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SOCIAL PHARMACOLOGY

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

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Summary

Objectives. — During the coronavirus disease 2019 (COVID-19) pandemic, public debates overtly addressed the promises of new innovative drugs. Many of these debates pitted those who advocated for the development of new drugs by pharmaceutical companies against those who favored the repositioning of existing drugs. Our study explored perceptions of the association between drug novelty and effectiveness as well as perceptions of the role of the pharmaceutical industry in drug development.

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Methods. – Data were collected in January 2021 from a quota sample of the French population aged 18–75 years ($n=1,000$) during the second round of the “Health Literacy Survey 2019” (HLS₁₉).

Results. – We tested the hypothesis that individuals with a high level of familiarity with the health care system and those with a high level of trust in institutions are more likely to agree that new drugs are more effective than old ones and that drug development should be driven by the pharmaceutical industry. A quarter (25%) of respondents agreed that new drugs are always more effective than old ones. Agreement with this statement was stronger among respondents with a high level of familiarity with the health care system (as measured by the navigational health literacy score, OR 3.34 [2.13–5.24]). Respondents with a low level of trust in pharmaceutical companies or politicians were two times less likely to agree that new drugs are always more effective than old ones (OR 0.63 [0.42–0.95] and OR 0.68 [0.49–0.94], respectively). A high level of trust in pharmaceutical companies was reported by 42% of respondents, and 43% agreed that drug development should be driven by the pharmaceutical industry.

Conclusion. – Our study shows that the perceived effectiveness of innovative drugs is associated with familiarity with the health care system and trust in institutions.

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Abbreviations

COVID-19 coronavirus disease 2019

HLS₁₉ health literacy survey

HL-EU European health literacy scale

INSERM French national biomedical research institute

NHL navigational health literacy

Introduction

During the coronavirus disease 2019 (COVID-19) pandemic, the development of new drugs, including vaccines, became a global priority [1,2]. Public debates on how to find a suitable cure pitted two camps against each other [2–4]. On the one side were those who advocated for the development of new drugs by pharmaceutical companies [5]. On the other were those who favored the repositioning of existing drugs on the grounds that they are massively available at low cost and that their safety has already been demonstrated. The following question was thus brought to the forefront of public debates: Are new drugs more effective than old ones for the treatment of COVID-19?

Public perceptions of the association between drug novelty and drug effectiveness affect health behaviour, as illustrated by the issue of vaccine hesitancy [6,7]. In the particular context of France, the controversy over the effectiveness of hydroxychloroquine against COVID-19 [8] increased the demand for the drug, which carried the risk of adverse effects [9,10] and led to drug shortages for other indications [11]. Therefore, it is important that we better understand these perceptions, especially in a social pharmacology perspective [12], since drugs and vaccines are not just a scientific and medical topic but need to be also investigated as social and political object [13].

Although medical innovation is central to promises of progress in health, few public health or social sciences studies have explored public perceptions of the association between drug novelty and drug effectiveness. Some studies have shown that branded drugs are perceived more favourably than generic ones [14], with a specific effect of labelling a drug as “new” [15]. Others have found that older drugs tend to be perceived as safer and more effective than new ones, except in the case of some innovative cancer therapies [16]. On a different note, a study on patient preferences has suggested that perceptions of novelty are associated with specific psychological characteristics [17]. Social science studies examining public perceptions of innovation stress the effect of overall trust in institutions and the pervasiveness of suspicion of corporate influence in medicine [18,19]. Hence again, vaccine hesitancy again provides a perfect illustration of these issues [20].

Our study aimed to explore this perception of the association between drug novelty and effectiveness from a social science perspective. Data were collected from a representative sample of the French population via an online survey in January 2021. More specifically, we tested the hypothesis that positive perceptions of medical innovation correlate with greater acceptance of the standard model of innovation underlying medical institutions (H1). Following our main hypothesis H1, individuals with a high level of familiarity with the health care system and those with a high level of trust in institutions (doctors, scientists, politicians, and/or pharmaceutical companies) are more likely to agree that new drugs are more effective than old ones and that drug development should be driven by the pharmaceutical industry. Two subsidiary hypotheses were tested, namely that individuals with a more direct and practical experience of the health care system due to illness or ageing (H2a) and those with low socio-economic status (H2b) are less

likely to believe that drug novelty and drug effectiveness are associated. Given the ongoing pandemic and massive media exposure of biomedical research [3], we also tested the hypothesis that COVID-19 has had a specific effect on perceptions of the association between drug effectiveness and drug novelty (H3).

Methods

Design and sample

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

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

Data collection

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

- demographic characteristics (gender, age, level of education, region of residence, household income, financial difficulties, occupation, current health condition);
- health literacy, health information-seeking behavior, and ability to navigate the health care system;
- perception of and familiarity with clinical research;
- trust in institutions (doctors, scientists, politicians, and/or pharmaceutical companies);
- knowledge and concerns about the COVID-19 epidemic.

The first two topics were shared with HLS₁₉, European survey when the last three were specific to the French survey.

The present study focuses specifically on responses to the following two statements: “New drugs are always more effective than old ones” and “Drug development

should be driven by the pharmaceutical industry”. Response options were “Completely agree”, “Somewhat agree”, “Somewhat disagree”, and “Completely disagree”.

Statistical analysis

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

To measure familiarity with the health care system, we used the pre-existing navigational health literacy (navigational HL, or NHL in this article) index [21]. This self-assessed measure draws on the 12-item version of the European health literacy scale (HLS-EU). In our study, each item of the NHL index was dichotomized into two responses: “easy” (value 1) and “difficult” (value 0). The final score was calculated by summing up the values obtained for each item. Participants were divided into quartiles ranging from Q1 (low navigating skills) to Q4 (high navigating skills). The consistency of our results was checked using also the Health Literacy scale [22].

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

Two binomial logistic regression analyses were performed to identify the (adjusted) factors that influenced perceptions of the association between drug novelty and drug effectiveness and perceptions of the role of the pharmaceutical industry in drug development. The analyses were carried out using a main effect model with purposeful selection of variables [23]. First, we selected variables showing univariate association with a $P=0.20$ and entered them in the binomial regression model. Second, we removed non-significant variables from the model (threshold value of $P=0.05$). Lastly, we re-entered each removed variable in the model and tested it for significance. Statistical analyses were performed using Python (Pandas 1.3.4–Scipy 1.7.2–Statsmodel 0.13.1–PySHS 0.2.0).

Results

Perceptions of the association between drug novelty and drug effectiveness

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

Perceptions of the association between drug novelty and drug effectiveness were correlated with familiarity with the health care system (Table 1). Indeed, 45% of respondents with a high NHL score agreed that new drugs are always more effective than old ones, compared to 16% of those with a low NHL score. Agreement was stronger among younger respondents (33%) and among respondents situated at the two ends of the income scale (34% for low household income

Table 1 Distribution of the association between novelty/effectiveness and the role of pharmaceutical companies regarding independent variables.

Variable	Modalities	Dependent variable (or Variable) Distribution	Association novelty/effectiveness		Driven by the pharmaceutical industry		Total
			1 – Disagree	2 – Agree	1 – Agree	2 – Disagree	Total
Age	[0–25[	13.0%	87.6 (67.4%)	42.4 (32.6%)	57.2 (44.0%)	72.8 (56.0%)	130.0 (100%)
	[25–45[	36.5%	259.6 (71.1%)	105.4 (28.9%)	165.7 (45.4%)	199.3 (54.6%)	365.0 (100%)
	[45–65[	37.7%	299.8 (79.5%)	77.2 (20.5%)	147.3 (39.1%)	229.7 (60.9%)	377.0 (100%)
	[65+	12.8%	99.5 (77.7%)	28.5 (22.3%)	62.3 (48.7%)	65.7 (51.3%)	128.0 (100%)
Sex	Female	51.4%	400.6 (77.9%)	113.4 (22.1%)	206.1 (40.1%)	307.9 (59.9%)	514.0 (100%)
	Male	48.6%	346.0 (71.2%)	140.0 (28.8%)	226.4 (46.6%)	259.6 (53.4%)	486.0 (100%)
Education	Below BD	18.5%	136.5 (73.9%)	48.1 (26.1%)	93.9 (50.9%)	90.6 (49.1%)	184.6 (100%)
	BD	19.7%	140.2 (71.2%)	56.6 (28.8%)	86.1 (43.8%)	110.6 (56.2%)	196.7 (100%)
	Above BD	61.9%	469.9 (75.9%)	148.8 (24.1%)	252.4 (40.8%)	366.3 (59.2%)	618.7 (100%)
Incomes	less than 1000	5.3%	34.9 (66.2%)	17.8 (33.8%)	26.0 (49.3%)	26.7 (50.7%)	52.7 (100%)
	1000 to 2000	23.4%	177.1 (75.6%)	57.3 (24.4%)	95.7 (40.8%)	138.7 (59.2%)	234.4 (100%)
	2000 to 3000	28.4%	220.4 (77.7%)	63.1 (22.3%)	112.3 (39.6%)	171.2 (60.4%)	283.5 (100%)
	3000 to 5000	24.8%	176.2 (70.9%)	72.4 (29.1%)	115.1 (46.3%)	133.4 (53.7%)	248.5 (100%)
	5000 and more	6.8%	42.4 (62.8%)	25.1 (37.2%)	40.3 (59.7%)	27.2 (40.3%)	67.6 (100%)
Health condition	NA	11.3%	95.6 (84.4%)	17.7 (15.6%)	43.0 (38.0%)	70.3 (62.0%)	113.3 (100%)
	Good	63.7%	468.4 (73.5%)	168.6 (26.5%)	305.7 (48.0%)	331.3 (52.0%)	637.0 (100%)
	Average	29.0%	217.7 (75.1%)	72.2 (24.9%)	102.0 (35.2%)	187.9 (64.8%)	289.9 (100%)
Trust in scientists	Bad	7.3%	60.4 (82.7%)	12.6 (17.3%)	24.8 (33.9%)	48.3 (66.1%)	73.1 (100%)
	Yes	87.0%	650.6 (74.8%)	219.6 (25.2%)	383.4 (44.1%)	486.7 (55.9%)	870.2 (100%)
Trust in doctors	No	13.0%	95.9 (73.9%)	33.9 (26.1%)	49.0 (37.8%)	80.8 (62.2%)	129.8 (100%)
	Yes	92.1%	688.3 (74.7%)	232.7 (25.3%)	406.4 (44.1%)	514.5 (55.9%)	920.9 (100%)
Trust in politics	No	7.9%	58.3 (73.7%)	20.8 (26.3%)	26.1 (33.0%)	53.0 (67.0%)	79.1 (100%)
	Yes	15.2%	83.4 (54.8%)	68.7 (45.2%)	100.7 (66.2%)	51.4 (33.8%)	152.1 (100%)
Trust in industrials	No	84.8%	663.1 (78.2%)	184.7 (21.8%)	331.7 (39.1%)	516.1 (60.9%)	847.9 (100%)
	Yes	42.2%	276.8 (65.6%)	145.2 (34.4%)	253.1 (60.0%)	168.9 (40.0%)	422.0 (100%)
Information seeking	No	57.8%	469.7 (81.3%)	108.3 (18.7%)	179.3 (31.0%)	398.6 (69.0%)	578.0 (100%)
	Yes	84.0%	642.5 (76.5%)	197.7 (23.5%)	346.9 (41.3%)	493.3 (58.7%)	840.2 (100%)
Concerns about COVID-19	No	16.0%	104.0 (65.1%)	55.8 (34.9%)	85.6 (53.6%)	74.2 (46.4%)	159.8 (100%)
	Yes	31.6%	221.1 (70.0%)	94.6 (30.0%)	149.2 (47.3%)	166.5 (52.7%)	315.8 (100%)
NHL	Some	62.3%	474.0 (76.1%)	148.9 (23.9%)	255.3 (41.0%)	367.6 (59.0%)	622.9 (100%)
	No	6.1%	51.4 (83.7%)	10.0 (16.3%)	28.0 (45.6%)	33.4 (54.4%)	61.4 (100%)
NHL	Q1-Low	27.1%	228.2 (84.2%)	42.7 (15.8%)	84.4 (31.2%)	186.4 (68.8%)	270.9 (100%)
	Q2	25.0%	217.3 (86.7%)	33.2 (13.3%)	89.4 (35.7%)	161.1 (64.3%)	250.5 (100%)
	Q3	25.9%	180.3 (69.5%)	79.0 (30.5%)	111.4 (43.0%)	147.9 (57.0%)	259.3 (100%)
	Q4-High	21.9%	120.7 (55.0%)	98.6 (45.0%)	147.2 (67.1%)	72.1 (32.9%)	219.3 (100%)
	Total	99.9%	746.5 (74.6%)	253.5 (25.4%)	432.5 (43.2%)	567.5 (56.8%)	1000.0 (100%)

BD: Bachelor degree; NA: no answer; NHL: navigating health literacy; Q1: quartile 1.

and 37% for high household income). It was also stronger among respondents with a high level of trust in politicians or companies (45% and 34%).

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

The binary logistic regression analysis (Table 2, $R^2 = 0.11$) found a significant effect of familiarity with the health care

system on perceptions of the association between drug novelty and drug effectiveness. Indeed, respondents with a high NHL score were more likely to agree that new drugs are always more effective than old ones (OR 3.34 [2.13–5.24]) compared to respondents with a low NHL score. Perception of risk also appeared to have a strong effect, as respondents who did not fear COVID-19 were more than two times less likely to agree with this statement than those who did (OR 0.38 [0.18–0.82]).

Trust in doctors and scientists had a non-significant effect on perceptions of the association between drug novelty and drug effectiveness. Respondents with a low level of trust in pharmaceutical companies or politicians were two times less

Table 2 Logistic regression of the association novelty/effectiveness.

Variable	Modality	OR – CI 95%	p
Intercept		0.62 [0.32–1.23]	0.171
Age	[0–25[
	[25–45[	0.78 [0.49–1.25]	0.3
	[45–65[	0.54 [0.34–0.88]	0.013*
	[65+	0.57 [0.31–1.03]	0.061
Sex	Female		
	Male	1.36 [1.00–1.85]	0.053
NHL	Q1-Low		
	Q2	0.80 [0.49–1.32]	0.379
	Q3	2.01 [1.30–3.10]	0.002**
	Q4-High	3.34 [2.13–5.24]	0.0***
Trust in politicians	Yes		
	No	0.63 [0.42–0.95]	0.028*
Trust in industrials	Yes		
	No	0.68 [0.49–0.94]	0.021*
Information-seeking behaviour	Yes		
	No	1.47 [0.99–2.19]	0.057
Concerns about COVID-19	Yes		
	Some	0.62 [0.45–0.87]	0.005**
	No	0.38 [0.18–0.82]	0.014*

COVID-19: coronavirus disease 2019; NHL: navigating health literacy; Q1: quartile 1; *:p-value < 0.05; **:p-value < 0.01;***:p-value<0.001.

likely to agree that new drugs are always more effective than old ones compared to those with a high level of trust in these institutions (OR 0.63 [0.42–0.95] and OR 0.68 [0.49–0.94], respectively).

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

Perceptions of the role of the pharmaceutical industry in drug development

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

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

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

were all associated with the belief that drug development should be driven by the pharmaceutical industry.

However, this belief did not exclude positive attitudes towards public intervention. Almost all respondents felt that the state should be directly involved in drug development when the disease is serious (86%). Even those who agreed that the pharmaceutical industry should drive drug development considered that direct state action was sometimes necessary (41%), with only 2% of respondents stating that drugs should be developed by the pharmaceutical industry alone.

The logistic regression analysis (Table 3, R²=0.15) showed that perceptions of the association between drug novelty and drug effectiveness had an important effect on perceptions of the role of the pharmaceutical industry in drug development. Respondents who agreed that new drugs are always more effective than old ones were almost four times more likely to agree that drug development should be driven in priority by the pharmaceutical industry (OR 3.85 [2.76–5.39] compared to respondents who disagreed). The NHL score had an independent effect, as respondents with a high NHL score were more than twice as likely to agree that drug development should be driven by the pharmaceutical industry (OR 2.62 [1.73–3.97] compared to respondents with a low NHL score). By contrast, respondents with a low level of trust in pharmaceutical industry were less likely to agree with that statement (OR 0.38 [0.28–0.50] compared to respondents with a high level of trust). Likewise, respondents with poor health condition were less likely to agree that drug development should be driven by the pharmaceutical industry (OR 0.60 [0.44–0.82] for respondents with average health condition compared to those with good health condition; low statistical significance for the difference between respondents with poor

Table 3 Logistic regression for agreement that pharmaceutical companies should drive drug development.

Variable	Modality	OR – CI 95%	p
Intercept		0.83 [0.58–1.18]	0.304
NHL	Q1-Low		
	Q2	1.20 [0.81–1.77]	0.355
	Q3	1.12 [0.76–1.66]	0.555
	Q4-High	2.62 [1.73–3.97]	0.0***
Coupling efficiency/novelty	Disagree		
	Agree	3.85 [2.76–5.39]	0.0***
	Health condition		
Health condition	Good		
	Average	0.60 [0.44–0.82]	0.002**
	Bad	0.77 [0.44–1.34]	0.351
Trust in industrials	Yes		
	No	0.38 [0.28–0.50]	0.0***

NHL: navigating health literacy; Q1: quartile 1; *:p-value < 0.05; **:p-value < 0.01;***:p-value<0.001.

health condition and those with good health condition, $P=0.35$).

Discussion

Our findings support our hypothesis that respondents with a high level of trust in institutions and those with a high level of familiarity with the health care system are more likely to believe that new drugs are more effective than old ones (H1). From a sociological perspective, the NHL measure captures familiarity with specific health practices and health contexts, often described as a specific cultural capital [24]. In the context of health care, the possession of cultural capital has been shown to affect health choices and the way that people navigate the health care system [25]. The strong effect of the navigating literacy reflects the value attributed to innovation in French medical culture. Indeed, the value of medical innovation is not only promoted by professionals and health policies in France, but is also embodied by individuals with a high level of familiarity with the health care system. As such, our finding is consistent with earlier studies on public understandings of science, which found institutional proximity to affect attitudes towards science and technology [26].

Moreover, our study supports the claim that attitudes towards new drugs reflect broader attitudes towards the health care system and towards institutions in general. Positive perceptions of medical innovation were also found to correlate with greater acceptance of the standard model of innovation, as the belief that new drugs are more effective than old ones was associated with a high level of trust in politicians, and/or pharmaceutical companies.

Our findings appear also to support our hypothesis of a specific effect of health condition and age on perceptions of the association between drug novelty and drug effectiveness (H2a). The lack of statistical significance of this effect in multivariate analysis may be explained by the limited statistical power of our survey, but also by the fact that statistical models do not account for individual trajectories and experiences. Some studies have shown that the experience of chronic disease leads to specific navigating skills and

favours specific attitudes towards medical innovation [27]. One could suppose that people with chronic diseases, who tend to have a high level of familiarity with the health care system, are more likely to develop a critical view of this system. This is especially likely if the disease is deadly or debilitating, with little hope for improvement or recovery.

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

Adding to those results, this study also extends the analysis initiated in June 2020 with the first round of HLS₁₉ [19]. Our findings indicate that trust in institutions and perceptions of clinical research in France have remained stable during the COVID-19 pandemic (Table 1). They also go beyond the original findings by showing that the role of the pharmaceutical industry in drug development is perceived as normal, even necessary, with almost half of respondents agreeing that drug development should be driven by this industry. This observation is especially interesting given that public agencies are regularly criticized, both in France and beyond, in terms of regulation failures and potential conflicts of interests [28]. Our findings also suggest that perceptions of the association between drug novelty and drug effectiveness vary depending on the terms used in public debates to refer to pharmaceutical actors. Thus, the questionnaire used in the first round of HLS₁₉ measured

respondents' level of trust in "*l'industrie pharmaceutique*" (the pharmaceutical industry), while that used in the second round measured respondents' level of trust in "*les laboratoires pharmaceutiques*" (pharmaceutical companies). Interestingly, the level of trust rose from 25% in the first round to 42% in the second one, which may be explained by the fact that the term "laboratory" evokes the scientific field while that of "industry" is associated with the economic domain. It should be noted, however, that the high level of trust reported in the second round may also reflect the increased presence of pharmaceutical actors in the media during the COVID-19 pandemic – and especially the success of the new vaccines.

This study unveils some elements of the largely under-investigated perception of pharmaceutical companies in public space. While pandemics have historically prompted the intervention of public actors in biomedical research [29], pharmaceutical companies remain the main actors of medical innovation today. However, public perceptions of the role of the pharmaceutical industry are increasingly polarized, with criticisms generally focusing on the industry's excessive role in the medical innovation process and on potential conflicts of interest [30]. But criticisms were also addressed to the model of innovation itself within the medical profession and by social sciences [31–34]. Physicians have begun publicizing the fact that new drugs are not necessarily better than old ones and that their higher prices are not always justified [35]. Studies have demonstrated that novelty does not equal better effectiveness, with only 25% of tested drugs showing increased therapeutic effect [36]. Both the "me-too" marketing model (i.e. the commercialization of a drug that is similar to a pre-existing drug) and economic incentives to market new products appear to have affected the relationship between drug effectiveness and drug novelty [15]. The acceleration of drug approval by regulatory agencies have weakened the requirement for proof of effectiveness [37]. Biomedical research driven by the pharmaceutical industry [38] is then regularly criticized in the public space, with some pointing out the unknown adverse effects of new drugs or vaccines [7] and others highlighting potential conflicts of interest [18,30]. This is especially the case for cancer drugs [39–41].

Expectations for better and more effective drugs, which underpin health and innovation policies [42], are based on trust in scientific and technological progress [43,44]. While public criticisms can contribute to a better regulation of the pharmaceutical industry [45], they can also reinforce science-related populism [46]. As several studies have shown, overall trust in pharmaceutical companies is especially low in France [19,47]. There is currently little explanation for this mistrust, though a series of public scandals, including the Mediator case [48], may have contributed to this. Interestingly, in our study, respondents who believed that new drugs are more effective than old ones were more likely to consider that drug development should be driven by the pharmaceutical industry. Likewise, respondents with a high level of familiarity with the health care system had a high level of trust in pharmaceutical companies. In a context where industrial R&D is both central to the innovation process and negatively depicted in the news, a better understanding of the factors associated with trust in the pharmaceutical industry is needed to reduce

polarization and, consequently, to ensure adequate public vigilance of biomedical research.

Opening new avenues for social pharmacology studies, our study has several limitations. First, our study was an exploratory analysis of an understudied topic that aimed to test a series of hypotheses. Our findings are therefore tentative and will need to be confirmed in future studies. Second, only two questions concerning the topic of interest were analysed, which precluded the development of an explanatory model. Political orientation, knowledge of specific aspects of the health care system, and perceptions of the cost of innovations will also need to be investigated in the future. Lastly, our questionnaire could not fully capture the diversity of attitudes towards medical innovation, suggesting a need for qualitative studies on the topic. Such future studies could determine the extent to which the COVID-19 pandemic changed people's perceptions of the association between drug novelty and drug effectiveness, and its consequences on health behaviours. However this rather large ($n=1000$) survey among a national sample representative regarding age, gender, and area of residence through quota sampling, was able to highlight various profiles of public perception of drug novelty and of pharmaceutical industry in line with our hypotheses.

Conclusion

Our study shows that the perceived effectiveness of innovative drugs is associated with familiarity with the health care system and trust in institutions. While drugs and vaccines with proven efficacy allow for sound health policy, pharmaceutical regulation failures and the overwhelming role of the pharmaceutical industry in drug development have created legitimate suspicion in the general public. Because the innovation process is an important component of health care, the way it is framed in public debates can have a lasting impact on trust in the medical system, in regulatory agencies, and even in science in general.

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Disclosure of interest

The authors declare that they have no competing interest.

Online Supplement. Supplementary data

Supplementary data (Annex 1) associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.therap.2022.05.001>.

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