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

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*Short title: Perception of the association between drug novelty and effectiveness*

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**Abstract**

Objectives:

During the COVID-19 pandemic, public debates overtly addressed the promises of new innovative treatments. Many of these debates pitted those who advocated for the development of new treatments 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.

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” ($HLS_{19}$).

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]) and among those with a high level of trust in pharmaceutical companies or politicians. 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. 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 by the pharmaceutical industry (OR 3.85 [2.76-5.39]).

Conclusion

A better understanding of public attitudes towards new treatments is needed to elucidate individual preferences in health care and their consequences on health behavior.

**Keywords:** drug innovation ; COVID-19 ; public attitude ; sociology

## Introduction

During the COVID-19 pandemic, the development of new treatments, including vaccines, became a global priority[1,2]. Innovative treatments were designed, manufactured, and tested at an accelerated pace. They were also overtly discussed in the media as they became available, sometimes even before their efficacy was robustly validated in clinical trials. Some of the innovations that garnered media attention include mRNA vaccines and the monoclonal antibodies administered to former president Donald Trump for his COVID-19 disease. 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 treatments (such as Remdesivir [5]) by pharmaceutical companies. 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. In the particular context of France, the controversy over the effectiveness of hydroxychloroquine against COVID-19 increased the demand for the drug, which carried the risk of adverse effects[6,7] and led to drug shortages for other indications[8]. 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? Insofar as public perceptions of the association between drug novelty and drug effectiveness affect health behavior and drive medical innovation – as illustrated by the issue of vaccine hesitancy[9,10] – it is important that we better understand these perceptions, especially in a social pharmacology perspective [11].

The success of modern medicine has largely hinged on the development of medical technologies and on their diffusion in the general population. As a result, medical innovation has become central to how modern medicine is perceived and discussed in the media[12,13]. Expectations for better and more effective treatments, which underpin health and innovation policies[14], are based on trust in scientific and technological

progress[15,16]. To fulfill those expectations, most modern democracies have adopted what can be described as the standard model of innovation in medicine. According to this model, academic and clinical researchers and actors of the pharmaceutical industry must collaborate to achieve new effective therapeutic solutions under the regulation of state agencies[17–20].

The standard model of innovation, however, is increasingly being criticized, both within the medical profession and in the public space. Studies have demonstrated that novelty does not equal better effectiveness, with only 25% of tested drugs showing increased therapeutic effect[21]. 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[22]. The acceleration of drug approval by regulatory agencies, in particular through mechanisms like the Orphan Drug Designation and PRIME programs put in place by the European Medicines Agency, have weakened the requirement for proof of effectiveness[23]. In this context, 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[24]. Biomedical research, especially when it is clearly driven by the pharmaceutical industry[25], is regularly criticized in the public space, with some pointing out the unknown adverse effects of new drugs or vaccines[26] and others highlighting potential conflicts of interest[27,28]. In particular, the rising cost of innovative oncological treatments has been criticized as unjustified in view of gains in effectiveness that could be considered as marginal or minor[29–31]. Unfortunately, while public criticisms can contribute to a better regulation of the pharmaceutical industry[32], they can also reinforce science-related populism[33].

The publicity given to medical controversies is not without consequences, as was made clear during the COVID-19 pandemic. The violent debate over hydroxychloroquine had a marked impact on health behaviors and attitudes[34,35] and on the production of scientific knowledge. Traditional strategies for conducting clinical research were called into question,

slowing down enrollment in clinical trials such as Discovery (NCT04315948) and Recovery (NCT04381936). The debate also had lasting consequences on public health policy in countries such as Brazil, precluding the adoption of much-needed prevention strategies[36]. As such, it raised broader questions regarding the role of science and research in society[37].

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. The few available data on the topic appear contradictory. Some studies have shown that branded drugs are perceived more favorably than generic ones[38], with a specific effect of labelling a treatment as ‘new’[22]. 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 oncological treatments[39]. On a different note, a study on patient preferences has suggested that perceptions of novelty are associated with specific psychological characteristics[40]. Studies focusing on the food industry have shown that trust in institutions has a positive impact on perceptions of new food products[41]. However, given the specificities of the health sector, public perceptions of innovation in other domains can hardly be extrapolated to it[42]. Most social science studies examining public perceptions of innovation have focused on attitudes towards science in general and not towards the medical sector. Nevertheless, these studies do provide context for perceptions of medical innovation, with some stressing the effect of overall trust in institutions and others highlighting the pervasiveness of suspicion of corporate influence in medicine[27,43]. Again, vaccine hesitancy again provides a perfect illustration of these issues[10].

Our study aimed to explore perceptions 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).

## Methodology

### 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" ($HLS_{19}$ - 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 focused on five main topics: (1) demographic characteristics (gender, age, level of education, region of residence, household income, financial difficulties, occupation, current health condition); (2) health literacy, health information-seeking behavior, and ability to navigate the health care system; (3) perception of and familiarity with clinical research; (4) trust in institutions (doctors, scientists, politicians, and/or pharmaceutical companies); and (5) knowledge and concerns about the COVID-19 epidemic. The first two topics were shared with $HLS_{19}$ 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 proposed by Griese et al.[44]. 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 the Health Literacy scale[45].

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[46]. 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).

## 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 and 37% for high household income). It was also stronger among respondents with a high level of trust in politicians or pharmaceutical 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 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 treatments. 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**, $R^2$=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 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 health condition and those with good health condition, p=0.35).

## Discussion

The notion of techno-scientific progress has been intertwined with biomedical advances[47] and the organization of modern medicine[48] at least since the eighteenth century. Health innovations are now ubiquitous and range from targeted drugs in genomic medicine[49] to imaging technologies based on Artificial Intelligence[50]. Innovations are introduced in medical practices at such a high pace that some of them remain on the market for short periods of time, before they are replaced with the next wave. With the COVID-19 pandemic, medical debates surrounding innovative treatments have come to the attention of the general public as never before[3,4]. The main opposition is observed between those who advocate for the development of new drugs to treat COVID-19 and those who favor the repositioning of old drugs with proven efficacy. Indeed, despite being a major achievement, new vaccines are being criticized due to their purported uncertainty[10]. Research on treatments for COVID-19 is ongoing and continues to impact both health behavior and public perceptions of the disease.

The paternalistic approach that prevailed in medicine up to the end of the twentieth century left little room for patients and their families to intervene in medical decisions. While the therapeutic decision is still up to doctors, shared decision-making is gaining ground, with patients and patients' advocates increasingly demanding that patients be actively involved in medical decisions and evaluations[51]. The advent of patient participation in their own care was an important change, but it also created a space for the pharmaceutical industry to exert direct influence on consumers and end-users (in particular through patients' associations). Patients can now pressure their doctors to develop or prescribe treatments that they believe to be "useful." Moreover, the greater emphasis on individual responsibility for health decisions has led many patients to engage in what some refer to as "doctor shopping" or "medical tourism." Indeed, some people may now choose to refuse a novel treatment (e.g., a

297 new vaccine), while others may favor a specific medical center or may decide to travel
298 abroad to receive innovative treatment[52]. However, in the context of clinical trial
299 recruitment, the narrative that stresses the value of drug novelty can be misleading given the
300 uncertain benefits of the tested treatments[53]. Instances of unproven therapies and
301 unfulfilled promises have led some people to criticize the pharmaceutical lobby, with frequent
302 denunciations of its economic power, influence on health policy, and nefarious effect on
303 citizen health. In view of this, a better understanding of public attitudes towards new
304 treatments, and more generally towards medical innovation, is needed to elucidate individual
305 preferences in health care.

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

320 In addition, the strong effect of the NHL index reflects the value attributed to innovation in
321 French medical culture. Indeed, the value of medical innovation is not only promoted by
322 professionals and health policies in France, but is also embodied by individuals with a high

level of familiarity with the health care system and by the beneficiaries of new treatments. 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[56]. Moreover, our study supports the claim that attitudes towards new treatments 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.

While pandemics have historically prompted the intervention of public actors in biomedical research[57], 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[28]. This is a major concern, as the association between public research and the pharmaceutical industry has consequences for the legitimacy of science[25]. As several studies have shown, overall trust in pharmaceutical companies is especially low in France[43,58]. There is currently little explanation for this mistrust, though a series of public scandals, including the Mediator case[59], 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.

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). This effect, however, was statistically significant in bivariate analysis only. The lack of statistical significance 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 favors specific attitudes towards medical innovation[52]. 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 socio-economic 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 socio-economic status. In other words, familiarity with the health care system as measured by the NHL index likely acts as a mediating factor between socio-economic 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 treatments, the actual and perceived severity of the disease, and the global or restricted nature of the health threat.

This study extends the analysis initiated in June 2020 with the first round of $HLS_{19}$[43]. 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 finding is especially interesting given that the pharmaceutical lobby is regularly criticized, both in France and beyond, in terms of regulation failures and potential conflicts of interests[60]. 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 $HLS_{19}$ 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.

Today, public acceptance of the standard model of innovation in medicine is a major political issue. The economic influence exerted by the pharmaceutical industry on the orientation and supervision of biomedical research, and especially on the conduct of clinical trials[61], has been well documented[17,18]. In France, public funding of biomedical research by international private companies has been regularly criticized. For instance, a major controversy erupted over the important public funds allocated to the pharmaceutical company Sanofi (via the *Crédit d'Impôt Recherche*), which laid off many workers and failed to develop a "French" vaccine. Moreover, the economic domination of the pharmaceutical industry was loudly denounced when Pfizer decided to raise the cost of vaccines. In a recent book, Fierlbeck et al. argued that "*there is plenty of controversy surrounding pharmaceuticals, but it cannot be denied that the pharmaceutical industry is both socially beneficial and profitable.*" However, they also recognized that "*the fact that citizens believe*

*medicines are reasonably safe and that the medications work is based more on trust than on the scientific evidence (p.4)*"[32]. 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.

## Limitations

This 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 analyzed, 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. Third, our sample was not probabilistic. However, it was representative of the French population since we used quota sampling. Lastly, our questionnaire could not fully capture the diversity of attitudes towards medical innovation, suggesting a need for qualitative studies on the topic. Such studies could determine the extent to which the COVID-19 pandemic changed people's perceptions of the association between drug novelty and drug effectiveness.

## Conclusion

Today, medical research and innovation are framed both as a solution and as a problem in public debates. 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 positive value assigned to medical innovation is directly linked to the belief in scientific progress that underpins medical institutions, public criticism of medical research has an

impact on the process of drug development and, consequently, on the level of trust in experts and scientists. In fact, public attitudes towards medical innovation can be ambivalent, as novelty increases both the perceived value of a given product and the perceived risk associated with it[41]. This ambivalence is not limited to drugs and can be extended to other innovations – for instance, the contact tracing apps developed during the COVID-19 pandemic[62,63]. In a global context where trust in institutions, and especially in science, has a major impact on health behavior and democratic life, there is a growing need for a better understanding of public perceptions of medical innovation.

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