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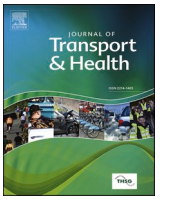

Changes in cycling practices in France during the Covid-19 pandemic. An illusory reduction in inequalities

Matthieu Adam [a,*], David Sayagh [b], Thomas Buhler [c]

[a] CNRS, UMR 5600 EVS, ENS de Lyon, F-69007, Lyon, France
[b] Faculty of Sports Sciences, Complexity Innovation Motor and Sports Activities (CIAMS), Paris-Saclay University, France
[c] Université de Franche-Comté, CNRS, ThéMA, F-25000 Besançon, France

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ABSTRACT

Introduction: The Covid-19 health crisis and the attendant pro-bicycle policies have accelerated the development of urban cycling worldwide. Bicycle traffic flows have generally been well documented, with particular focus on utilitarian trips during lockdowns. However, little research has examined the profiles of social groups affected by changes in bicycle use. That is the purpose of this article, which examines the socio-spatial factors behind changes in utilitarian and recreational cycle use.

Methods: The study is based on a nationwide questionnaire completed by 7343 cyclists in France between May and October 2021. The analyses are based on bivariate treatments, tests of independence, logistic regressions, and additional comments by some respondents (n = 1594).

Results: Our results show both utility and leisure cycling were more likely to have increased than decreased over the period under study. However, while utility practice was driven by fear of Covid-19 but inhibited by teleworking, recreational practice was driven by both working-at-home and by the desire to get out for some physical exercise. Compensatory phenomena, blurring the boundary between leisure and utility, are perceptible. Reductions in both the gender gap and the income gap in bicycle use are measured. However, since these were mainly forced changes and since inequalities in access to cycling persist, the narrowing of these gaps cannot be interpreted as steps toward gender or class equality.

Conclusions: The article recommends further research to assess the persistence of observed changes in leisure and utility cycling. At the same time, it warns against the pitfall of considering that a reduction in inequalities in cycling practices implies a reduction in social inequalities.

1. Introduction

"Protecting myself and others: the bicycle is my social-distancing measure."

This was the slogan for the campaign to promote cycling in France launched in May 2020 by national user groups, local authorities and professional organizations. The stated objective was to make the onset of the Covid-19 crisis and the resulting mobility issues (maintaining physical distances, avoiding massive modal shift to the car) an opportunity to develop bicycle use.

The pandemic has boosted cycling as a healthy form of mobility in many cities around the world (De Vos, 2020). Indeed, since

* Corresponding author.
E-mail addresses: matthieu.adam@ens-lyon.fr (M. Adam), david.sayagh@universite-paris-saclay.fr (D. Sayagh), thomas.buhler@univ-fcomte.fr (T. Buhler).

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2020, there has been (1) an increase in bicycle-friendly policies in cities (Buehler and Pucher, 2022), (2) less erosion of bicycle use than other modes during lockdowns (de Haas et al., 2020), and (3) a widespread increase in bicycle use outside of lockdown periods (Buehler and Pucher, 2021; Cusack, 2021).

French cities have been no exception to this general trend, with cycling in cities increasing sharply in 2020 (+28%), then holding steady in 2021, and increasing again in 2022 (+10%) (Vélo et territoires, 2023). This surge has amplified an existing trend of increasing bicycle modal share since the early 2000s in most major French cities (Héran, 2018). France has witnessed a proliferation of bicycle-friendly development initiatives in recent years that have grown considerably during the pandemic with the perpetuation of many of the provisional cycle lanes (Morio and Raimbault, 2021).

A significant amount of literature has identified a widespread increase in urban cycling with the crisis (e.g., Rérat et al., 2022; Schaefer et al., 2021). However, one question remains largely unanswered: for which social profiles has bicycle use increased and which have seen it decrease?

With fieldwork proving difficult during periods of lockdown, most researchers have initially focused on measuring changes in cyclist traffic flows, most often through the use of counting data (Buehler and Pucher, 2022; Kraus and Koch, 2021) or through GPS-equipped panelists (Molloy et al., 2020). All of this has led to research that primarily measures increases in practices and their spatial location.

Quantitatively, much less research has attempted to identify the social profiles that took up or abandoned daily cycling during the early months of the pandemic.

Yet the question of social profiles is not trivial. Indeed, before the Covid health crisis, cycling could be considered in most cities of the global North as a socially selective mode of travel in terms of gender (Garrard et al., 2012; Bonham and Wilson, 2012; Aldred et al., 2016; Prati et al., 2019; Sayagh et al., 2022), income (Vidal Tortosa et al., 2022), race/ethnicity (Braun et al., 2019), age (Grudgings et al., 2021), and cultural capital (Quaglione et al., 2019). Indeed, in most cases male, white, affluent, working, and inner-city residents make up the majority of regular cyclists.

For many operational and research observers, the early months of Covid-19 (March–June 2020) significantly altered the context of daily cycling in many countries as: (1) a decrease in traffic and car congestion was observed during lockdowns, making it easier for bicycles to move around (Naseri et al., 2023); and (2) bike lanes and other temporary facilities made bicycle travel safer (Buehler and Pucher, 2022). These first two elements correspond to well-identified barriers to practice among female populations, who generally prioritize safe travel and separate cycle paths (Aldred et al., 2017). In addition, (3) the increase in teleworking related to Covid-19 has been most prevalent among executives, high-income populations, and males; i.e., among audiences already overrepresented in the general cycling population in many countries including France (INSEE, 2022; Naseri et al., 2023).

Some research findings are emerging on the question of social profiles that have reportedly increased or decreased their cycling since the outbreak of Covid-19. The findings of this research are contrasted. Because of the differences in the (1) time periods studied, (2) local health measures, (3) bicycle policies, (4) geographic contexts, and (5) the nature of the data collected, comparisons among these studies appear to be of limited relevance.

Studies of changes in cycling by gender show (1) in Germany, a greater decrease for men during the first lockdown (Eisenmann et al., 2021); (2) on the contrary, during the same period, an increase in cycling distances and times was observed in Switzerland, particularly for men (Molloy et al., 2020); (3) in Iran, although female cycling is uncommon, it increased during the pandemic, as did male cycling (Shaer et al., 2021); and (4) studies in the United States and Australia show a widening of the gender gap in cycling (Gladwin and Duncan, 2022; Naseri et al., 2023).

In this academic and operational context, the present article aims (1) to provide new elements on what has constrained or motivated changes in practice in French cities and (2) to contribute to emerging knowledge of the role of Covid-19 in amplifying or reducing practice inequalities.

In order to contribute on these two specific points, we draw on a survey conducted in France among 7343 people questioned between May and October 2021 about changes in their practices with the crisis, focusing on both utility and leisure uses.

2. Materials and methods

2.1. A web-questionnaire survey

This paper is based on material collected as part of the "*Vélotactique*" project, whose objective was to study changes in cycling habits during the first 18 months of the Covid-19 pandemic (March 2020–October 2021) which were characterized by intense communication and the implementation of pro-bike policies in France.

This article is based on a nationwide survey (n = 7343), conducted via a self-administered questionnaire at the end of this period, between May 2021 and October 2021. In order not to investigate frequent cyclists exclusively, while cycling is not very common in France (only 2.7% modal share (ENMP, 2019) compared to 26.8% in the Netherlands for example (Goel et al., 2022)), the questionnaire was addressed to any adult (>18 years old) who had cycled at least once during the 24 months preceding the survey. The questionnaire was circulated via various media (social networks, e-mail, print media). Some of the cities targeted by the research project because of the location of research teams (Paris, Lyon, Montpellier, Rennes, and Grenoble) were oversampled, but the questionnaire was distributed throughout France so as not to exclude small towns and rural areas from the survey.

The discussion focuses on the following aspects: (1) practices and perceptions of cycling and daily mobility; (2) changes in cycling-related to the health crisis; (3) socio-demographic and geographic data.

The results are based on bivariate treatments, tests of independence, logistic regressions and additional comments made by some of

the respondents in answer to an open question (n = 1594) inviting them to explain any change in their cycling habits. The regressions are multinomial and based on a stepwise top-down selection procedure. The calculations were performed on RStudio using the *JLutils* package for the regressions. The range of values of some variables has been reduced by grouping them together in order to make the regression model more robust, which does not prevent us from referring to non-simplified bivariate statistics to gain analytical accuracy.

2.2. Descriptive statistics

The general sample (n = 7343) can be described with the following sociological characteristics (see Table 1) .

The first observation on this sample is that, despite our efforts to reach a diverse audience, most of the respondents use bicycles regularly (only 12.7% said they use them less than once a month). This is probably because this topic is more likely to be of interest to them, motivating them to fill out the self-administered questionnaire.

This factor also strongly influences the proportion of executives and managerial staff in the sample. Self-administered surveys tend to select people who are comfortable with the written word and with digital tools, and are therefore of a higher social category (Bandilla et al., 2003).

Two factors are also the direct consequence of the mode of administration and dissemination: the median age of respondents is relatively low, the working population is largely represented and our respondents are concentrated in dense urban areas.

These biases do not invalidate the capacity of our sample to reveal social and spatial inequalities in cycling practice. Indeed, this sample composition is consistent with the statistical data available on urban cycling in France (two main sources: the national travel survey (latest version: 2019 (Ministère de la Transition Ecologique, et de la Cohésion des Territoires, 2021)) which records all modes of transport used by a person on a typical day, and the national census (latest data available: 2017 (Tallet, 2017) which focuses on commuting).

Table 1
Main characteristics of the sample group.

Gender	Male: 58.6%
	Female: 40.3%
	Non-binary: 1.1%
Socio-professional categories	In employment: 84.6%
	Executives and higher intellectual professions: 56.1%
	Intermediate professions and clerical workers: 25.1%
	Manual workers: 1.3%
	Students: 8.4%
	Retired: 4.6%
Degree	Master's degree or Doctorate: 64%
	Bachelor's degree (3 or 4 years in higher education): 19.6%
	Technical university diploma (2 years in higher education): 9.1%
	High school diploma (or less): 1.1%
Age	18–24 years: 9%
	25–34 years: 29.6%
	35–44 years: 27.6%
	45–54 years: 18.4%
	55–64 years: 10.7%
	More than 65 years: 4.6%
Cities	Lyon: 21.48%
	Montpellier: 11.61%
	Paris: 9.83%
	Grenoble: 5.48%
	Rennes: 4.89%
	Other: 35.2%
Population density of the area of residence[1]	High density (urban areas): 83.8%
	Intermediate density (suburban areas): 9.8%
	ow density (populated rural areas): 6.1%
	Very low density (isolated rural areas): 0.3%
Commuting transport mode to place of work or education[2]	Classical bike: 53.1%
	E-bike: 12.7%
	Car (as driver): 11.2%
	Car (as passenger): 1%
	Walking: 8.4%
	Public transport: 6.6%
Frequency of teleworking since the onset of the Covid crisis[3]	Every day or almost every day: 27.3%
	At least once a week: 69.6%
	Never: 7.11%

[1] Respondents entered their postal code, the densities shown here are based on density indicators proposed by the French national statistics office (INSEE).

[2] Main transport mode declared for commuting since the beginning of the Covid-19 crisis.

[3] People declaring they have teleworked since the outbreak of the crisis.

The modal share of cycling was 3% in 2019 for all trips and 1.9% for commuting in 2017. It is higher in dense urban centers. This modal share has most likely increased since then, especially with the impetus given by the first months of the Covid-19 crisis.

Bicycle ownership is socially selective in France: 32% of French households own at least one bicycle (in 2019). This is the case for 41% of households with an income per consumption unit of more than €2500/month, but for only 21% when it is less than €1000/month. Although they are over-represented in our sample, executives and managerial staff is the category in France that uses bicycles most often for commuting, particularly in urban centers, where they are the driving force behind the expansion of cycling (Adam, forthcoming). Indeed, executives (3%, in 2017) and particularly those in the public sector (4%) are the ones who proportionally use their bicycle the most to go to work. The level of education is even more decisive: while 3.5% of university graduates and 5.1% of PhDs use their bicycle to commute, only 1.6% of workers with a high-school diploma do so. In terms of gender, our sample is consistent with the 60% male/40% female split around which most French studies converge (*ibid.*). Because of its high proportion of executives, our sample includes a large proportion of people who have teleworked (or tele-studied for students) since the beginning of the health crisis.

Large-scale surveys in France often focus separately on either leisure or utility cycling practices. There is therefore no uniform representativeness parameter that would have enabled us to make statistical adjustments. Knowing that the divide between utility and leisure cycling is a debatable categorization (Aldred and Jungnickel, 2012), we clarified the meaning in the questionnaire. Indications were added in parentheses for each question involving these categories: "utility cycling" (commuting, visiting friends, shopping, etc.) and "leisure cycling" (cycling for fun, cycling for exercise, playing out, etc.).

3. Results

More than seven out of ten respondents have seen their bicycle use change with the crisis, as shown in Table 2. Both utility and leisure cycling are more likely to have increased than decreased during the period analyzed. It is also noticeable that all possible combinations of directions of change between utility and leisure practice have occurred. In particular, among cyclists who increased their utility cycling frequency, nearly two out of ten also increased their leisure cycling frequency.

3.1. A utility practice motivated by fear of Covid-19 and restrained by teleworking

Generally, people who are the least likely to have changed their utility cycling habits with the crisis are those who are usually the least likely to travel by bicycle (see Table 3). This is particularly the case for individuals aged 65 and over, those on low incomes (<€1500/household), those who report little or no teleworking, those who are not comfortable cycling, those who live in low-density environments, and those who consider that the route between their home and their main activity is not well equipped for cycling.

The people most likely to have increased their utility cycling with the crisis are particularly likely to have been prompted by fear of Covid-19 (45.9% vs. 26.9% of those who "disagree") and the desire to avoid public transport (42.9% vs. 22.8% of "disagree").

Women are more likely than men to agree with the idea of having been prompted by fear of the virus (15.9% vs. 11.4%) and concern about avoiding public transport (27.7% vs. 22.5%). Besides, women account for a greater share of this increase (39.3% compared to 30.8% of men), along with residents of large metropolitan areas, particularly those of Greater Paris (47.3% compared to 34.5% of residents of Greater Lyon), especially those of the center (49.2%) and the inner suburbs (47.6%).

The decrease in utility cycling particularly concerns cyclists declaring a high frequency of teleworking during the crisis, aged between 25 and 59 years, who are wealthy and at ease with cycling. Indeed, this decrease concerns 39.8% of the respondents

Table 2
Cross evolution of utility and leisure cycling before and since Covid-19 (n = 7267).

		Change in the frequency of **leisure cycling**			
		Increase	No change	Decrease	
Change in the frequency of **utility cycling**	Increase	n=1322 18.2%	n=967 13.3%	n=202 2.8%	n=2491 34.3%
	No change	n=690 9.5%	n=2008 27.6%	n=424 5.8%	n=3122 42.9%
	Decrease	n=342 4.7%	n=586 8.1%	n=726 10%	n=1654 22.8%
		n=2364 32.4%	n=3561 49%	n=1352 18.6%	

Table 3
Change in **utility** cycling with the Covid-19 crisis (logistic regression).

Characteristic	OR[a]	95% CI[a]	p-value	OR	95% CI	p-value
	Decreased frequency of utility cycling (compared to "no change")			Increased frequency of utility cycling (compared to "no change")		
Gender			<0.001			<0.001
Male	–	–		–	–	
Female	1.08	0.93, 1.26	0.3	1.51	1.33, 1.73	<0.001
Age categories (years)			<0.001			<0.001
18–24	–	–		–	–	
25–34	1.93	1.37, 2.73	<0.001	0.96	0.74, 1.25	0.8
35–44	1.97	1.38, 2.83	<0.001	0.79	0.60, 1.03	0.084
45–54	2.17	1.49, 3.16	<0.001	0.61	0.45, 0.82	0.001
55–64	1.85	1.22, 2.81	0.004	0.62	0.45, 0.86	0.005
65 and +	2.22	1.24, 3.97	0.007	0.45	0.29, 0.71	<0.001
Study areas			<0.001			<0.001
Other	–	–		–	–	
Lyon metropolitan area	0.96	0.79, 1.16	0.6	1.13	0.95, 1.33	0.2
Paris metropolitan area	1.07	0.88, 1.31	0.5	1.97	1.67, 2.32	<0.001
Population density (area of residence)			0.059			0.059
High density (urban)	–	–		–	–	
Intermediate density (suburban)	0.79	0.61, 1.02	0.074	0.97	0.77, 1.22	0.8
Low density (populated and isolated rural)	0.63	0.45, 0.89	0.008	1.10	0.83, 1.45	0.5
Household income			0.023			0.023
More than €5000/month	–	–		–	–	
Less than €1500/month	0.56	0.41, 0.77	<0.001	0.65	0.51, 0.84	<0.001
€1500–3000/month	0.85	0.69, 1.04	0.12	0.84	0.70, 1.01	0.060
€3000–5000/month	0.89	0.74, 1.08	0.2	0.86	0.73, 1.03	0.10
Telework or telestudy frequency			<0.001			<0.001
Never	–	–		–	–	
Less than 1 day/week	0.70	0.45, 1.09	0.11	0.96	0.76, 1.22	0.7
1–4 days/week	4.50	3.38, 5.99	<0.001	1.51	1.26, 1.82	<0.001
Every day or almost every day	11.9	8.87, 16.0	<0.001	1.57	1.27, 1.93	<0.001
"I am at ease on a bike"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	3.33	1.81, 6.10	<0.001	3.12	1.98, 4.89	<0.001
Agree	3.38	2.04, 5.61	<0.001	2.20	1.52, 3.19	<0.001
"Fear of the virus motivates me to cycle more"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	0.90	0.71, 1.14	0.4	0.77	0.62, 0.95	0.016
Agree	0.85	0.67, 1.08	0.2	1.36	1.11, 1.66	0.003
"Avoiding public transport motivates me to cycle more"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	1.06	0.81, 1.38	0.7	1.11	0.87, 1.43	0.4
Agree	1.27	1.00, 1.62	0.055	2.17	1.74, 2.70	<0.001
"My main route has good cyclability"			0.034			0.034
Disagree	–	–		–	–	
Neither agree, nor disagree	1.09	0.89, 1.32	0.4	0.94	0.79, 1.11	0.5
Agree	1.31	1.10, 1.55	0.002	1.17	1.01, 1.35	0.041

[a] OR = Odds Ratio, CI = Confidence Interval.

teleworking every day (or almost every day) against 5.8% of those teleworking less than one day per week, and 26.7% of the wealthiest respondents (>€5000/household) against 15% of the least wealthy (<€1500/household).

3.2. A leisure practice slightly less encouraged by the fear of Covid-19 but motivated by teleworking and the desire to exercise

The explanatory variables for the change in leisure practice differ from the previous model (see Table 4). While the variables income, density, and cyclability of the main route are rejected by the model, the variable "*I cycle to do physical exercise*" is significant here. Indeed, cyclists who are generally motivated by the desire to exercise are particularly likely to have increased their leisure cycling during the crisis.

In addition, the gender difference here is characterized by a decrease in cycling, which is more common among men (20.5%) than among women (15.8%). In contrast to the decrease in utility cycling, which particularly concerns individuals aged between 25 and 59, the decline in leisure cycling particularly affects those over 65, and its rise particularly concerns young people (18–34 years old).

To a lesser extent than for utility cycling, respondents declaring an increase in the frequency of leisure cycling are nevertheless particularly likely to consider that the desire to avoid public transport has encouraged them to cycle more (37.1% compared with 24.5% for those who "disagree").

Lastly, if the decrease in utility cycling is reinforced by the frequency of teleworking, the trend is the opposite for leisure practice:

Table 4
Change in **leisure** cycling with the Covid-19 crisis (logistic regression).

Characteristic	OR[a]	95% CI[a]	p-value	OR	95% CI	p-value
	Decreased frequency of leisure cycling (compared to "no change")			Increased frequency of leisure cycling (compared to "no change")		
Gender			0.003			0.003
Male	–	–		–	–	
Female	0.75	0.64, 0.87	<0.001	1.01	0.89, 1.14	0.9
Age categories (years)			<0.001			<0.001
18–24	–	–		–	–	
25–34	1.22	0.89, 1.67	0.2	0.94	0.75, 1.19	0.6
35–44	1.38	1.01, 1.88	0.046	0.86	0.68, 1.08	0.2
45–54	1.44	1.04, 2.00	0.030	0.71	0.55, 0.92	0.009
55–64	1.19	0.82, 1.72	0.4	0.59	0.44, 0.80	<0.001
65 and +	2.46	1.56, 3.86	<0.001	0.64	0.41, 0.99	0.046
Study areas			0.013			0.013
Other	–	–		–	–	
Lyon metropolitan area	1.14	0.95, 1.37	0.2	1.03	0.88, 1.21	0.7
Paris metropolitan area	1.06	0.88, 1.28	0.6	1.31	1.13, 1.52	<0.001
Telework or telestudy frequency			<0.001			<0.001
Never	–	–		–	–	
Less than 1 day/week	0.89	0.67, 1.19	0.4	1.11	0.87, 1.41	0.4
1–4 days/week	1.03	0.83, 1.27	0.8	1.31	1.09, 1.57	0.004
Every day or almost every day	1.59	1.26, 1.99	<0.001	1.57	1.29, 1.91	<0.001
"I am at ease on a bike"			0.064			0.064
Disagree	–	–		–	–	
Neither agree, nor disagree	1.48	0.82, 2.66	0.2	1.26	0.82, 1.92	0.3
Agree	1.99	1.23, 3.23	0.005	1.21	0.86, 1.69	0.3
"Fear of the virus motivates me to cycle more"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	1.08	0.85, 1.37	0.5	0.83	0.68, 1.01	0.063
Agree	0.99	0.78, 1.25	>0.9	1.19	0.98, 1.43	0.077
"Avoiding public transport motivates me to cycle more"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	1.07	0.82, 1.40	0.6	1.41	1.12, 1.79	0.004
Agree	1.20	0.94, 1.54	0.15	1.72	1.40, 2.12	<0.001
"Exercising motivates me to cycle more"			<0.001			<0.001
Disagree	–	–		–	–	
Neither agree, nor disagree	1.42	0.82, 2.45	0.2	1.25	0.75, 2.06	0.4
Agree	1.59	0.99, 2.57	0.056	2.25	1.46, 3.45	<0.001

[a] OR = Odds Ratio, CI = Confidence Interval.

the more frequently people have teleworked, the more likely they are to have intensified their leisure cycling.

4. Discussion

4.1. An illusory reduction in socio-spatial inequalities

Being more involved in teleworking, wealthy cyclists are particularly likely to have reduced their utility cycling during the crisis. Because other health measures were taken by companies, this decrease often lasted beyond the periods of forced teleworking:

> The closing of the company locker rooms made me abandon the bike to go to work. No shower possible, no bike. (Man, 54 years old, senior manager)

It would be tempting to associate this time period with a reduction—albeit temporary—in cycling inequalities between the wealthier and the poorer. But on the one hand, teleworkers are particularly concerned by an increase in their leisure practice, and on the other hand, teleworking has now considerably decreased compared to the study period. Most importantly, although considerably less involved in teleworking, the poorest respondents have not increased their cycling more than the richest despite a government subsidy for the purchase of a bicycle for the poorest households and a subsidy of €50 per bicycle for repairs without the need to pay up front. This finding suggests that the main obstacles to access to bicycles for the working classes (problem of image and lack of cycling infrastructure, dependence on the car) (Braun et al., 2019; Quaglione et al., 2019; Vidal Tortosa et al., 2022) have not been overcome.

It is worth noting that the poorest people, those who are not comfortable cycling, those who live in low-density environments, and those who do not consider the route between their home and their main activity (work, study, other) to be well equipped for cycling are particularly unlikely to have changed their utility cycling habits during the crisis.

Of course, this finding was confirmed—as in Germany (Eisenmann et al., 2021)—by the fact that small municipalities were much less affected by the decline in public transport use.

This finding is also supported by the fact that (like the financial incentives for repairs (OpinionWay, 2021) the development of new

bicycle lanes (at first temporary and then mostly permanent) has mainly concerned the centers of metropolitan areas (Morio and Raimbault, 2021). This explains the complaints of respondents who feel that bicycle facilities should have been designed primarily "outside the metropolitan area and nearby municipalities" (woman, 44 years old, clerical worker). It is perceived as necessary to "think about the small villages as well" (woman, 22 years old, student). Although cycling increased during the crisis in peri-urban and rural areas due to the growing use of e-bikes, this effect had already disappeared by 2022 (Vélo et territoires, 2023).

4.2. An illusory reduction in gender inequalities

Insofar as the gap in cycling between women and men has narrowed with the crisis, the finding is again comparable to that of the German study (Eisenmann et al., 2021). However, our results go beyond the period of lockdown and make it possible to differentiate between utility and leisure cycling. Whereas women are particularly likely to have increased their utility practice, men are more likely to have reduced their leisure practice. It is therefore tempting to interpret this finding as a step towards gender equality.

Some women stated in the questionnaire that they had taken advantage of the considerable reduction in motorized traffic during the first lockdown and/or the considerable growth in safe bicycle facilities to take up or resume cycling.

But multiple indicators suggest that this reduction in the gender gap cannot be interpreted as a mark of emancipation. First, it should be remembered that women are more likely to use public transport and therefore have a greater real and perceived risk of being infected with Covid-19 (Schaefer et al., 2021; Assoumou Ella, 2021). Furthermore, because they engage in activities that are considered more essential, women have been both more exposed to the virus and more affected by the increase in their workload, while continuing to contribute more than men to domestic duties (Fondation des femmes, 2021; Delhomme et al., 2022).

The crisis has both forced women to make more mandatory trips and accentuated their lesser economic capacity and their lesser time available for leisure travel or to engage in physical activities (Mutz and Reimers, 2021). On this last aspect, it seems important to point out that women's sports activities are more likely to take place indoors and in clubs (INJEP, 2021). These activities have thus been further slowed by the closure of sports facilities during lockdowns. Accordingly, our data show that women are significantly more likely than men to consider that they were prompted to cycle by it being impossible to enjoy their usual sport (37% versus 30.3%).

Finally, several female respondents stated that they felt "forced" or "obliged" to cycle. As their free time was squeezed, some of them seem to have cycled as a way to perform their role in the family sphere more efficiently. The bicycle could therefore replace the car in this role that seems not emancipatory but instead seems to intensify women's domestic work (Demoli, 2014).

4.3. Compensation strategies through substitution or hybridization of utilitarian and recreational practices

> I finally bought this bicycle (an e-bike) this spring and I have no regrets. I use it on weekends to go to the market, downtown, to the library, to my parents' house, out and about, to the park. My children are 2 and 3 years old and they love it. It's great. I haven't used my car since I got it. (Woman, 34 years old, clerical worker)

This excerpt suggests that utility and leisure cycling tend to be intertwined. In particular, the crisis has encouraged utility-based recreational trips, especially when people used the pretext of having something to do to get out and about, to get some fresh air or to let off steam on their bikes. Also, the crisis has sometimes led to intentional extensions of the distance or duration of usual utility trips, in order to prolong the pleasure and/or for sporting gain.

> I actually do more than it takes. I deliberately do more than it takes, because I still need to go out, and so I'll add on trips, I'll make detours to compensate a little […] I'm capable of going to buy a kilo of apples at 11:30 in the morning and going to the other end of the city. (Man, 41 years-old, manager)

Temporary bike lanes were often well received by cyclists and seem to have encouraged cycling by creating a more positive relationship with travel time and more comfortable urban leisure practices.

In addition, respondents reported that, faced with being forced to telework for several months, they decided—in order to keep physically fit and/or to clear their minds—to convert their commute to recreational use (often at the same morning hours), sometimes planning their route along transitional bike lanes. Illustrated by the following extract, another strategy—often combined with the first—was to compensate for their usual sports activities:

> I have to replace my sports activities by cycling. So, leisure cycling has increased due to the crisis. In order to avoid traffic, I do my bike riding (road/trail) at 7:30 in the morning on the weekends. (Woman, 32 years old, manager)

Finally, by generating forced deprivations, the periods of lockdown and teleworking have encouraged cyclists to set up compensatory strategies by substituting or hybridizing utility and leisure cycling. The outbreak of the health crisis thus seems to have blurred the conventional dividing line between leisure and utility cycling.

5. Conclusions

The objective of this article was to investigate the factors that constrained or motivated changes in cycling practice during the first 18 months of the health crisis while contributing to emerging knowledge about the role of Covid-19 in amplifying or reducing inequalities.

Based on a nationwide questionnaire answered by 7343 cyclists between May and October 2021, we showed that while utility

cycling was particularly driven by fear of Covid-19 and curbed by teleworking, leisure cycling was particularly driven by teleworking and the desire to exercise.

The deprivation generated by lockdowns and teleworking revealed compensatory phenomena, blurring the boundary between leisure and utility cycling. Because wealthy cyclists are particularly likely to have reduced their utility riding and women are more likely to have increased theirs, it would be tempting to conclude that inequalities have been reduced.

However, while teleworkers in particular reported an increase in their leisure activities and the development of cycling facilities near their place of residence, the poorest populations did not increase their use of bicycles as much as the wealthiest. The poorest respondents are the least likely to have changed their utility cycling habits as a result of the crisis, especially the least urban populations (i.e., people living in isolated rural areas) who have been largely overlooked by public incentive policies (Morio and Raimbault, 2021).

These findings suggest that inclusive measures should be taken to remove the main barriers to cycling for those who are least likely to take it up. In the same way, the reduction in cycling disparities between men and women masks the forced nature of the increase in cycling by women, for whom cycling has been mainly a means of protecting themselves and others and/or a means of overcoming a reduction of their free time due to their increased professional and domestic workload. This finding serves to caution against the pitfall of thinking that reducing gender inequalities in cycling is necessarily a step towards gender equality (Sayagh et al., 2022).

Finally, it should be recalled that this article focuses on the first 18 months of the crisis. Future studies will be needed to assess whether the observed changes prove permanent.

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Declaration of competing interest

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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