaceutical companies
206 (45% and 34%).

207 By contrast, respondents with poor health condition were less likely to agree that new drugs
208 are always more effective than old ones. A correlation was also found between perception of
209 risk and perception of the association between drug novelty and drug effectiveness. Thus,
210 16% of respondents who did not fear COVID-19 agreed that new drugs are always more
211 effective than old ones compared to 35% of those who did fear the disease.

212 The binary logistic regression analysis (**Table 2**, $R^2=0.11$) found a significant effect of
213 familiarity with the health care system on perceptions of the association between drug
214 novelty and drug effectiveness. Indeed, respondents with a high NHL score were more likely
215 to agree that new drugs are always more effective than old ones (OR 3.34 [2.13-5.24])
216 compared to respondents with a low NHL score. Perception of risk also appeared to have a
217 strong effect, as respondents who did not fear COVID-19 were more than two times less
218 likely to agree with this statement than those who did (OR 0.38 [0.18-0.82]).

219 Trust in doctors and scientists had a non-significant effect on perceptions of the association
220 between drug novelty and drug effectiveness. Respondents with a low level of trust in
221 pharmaceutical companies or politicians were two times less likely to agree that new drugs
222 are always more effective than old ones compared to those with a high level of trust in these
223 institutions (OR 0.63 [0.42-0.95] and OR 0.68 [0.49-0.94], respectively).

224 Finally, older respondents were two times less likely than younger ones to agree with this
225 statement (OR 0.57 [0.31-1.03]). Neither gender nor health information-seeking behavior
226 had a statistically significant effect in the final model.

227 *Perceptions of the role of the pharmaceutical industry in drug development*

228 Respondents had a high level of trust in doctors (92%) and scientists (87%) but a low level
229 of trust in politicians (only 15%). They were much more split concerning pharmaceutical
230 companies (42% trusted them).

231 Most respondents (86%) agreed that doctors need to collaborate with the pharmaceutical
232 industry to develop new treatments. Less than half (43%) agreed that drug development
233 should be driven by the pharmaceutical industry.

234 Different factors were associated with perceptions of the role of the pharmaceutical industry
235 in drug development. Thus, 71% of respondents who agreed that new drugs are always
236 more effective than old ones also agreed that drug development should be driven by the
237 pharmaceutical industry. Likewise, 67% of respondents with a high NHL score agreed with
238 the latter statement, compared to only 31% of respondents with a low NHL score. Low
239 educational level (51%), high household income (60%), low health information-seeking
240 behavior (54%), trust in pharmaceutical companies (66%) or politicians (60%), and good
241 health condition (48%) were all associated with the belief that drug development should be
242 driven by the pharmaceutical industry.

243 However, this belief did not exclude positive attitudes towards public intervention. Almost all
244 respondents felt that the state should be directly involved in drug development when the
245 disease is serious (86%). Even those who agreed that the pharmaceutical industry should
246 drive drug development considered that direct state action was sometimes necessary (41%),

247 with only 2% of respondents stating that drugs should be developed by the pharmaceutical
248 industry alone.

249 The logistic regression analysis (**Table 3**, $R^2=0.15$) showed that perceptions of the
250 association between drug novelty and drug effectiveness had an important effect on
251 perceptions of the role of the pharmaceutical industry in drug development. Respondents
252 who agreed that new drugs are always more effective than old ones were almost four times
253 more likely to agree that drug development should be driven by the pharmaceutical industry
254 (OR 3.85 [2.76-5.39] compared to respondents who disagreed). The NHL score had an
255 independent effect, as respondents with a high NHL score were more than twice as likely to
256 agree that drug development should be driven by the pharmaceutical industry (OR 2.62
257 [1.73-3.97] compared to respondents with a low NHL score). By contrast, respondents with a
258 low level of trust in pharmaceutical industry were less likely to agree with that statement (OR
259 0.38 [0.28-0.50] compared to respondents with a high level of trust). Likewise, respondents
260 with poor health condition were less likely to agree that drug development should be driven
261 by the pharmaceutical industry (OR 0.60 [0.44-0.82] for respondents with average health
262 condition compared to those with good health condition; low statistical significance for the
263 difference between respondents with poor health condition and those with good health
264 condition, $p=0.35$).

265 **Discussion**

266 The notion of techno-scientific progress has been intertwined with biomedical
267 advances(47) and the organization of modern medicine(48) at least since the eighteenth
268 century. Health innovations are now ubiquitous and range from targeted drugs in genomic
269 medicine(49) to imaging technologies based on Artificial Intelligence(50). Innovations are
270 introduced in medical practices at such a high pace that some of them remain on the market
271 for short periods of time, before they are replaced with the next wave. With the COVID-19

272 pandemic, medical debates surrounding innovative treatments have come to the attention of
273 the general public as never before(3,4). The main opposition is observed between those
274 who advocate for the development of new drugs to treat COVID-19 and those who favor the
275 repositioning of old drugs with proven efficacy. Indeed, despite being a major achievement,
276 new vaccines are being criticized due to their purported uncertainty(43). Research on
277 treatments for COVID-19 is ongoing and continues to impact both health behavior and public
278 perceptions of the disease.

279 The paternalistic approach that prevailed in medicine up to the end of the twentieth century
280 left little room for patients and their families to intervene in medical decisions. While the
281 therapeutic decision is still up to doctors, shared decision-making is gaining ground, with
282 patients and patients' advocates increasingly demanding that patients be actively involved in
283 medical decisions and evaluations(51). The advent of patient participation in their own care
284 was an important change, but it also created a space for the pharmaceutical industry to exert
285 direct influence on consumers and end-users (in particular through patients' associations).
286 Patients can now pressure their doctors to develop or prescribe treatments that they believe
287 to be "useful." Moreover, the greater emphasis on individual responsibility for health
288 decisions has led many patients to engage in what some refer to as "doctor shopping" or
289 "medical tourism." Indeed, some people may now choose to refuse a novel treatment (e.g., a
290 new vaccine), while others may favor a specific medical center or may decide to travel
291 abroad to receive innovative treatment(52). However, in the context of clinical trial
292 recruitment, the narrative that stresses the value of drug novelty can be misleading given the
293 uncertain benefits of the tested treatments(53). Instances of unproven therapies and
294 unfulfilled promises have led some people to criticize the pharmaceutical lobby, with frequent
295 denunciations of its economic power, influence on health policy, and nefarious effect on
296 citizen health. In view of this, a better understanding of public attitudes towards new
297 treatments, and more generally towards medical innovation, is needed to elucidate individual
298 preferences in health care.

299 Our findings support our hypothesis that respondents with a high level of trust in institutions
300 and those with a high level of familiarity with the health care system are more likely to
301 believe that new drugs are more effective than old ones (H1). Familiarity with the health care
302 system was measured using the NHL index. This indicator was developed to evaluate
303 people's difficulties in accessing, understanding, appraising, and applying information for
304 navigating the health care system(44). Compared to standard health literacy indexes, which
305 focus more broadly on health and illness, the NHL index measures respondents' familiarity
306 with their own national health care system. From a sociological perspective, it captures
307 familiarity with specific health practices and health contexts. Such familiarity is often
308 described as a specific form of what sociologists, following Pierre Bourdieu, have referred to
309 as cultural capital(54). In the context of health care, the possession of cultural capital has
310 been shown to affect health choices and the way that people navigate the health care
311 system(55). The strong effect of the NHL index observed in our study indicates that it is also
312 correlated with attitudes towards medical innovation.

313 In addition, the strong effect of the NHL index reflects the value attributed to innovation in
314 French medical culture. Indeed, the value of medical innovation is not only promoted by
315 professionals and health policies in France, but is also embodied by individuals with a high
316 level of familiarity with the health care system and by the beneficiaries of new treatments. As
317 such, our finding is consistent with earlier studies on public understandings of science, which
318 found institutional proximity to affect attitudes towards science and technology(56).
319 Moreover, our study supports the claim that attitudes towards new treatments reflect broader
320 attitudes towards the health care system and towards institutions in general. Positive
321 perceptions of medical innovation were also found to correlate with greater acceptance of
322 the standard model of innovation, as the belief that new drugs are more effective than old
323 ones was associated with a high level of trust in politicians, and/or pharmaceutical
324 companies.

325 While pandemics have historically prompted the intervention of public actors in biomedical
326 research(57), pharmaceutical companies remain the main actors of medical innovation
327 today. However, public perceptions of the role of the pharmaceutical industry are
328 increasingly polarized, with criticisms generally focusing on the industry's excessive role in
329 the medical innovation process and on potential conflicts of interest(27). This is a major
330 concern, as the association between public research and the pharmaceutical industry has
331 consequences for the legitimacy of science(24). As several studies have shown, overall trust
332 in pharmaceutical companies is especially low in France(42,58). There is currently little
333 explanation for this mistrust, though a series of public scandals, including the Mediator
334 case(59), may have contributed to this. Interestingly, in our study, respondents who believed
335 that new drugs are more effective than old ones were more likely to consider that drug
336 development should be driven by the pharmaceutical industry. Likewise, respondents with a
337 high level of familiarity with the health care system had a high level of trust in pharmaceutical
338 companies. In a context where industrial R&D is both central to the innovation process and
339 negatively depicted in the news, a better understanding of the factors associated with trust in
340 the pharmaceutical industry is needed to reduce polarization and, consequently, to ensure
341 adequate public vigilance of biomedical research.

342 Our findings appear also to support our hypothesis of a specific effect of health condition and
343 age on perceptions of the association between drug novelty and drug effectiveness (H2a).
344 This effect, however, was statistically significant in bivariate analysis only. The lack of
345 statistical significance in multivariate analysis may be explained by the limited statistical
346 power of our survey, but also by the fact that statistical models do not account for individual
347 trajectories and experiences. Some studies have shown that the experience of chronic
348 disease leads to specific navigating skills and favors specific attitudes towards medical
349 innovation(52). One could suppose that people with chronic diseases, who tend to have a
350 high level of familiarity with the health care system, are more likely to develop a critical view

351 of this system. This is especially likely if the disease is deadly or debilitating, with little hope
352 for improvement or recovery. By contrast, our findings did not support our hypothesis of a
353 specific effect of socio-economic status (H2b). Beyond the limited statistical power of the
354 survey, this absence of effect may be explained by the fact that the NHL index already
355 accounts for health condition or socio-economic status. In other words, familiarity with the
356 health care system as measured by the NHL index likely acts as a mediating factor between
357 socio-economic status and perceptions of the association between drug novelty and
358 effectiveness. By contrast, our hypothesis H3 was supported by our findings, as fear of
359 COVID-19 appeared to correlate with the belief that new drugs are more effective than old
360 ones. This finding suggests that in an epidemic context, people who are more anxious about
361 the disease are more likely to support medical innovation. More generally, one could argue
362 that perceptions of the association between drug novelty and drug effectiveness are
363 influenced by health policy, the availability of existing treatments, the actual and perceived
364 severity of the disease, and the global or restricted nature of the health threat.

365 This study extends the analysis initiated in June 2020 with the first round of HLS₁₉(42). Our
366 findings indicate that trust in institutions and perceptions of clinical research in France have
367 remained stable during the COVID-19 pandemic (**Table 1**). They also go beyond the original
368 findings by showing that the role of the pharmaceutical industry in drug development is
369 perceived as normal, even necessary, with almost half of respondents agreeing that drug
370 development should be driven by this industry. This finding is especially interesting given
371 that the pharmaceutical lobby is regularly criticized, both in France and beyond, in terms of
372 regulation failures and potential conflicts of interests(60). Our findings also suggest that
373 perceptions of the association between drug novelty and drug effectiveness vary depending
374 on the terms used in public debates to refer to pharmaceutical actors. Thus, the
375 questionnaire used in the first round of HLS₁₉ measured respondents' level of trust in
376 "*l'industrie pharmaceutique*" (the pharmaceutical industry), while that used in the second
377 round measured respondents' level of trust in "*les laboratoires pharmaceutiques*"

378 (pharmaceutical companies). Interestingly, the level of trust rose from 25% in the first round
379 to 42% in the second one, which may be explained by the fact that the term “laboratory”
380 evokes the scientific field while that of “industry” is associated with the economic domain. It
381 should be noted, however, that the high level of trust reported in the second round may also
382 reflect the increased presence of pharmaceutical actors in the media during the COVID-19
383 pandemic – and especially the success of the new vaccines.

384 Today, public acceptance of the standard model of innovation in medicine is a major political
385 issue. The economic influence exerted by the pharmaceutical industry on the orientation and
386 supervision of biomedical research, and especially on the conduct of clinical trials(61), has
387 been well documented(16,17). In France, public funding of biomedical research by
388 international private companies has been regularly criticized. For instance, a major
389 controversy erupted over the important public funds allocated to the pharmaceutical
390 company Sanofi (via the *Crédit d’Impôt Recherche*), which laid off many workers and failed
391 to develop a “French” vaccine. Moreover, the economic domination of the pharmaceutical
392 industry was loudly denounced when Pfizer decided to raise the cost of vaccines. In a recent
393 book, Fierbeck et al. argued that “*there is plenty of controversy surrounding*
394 *pharmaceuticals, but it cannot be denied that the pharmaceutical industry is both socially*
395 *beneficial and profitable.*” However, they also recognized that “*the fact that citizens believe*
396 *medicines are reasonably safe and that the medications work is based more on trust than on*
397 *the scientific evidence (p.4)*”(31). Because the innovation process is an important component
398 of health care, the way it is framed in public debates can have a lasting impact on trust in the
399 medical system, in regulatory agencies, and even in science in general.

400 **Limitations**

401 This study has several limitations. First, our study was an exploratory analysis of an
402 understudied topic that aimed to test a series of hypotheses. Our findings are therefore

403 tentative and will need to be confirmed in future studies. Second, only two questions
404 concerning the topic of interest were analyzed, which precluded the development of an
405 explanatory model. Political orientation, knowledge of specific aspects of the health care
406 system, and perceptions of the cost of innovations will also need to be investigated in the
407 future. Third, our sample was not probabilistic. However, it was representative of the French
408 population since we used quota sampling. Lastly, our questionnaire could not fully capture
409 the diversity of attitudes towards medical innovation, suggesting a need for qualitative
410 studies on the topic. Such studies could determine the extent to which the COVID-19
411 pandemic changed people's perceptions of the association between drug novelty and drug
412 effectiveness.

413 **Conclusion**

414 Today, medical research and innovation are framed both as a solution and as a problem in
415 public debates. While drugs and vaccines with proven efficacy allow for sound health policy,
416 pharmaceutical regulation failures and the overwhelming role of the pharmaceutical industry
417 in drug development have created legitimate suspicion in the general public. Because the
418 positive value assigned to medical innovation is directly linked to the belief in scientific
419 progress that underpins medical institutions, public criticism of medical research has an
420 impact on the process of drug development and, consequently, on the level of trust in
421 experts and scientists. In fact, public attitudes towards medical innovation can be
422 ambivalent, as novelty increases both the perceived value of a given product and the
423 perceived risk associated with it(40). This ambivalence is not limited to drugs and can be
424 extended to other innovations – for instance, the contact tracing apps developed during the
425 COVID-19 pandemic(62,63). In a global context where trust in institutions, and especially in
426 science, has a major impact on health behavior and democratic life, there is a growing need
427 for a better understanding of public perceptions of medical innovation.

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