Manuscript Details

Manuscript number	LAND_2019_283_R1
Title	Impact of a riverside accessibility intervention on use, physical activity, and wellbeing: A mixed methods pre-post evaluation
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Abstract

Introduction: Access to natural outdoor environments can promote physical activity, social cohesion, and improved psychological well-being. In 2016, an urban riverside regeneration project to facilitate access to the riverbank for pedestrians and cyclists was conducted in Barcelona (Spain). We aim to evaluate its effect in terms of changes in use and physical activity of users, and changes in local's use and perception of the urban riverside, and their corresponding self-perceived health and well-being. Methods: We conducted systematic observations, before and after the intervention, using the System for Observing Parks and Recreation in Communities (SOPARC) to quantify the use and physical activity levels of users and compared them over time. Qualitative assessment consisted of semi-structured face-to-face interviews with the locals. Results: We observed a 25% increase in users of the renovated area of the river after the intervention. There was an increase in sedentary users and those engaged in moderate levels of physical activity [7.7% vs. 12.0% sedentary users, and 66.9% vs. 68.7% moderately active users before and after the intervention respectively, $p<0.001$]. The growth of users in the renovated area was mainly driven by females, adults, children, and the non-Caucasian population. Resident interviewees, in general, reported to be happy to live near the river, where they usually go for a stroll, and thought living near the riverside area might benefit their health and well-being. Overall, residents seemed satisfied with the intervention. Conclusions: Nature-based interventions in socioeconomically-deprived neighbourhoods might reduce inequalities in access to natural areas, creating attractive destinations for residents, promoting physical activity and/or creating opportunities for social interactions, and improving their health and well-being.

Keywords	environmental improvement; river; physical activity; SOPARC; deprived community; social cohesion
Taxonomy	Urban Planning, Behavior, Landscape Planning
Manuscript category	Landscape Design

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Submission Files Included in this PDF

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Editorial Board
Landscape and Urban Planning

June 6, 2019

Dear Editor,

Please find attached the manuscript entitled "Impact of a riverside accessibility intervention on use, physical activity, and wellbeing: A mixed methods pre-post evaluation". This manuscript was submitted to the Landscape and Urban Planning journal in March 2019 (submission number: LAND_2019_283) and now it is submitted as a revised submission.

We would like to thank the opportunity to provide a revised version of this manuscript. We also appreciate all the comments and suggestions provided by the reviewers, which have certainly helped us to improve our manuscript.

We responded to every comment and modified the manuscript to comply with the requests. As suggested by Reviewer 2, we have employed a more advanced statistical method to evaluate the effects of the urban riverside regeneration project in the user's physical activity levels. The results for this analysis are reported in Table 2, and described in the Results section.

All co-authors have reviewed and approved the revisions of this manuscript. This is an original work and has not been published, partially or totally, in any other journal. The present study is not under consideration for publication anywhere else.

We look forward to hearing from you.

Yours sincerely on behalf of all co-authors,

Mireia Gascon
Mark Nieuwenhuijsen

Impact of a riverside accessibility intervention on use, physical activity, and wellbeing: A mixed methods pre-post evaluation

Manuscript number: LAND_2019_283

Response to Editors and Reviewers

Comments from the editors and reviewers:

-Reviewer 1

This is a well-written and comprehensive, mixed methods study of how green space renovations effect the types and quantity of users, as well their activity. Some of the findings were unexpected (e.g., preference of non-renovated space for running and biking; reduced usage among adolescents) but did imply importance of "foot traffic" flow and congestion, that could discourage faster paced activities; and potential area for future research, re: preferences of adolescents.

- We thank the reviewer for their comments and their contribution by reviewing the manuscript. Below, please find an itemized response to all the comments provided. The changes are highlighted in red in the revised manuscript.

Feedback, suggestions:

Lines 196, 207-211. You indicated that where values were missing you defaulted to categorizing people as "adult Caucasian males walking". You then reported ICC between observers, and varying levels of agreement (lowest for ethnicity, which is very common for this type of observational research). You then said results were similar when missing data were filled in with the default information. So I just want to confirm that my understanding of all this is correct. That only MISSING values were coded as adult Caucasian males walking, not when there was disagreement among reviewers (e.g., how was it handled if one identified someone as "Latin-American" and the other rater said they were "Black"? I am assuming they didn't then default to "Caucasion", correct?)... In other words, please also describe your procedure for coming to consensus re: which category they belonged to when the values weren't missing, but the reviewers disagreed?

- We thank the reviewer for bringing this possible confusion to our attention. The reviewer is correct in their interpretation and understanding of the procedure that was followed in this section of the manuscript. To clarify, observations were conducted by two observers simultaneously and, as mentioned in section "2.3. Data analysis" of the manuscript, *"(...) We measured the degree of agreement between observers using the Intraclass Correlation Coefficient (ICC) (...)"*. This

was to assess reliability of the data and agreement between observers. As mentioned in section "3.1. Agreement between observers and good reproducibility of the procedure" and pointed out by the reviewer, *"(...) the overall ICC between observers was 0.996 (95% CI; 0.994, 0.998) (...)"*, which indicates a high degree of agreement between observers. After conducting this assessment, and as mentioned in section "2.3. Data analysis" *"(...) for each day, time of the day, and target area we randomly selected one of the two observations (...)"*. And after this, we replaced missing values using the data provided by the partner observer (already excluded, but used in this data cleaning stage for this purpose). In case both observers had a missing value for a particular observation, *"we coded these missing observations as men, adults, Caucasian, and walking because these were the main characteristics of the study population"*.

Consensus between observers on user characteristics was therefore not required because after determining good inter-rater reliability, only one observer's data was randomly selected for inclusion in this study. Reliability checks were conducted before, and as above mentioned, the degree of agreement between observers was very high.

In order to clarify it, we have amended the text in section "2.3. Data analysis" of the manuscript (lines 193-195):

"Then, for each day, time of the day, and target area we randomly selected one of the two observations in order to avoid duplicates. If there were missing values for the selected observer, we replaced them with the values provided by the excluded partner observer."

Lines 450-453. This is a very important point! Great to have this, but as some of your interviewees told you, if access is difficult (they have to walk a long distance or jump a fence to get there), that is a real barrier, particularly for older adults and kids. You may want to discuss this further under recommendations (see below).

- We thank the reviewer for their comment. We agree this is an important point because outdoor natural spaces should be accessible to the population to ensure

the possibility for its equal use among all citizens. It is true that some interviewees mentioned difficulties in accessing the urban riverside area, but this was mainly reported before the intervention, as indicated at the end of section "3.4.2. Use and perception of the urban riverside": *"(...) Before the intervention, some people jumped the fences to reach the riverbank, which was a dangerous practice (...)"*.

As mentioned in section "2.1. The intervention: an urban riverside regeneration project in the Besòs River" of the manuscript: *"(...)The urban riverside regeneration project aimed to provide access to the riverbank to promote its use and enjoyment by the population (...)"*. Thus, the main goal of this intervention was to provide access to the riverbanks and this was achieved by providing *"four new access points to the riverbank: two wheelchair-accessible ramps and two sets of stairs connecting the upper and the lower parts of the river"*. Results of this study suggest that this objective has been accomplished because *"(...) The highest increase of users was observed in the lower part of the renovated area, indicating that users employed the stairs and ramps dedicated to facilitate access to the riverbank (...)"*. Also, this is reported in section "3.4.3. Assessment of the urban riverside regeneration project": *"(...) Overall, participants were satisfied with the urban riverside regeneration. They said that the access to the riverbank significantly improved (...)"*.

Discussion/Conclusions. I would like to see a few recommendations of potential ways to increase the physical activity expenditure within the overall spaces (e.g., shift sedentary to walking) and also ways to increase use of the river front among under-represented groups (e.g., teens, seniors). This could be accomplished through programming, and as was mentioned, more amenities (bathrooms and benches). But are there other effective interventions that have been shown to influence activity levels for these groups? e.g., activity stations along the walking path, or distance markers? Organized events, races, walks for charity? For example, seniors tend to prefer walking loops, with benches available… incorporating loops may be difficult along a river bank, but perhaps could be installed within park areas adjacent to the river bank.

- We appreciate the reviewer's comment. We consider that the findings of this study suggest that the riverside area affected by the intervention (i.e. renovated

area) was used for leisure activities that might promote social interactions among residents, relaxation, reduction of stress, and improve well-being, which may have beneficial effects on mental health. We think this is already very relevant for public health. However, we acknowledge the health benefits of physical activity, and we think it is also very important that citizens have access to spaces for both physical activity and relaxation. Thus, we have included the following sentence at the end of the first paragraph in the Discussion:

"Thus, in this study, the renovation of the Besòs Riverside Park seemed to mostly facilitate relaxation rather than increased physical activity. However, previous studies have suggested that a number of strategies such as introducing signage, organised activities, and promotional incentives, may increase the physically active use of a park, at least in the short-term (Roberts et al. 2018)."

I would also like to see more discussion of why teenagers were under-represented, and potential ways to engage teens in positive physical activity in the renovated area. Either evidence-based or potential interventions for future research.

- We thank the reviewer for their suggestion. The section of the Besòs Riverside Park assessed in this study does not seem to engage teenagers to actively use it, which is partly consistent with results from previous studies. This might be partly due to physical characteristics of the area, which do not include any facility which may be designed to promote its use among teenagers (e.g. skate park, football/basketball court, table tennis etc.). However, the incorporation of this kind of facility should be discussed with all stakeholders involved in the management of the area to ensure environmental costs and potential human health risks and benefits are fully considered. Also, and consistent with the findings provided by the interviews, some users preferred to keep the area as natural as possible. Thus, any introduction of new facilities might encourage one group to use the area but discourage others. Nonetheless, we have included a sentence mentioning such possibilities in the Discussion, at the end of section "4.1. Main findings":

"As children and teenagers were also not frequent users, strategies to engage them to actively use the riverside area (e.g. skate park, climbing wall, organization of dancing events, etc.) might be considered to ensure that the area appealing to different age groups".

Also, I couldn't quite tell from the photos where people could be sedentary… were there benches where moms/families were able to sit, or picknick tables? Or were they bringing their own folding chairs? Having places to sit can be good, since people sitting and watching their children, socializing, reading, all increase perceptions of safety and social cohesion. Places to sit may also encourage sitting instead of walking, however, could be those users were not people who would walk anyway, so at least they are using the riverfront versus sitting at home or someplace else.

- Thank you for this insightful observation. The reviewer is right that photos included in this manuscript do not show benches or picnic tables. In fact, the amenities that might promote sedentary behavior were very scarce (only a few benches in the upper part of the renovated area, which cannot be seen in the photos). However, users used the stairs in the lower part of the river to sit or to lie on. As described in Methods, section "2.2.1. Systematic observations of riverside users", the group of sedentary users included people lying down, sitting, or standing. We have included a sentence in the Results, section "3.3. Energy expenditure":

  "(…) Sedentary users in the renovated area mainly used the stairs to sit or lie on, although some users also sat on the benches, or leant against the fence, both in the upper and the lower part of the river (Figure 2-A.2.)".

Minor feedback:

Highlights page, a typo in the second bullet. "We found an increased users"... change to "We observed an overall increase in users of an urban riverside after renovation"

- We really appreciate the reviewer's suggestion and, accordingly, we have amended the second bullet of the highlights page.

Line 76-77. Not sure what is meant by "different competencies", do you mean the public administration body who sets social and environmental policies within Barcelona is multi-disciplinary in composition? Or represents diverse sectors? Can you describe this in a different way?

- We thank the reviewer for bringing this possible confusion to our attention. The aim of this sentence was to report that the Barcelona Metropolitan Area is a public administration body which has rights on deciding on social and environmental policies in the metropolitan territory of Barcelona. We have amended the sentence:

  "In August 2016, the Barcelona Metropolitan Area, a public administration responsible of social and environmental policies in the metropolitan territory of Barcelona (...)".

Line 173. Typo, "enrolment" should be "enrollment"

- Thank you. We have corrected it (now in line 173).

Line 184. Change the word "along" to "from" or, if you prefer, "within"

- Thank you. We have corrected it (now in line 184).

Line 328. Change "reported to use" to "reported using"

- Thank you. We have corrected it (now in line 341).

Line 333. Change the word "floor" to "ground" or could just delete the words "on the floor".

- Thank you. We have deleted the words “on the floor” (now in line 345), which we consider are not necessary for the understanding of the sentence.

Line 354. Change “playing with the water of the river” to “playing in the river” (if that is what you meant? Do they go into the water? Or did you mean they engage in recreational or water-based sports?)

- We thank the reviewer for noticing this confusion. In this sentence we attempted to say that some residents liked playing in the river (being in direct contact with the water). In order to clarify it, we have amended the text (now in lines 360-361):

  “They liked either seeing the river from home (if possible), walking along it, or even observing and playing in the river being in contact with the water”.

Line 412. Change “new intervention” to “renovation”… I would suggest doing this throughout this section, so that you retain consistency with the rest of the paper where you discussed renovated and non-renovated areas along the river.

- We thank the reviewer for this suggestion. In order to be consistent with the rest of the manuscript, we have amended section “3.4.3. Assessment of the urban riverside regeneration project”. However, on some occasions, we preferred to use “urban riverside regeneration” (which has also been used in the manuscript) instead of “renovation”.

-Reviewer 2

This is a very interesting topic to explore the use of urban riverside and its relationship with physical activity and well-being of users. This study has its merits including that they used a mixed method (both quantitative and qualitative) and conducted the observation systematically in a large sample, and they also compared the changes of outcome measures before and after the regeneration (intervention). I appreciate the great effort the authors have spent on data collection. Although the findings in this study may not be generalized to other countries/regions due to cultural difference, the information gained is still valuable to understand the impact of built-environment on physical activity and other health-related outcomes in the context of Spain. This manuscript is generally well written. However, I have some major concerns for the authors to improve this manuscript before publication as follows.

- We really appreciate reviewer's words and their contribution by reviewing the manuscript. Please find below an itemized response to all the comments provided. The changes are highlighted in red in the revised manuscript.

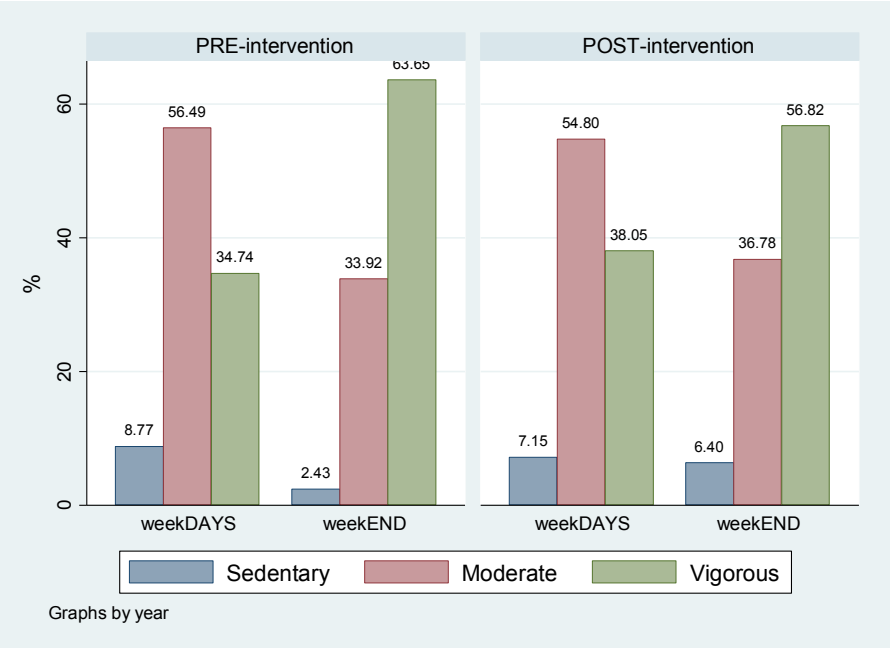
1. Observations were conducted on different days and time slots. It could be very interesting to dig into the data and examine whether there is any difference in physical activity levels of users between weekdays and weekend days as well as among morning, midday, and afternoon? Because the pattern of physical activity is often influenced by this factor. Some valuable information may be omitted by averaging physical activity on all days and time slots.

- The reviewer is right to highlight this oversight. Physical activity levels might differ between days of the week, and time slot. Thus, we have conducted a descriptive analysis describing levels of physical activity stratified by day of the week (i.e. weekday and weekend) and time slot (i.e. morning, midday, and afternoon). The distribution of systematic observations among time periods is described in Figure S1 (Supplementary Material). For each period of evaluation, 4 observation sessions were conducted at weekends, and 9 on weekdays.

  As shown in Figure R1, the percentage of sedentary and moderately active users was significantly lower in the weekend than the rest of the week. The opposite

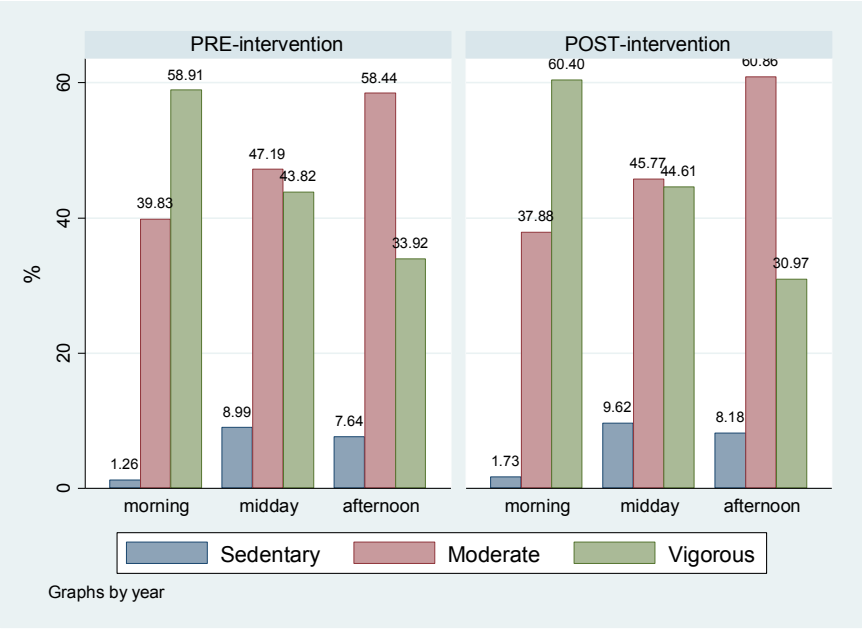
was observed for vigorously active users (i.e. higher percentage of users during the weekend). This might be explained by the larger influx of specific users visiting the area during the weekend; according to the observation assessment, most of them were cyclists who used this part of the riverside area as part of their cycling route. This pattern was similar before and after the intervention. However, after the intervention, the influx of sedentary users on the weekends increased (2.43% in 2016 compared with 6.40% in 2017); and the difference on the % of vigorously active users between weekdays and weekends decreased (Figure R1).

Figure R1. Levels of physical activity by day of the week (i.e. weekday and weekend), and stratified by period of evaluation (i.e. pre/post-evaluation).



Users' distribution within time slots did not change between periods of evaluation (i.e. year 2016 vs. 2017) (data not shown). For both periods of evaluation, sedentary users were more frequent during the midday, moderately active users were more frequent in the evening, and vigorously active users were more frequent in the morning (Figure R2).

Figure R1. Levels of physical activity by time slot (i.e. morning, midday, and evening), and stratified by period of evaluation (i.e. pre/post-evaluation).



We think it is not necessary to include this descriptive analysis in the manuscript because it is not in the scope of our study. Nevertheless, we have included these two variables (i.e. day of the week, and time slot) into the adjusted models (please, see response to comment #2).

2. Results generated from T-test is not appropriate or enough to answer the research question. A more advance statistical method, like linear mixed models, should be adopted to compare the impact of *regeneration of riverside* (renovated vs. non-renovated area) and *time* (baseline vs. posttest) on physical activity participation, so to gain more solid results. The effects of age, gender, and ethnicity can be further explored. Additionally, the results section is not concise enough for the readers to capture the critical findings.

- We thank the reviewer for their comment and suggestions. We agree that the results of this study can be further explored to get more robust results that strengthen the internal validity of this study. For this reason, we have used multinomial logistic regression models to assess the effects of the urban riverside regeneration project (i.e. pre/post intervention) and the target area (i.e. renovated and non-renovated area) on the user's physical activity levels. The

effects of other covariates (i.e. gender, age, ethnicity, location, day of the week, and time of the day) have also been assessed. Results have been included in the main manuscript (reported in Table 2 and described in Results, section "3.3. Energy expenditure"). The methodological procedure has been described in section "2.3. Data analysis":

"2.3. Data analysis. (...) Moreover, we have used multinomial logistic regression models to assess the effects of the urban riverside regeneration project (i.e. pre/post intervention) and the target area (i.e. renovated and non-renovated area) on the user's physical activity levels. We assessed effect modification using likelihood ratio test (LRT). We also assessed the influence of other covariates (i.e. gender, age, ethnicity, location, day of the week, and time slots) (...)".

Table 2. Association [Relative Risk Ratio (RRR) 95% CI] between post intervention evaluation period (year 2017) – having the pre-intervention evaluation period (year 2016) as the reference – and covariates, with user's physical activity level [i.e. sedentary, moderate and vigorous (reference)], for the renovated and non-renovated area.

	Renovated area		**Non-renovated area**	
	Physical activity level (Reference=Vigorous)		Physical activity level (Reference=Vigorous)	
	Sedentary RRR (95% CI)	Moderate RRR (95% CI)	Sedentary RRR (95% CI)	Moderate RRR (95% CI)
POST (2017) [Reference=PRE (2016)]	1.78 (1.26; 2.51)*	1.25 (0.99; 1.57)*	0.68 (0.49; 0.94)*	0.67 (0.58; 0.78)*
Covariates				
Females (ref=males)	2.73 (1.74; 4.29)*	6.55 (4.68; 9.17)*	8.23 (5.66; 11.96)*	10.12 (8.19; 12.51)*
Age group (ref=adults)				
Children	5.22 (2.23; 12.26)*	1.57 (0.70; 3.55)	41.84 (18.89; 92.65)*	11.06 (5.70; 21.48)*
Teens	0.78 (0.33; 1.83)	1.18 (0.69; 2.01)	19.95 (11.53; 34.51)*	1.08 (0.61; 1.91)
Senior	2.41 (1.66; 3.51)*	4.80 (3.71; 6.22)*	7.26 (5.03; 10.46)*	8.30 (7.06; 9.75)*
Non-Caucasian (ref=Caucasian)	2.99 (1.44; 6.21)*	2.19 (1.24; 3.88)*	8.77 (3.55; 21.65)*	6.17 (3.43; 11.08)*
Lower location (ref=Upper location)	4.14 (2.21; 7.77)*	4.40 (2.62; 7.38)*	0.33 (0.16; 0.67)*	0.39 (0.30; 0.51)*
Weekend (ref=weekday)	0.48 (0.33; 0.70)*	0.50 (0.39; 0.65)*	0.27 (0.18; 0.40)*	0.43 (0.37; 0.51)*
Time of the day (ref=midday)				
Morning	0.18 (0.11; 0.30)*	0.54 (0.42; 0.69)*	0.11 (0.06; 0.21)*	1.02 (0.86; 1.21)
Afternoon	0.66 (0.40; 1.08)	0.94 (0.65; 1.36)	0.79 (0.54; 1.15)	1.49 (1.20; 1.85)*

RRR: Relative Risk Ratio
Ref=Reference
*Statistically significant ($p<0.05$)

"3.3. Energy expenditure. (…) Thus, in the post-intervention evaluation period, the risk being sedentary and moderate compared with vigorous was significantly higher for users in the renovated area (e.g. RRR for sedentary users = 1.78 (95% CI 1.26; 2.51)), and lower for those in the non-renovated (e.g. RRR for moderately active users = 0.67 (95% CI 0.58; 0.78)) (Table 2).

Even though in both areas of the river females and males were mainly moderately and vigorously active users respectively (Figure S3 – Supplementary Material); in the post-intervention evaluation period, sedentary use of the renovated area increased for both females and males (Figure 3). Nevertheless, females had a significant higher risk being sedentary and moderately active both in the renovated and in the non-renovated area, compared with males (Table 2).

Of all the age groups identified in this study, children had the highest risk being sedentary (e.g. RRR for sedentary children in the renovated area = 5.22 (95% CI 2.23; 12.26)) in both areas of the river (Table 2). Despite this, the increase of moderately active users over time in the renovated area was mainly driven by children (38.9% in 2016 vs. 57.7% in 2017) and adults (53.3% in 2016 vs. 60.9% in 2017), although the proportion of moderately active seniors also increased (Figure 4). In the non-renovated area, teenagers experienced the highest increase of vigorous physical activity levels (from 15.0% in 2016 to 71.4% in 2017) (Figure 4). We also observed an increase of vigorous levels of physical activity for adults and seniors, but not for children (Figure 4).

Non-Caucasians had a significantly higher risk of being sedentary and moderately active users than Caucasians (Table 2). The risk was higher in the non-renovated area than in the renovated area (e.g. RRR for moderate non-Caucasian in the non-renovated area = 6.17 (95% CI 3.43; 11.08)) (Table 2). However, in the post-evaluation, the proportion of sedentary non-Caucasian users increased in both the renovated (from 0% in 2016 to 18.6% in 2017) and the non-renovated area (from 2.6% in 2016 to 16.3% in 2017) (Figure 5). Likewise, the proportion of Caucasian vigorously active users increased in the non-renovated area (from 56.8% in 2016 to 63.4% in 2017), while the proportion of non-Caucasian vigorously active users decreased (from 35.9% in 2016 to 11.6% in 2017) (Figure 5).

Users in the lower part of the renovated area had a significant higher risk being sedentary and moderately active than those in the upper part. In the non-renovated area the pattern was the opposite (Table 2). The users' risk being sedentary and moderately active, compared with being vigorously active, decreased in the weekend (e.g. RRR for moderately active users in the weekend in the renovated area = 0.50 (95% CI 0.39; 0.65)), compared with the rest of the week, in both areas of the river (Table 2)."

3. Regarding the qualitative results, the authors should place more emphasis on comparing changes in perceptions of residents on physical activity participation before and after the regeneration of riverside. Any changes to facilitate their active behavior? It will be then connected to the changes in physical activity levels measured by SOPARC. In the current version, the qualitative and quantitative results seem independent rather than complementary to each other.

- We appreciate the reviewer's comment, and we agree it would have been very interesting for this study to delve deeper into resident's perceptions on physical activity participation in the riverside area before and after the intervention. Nevertheless, the second objective of this study was to *"assess the local community's use and perception of the urban riverside and its surroundings before and after the intervention, as well as their self-perceived health and well-being, through a qualitative assessment"*. Thus, in the interviews (see Table S1 – Supplementary Material), we focused on asking residents about the reasons why they liked or disliked the riverside area, whether they used it or not, and other questions related to the neighborhood and residents' lifestyle, to contextualize their responses. Although we acknowledge its potential relevance for this study, we did not ask any specific question about their perception on physical activity participation in the riverside area before and after the intervention.

  Nevertheless, residents' perception of the riverside area and its use once the intervention was conducted is described at the end of section "3.4.3. Assessment of the urban riverside regeneration project": *"(...) Overall, participants were*

satisfied with the urban riverside regeneration. They said that the access to the riverbank significantly improved. They liked the appearance of the riverside park, and some participants mentioned that more people were going to the riverbank after the intervention (...)".

Also, we have included two more quotations emphasizing the active behavior of the riverside users. First quotation has been included at the beginning of section "3.4.2. Use and perception of the urban riverside":

""I always follow the same route because, as I told you, hmm...we walk, then we stop, we look at...in the river, we look at some ducks...you know...we look at them for a while, then we keep walking a little bit more, and so on. And we like it...to walk and...looking around" (Adult, female, Caucasian)"

The second quotation is at the end of section "3.4.3. Assessment of the urban riverside regeneration project":

"Participants highlighted the fact that riverside users were mainly physically active along the river. They mainly walked for pleasure, although some users also reported to run or cycle:

"My reason [to go to the riverside area] is...because I like it, I've already told you that I like so much the river, the birds and so, but I also go [to the riverside area] because...I like walking. I go for a stroll with my husband" (Adult, female, Caucasian)

Finally, we have also amended the abstract accordingly:

"(...) Resident interviewees, in general, reported to be happy to live near the river, where they usually go for a stroll, and thought living near the riverside area might benefit their health and well-being. Overall, residents seemed satisfied with the intervention (...)".

4. In this study, sedentary and moderate level of physical activity were increased in the renovated area, whereas vigorous physical activity (which is closely related to better health) was increased in the non-renovated area. This part of results is quite interesting to me from the perspective of physical activity and health promotion and thus requires more discussion. As mentioned above (point #1 and #2), these findings may be impacted by the statistical methods that you have used. So you may have better understand the truth by revising the data analyses.

- We thank the reviewer for their comment. Although the results of this study are in line with other similar studies which also typically do not find positive effects of environmental interventions on physical activity (as mentioned at the beginning of the Discussion, in the main manuscript), we agree with the reviewer that finding an increase of sedentary and moderate levels of physical activity in the renovated area, and an increase of vigorous levels of physical activity in the non-renovated area, is quite surprising and unexpected. The reviewer made excellent suggestions regarding the analysis. While these have clarified our findings, they have not changed the results substantially, and therefore the discussion that was already present – i.e. that the renovation more clearly delineated the use of the renovated area (as somewhere to relax) from the non-renovated area (as somewhere to be vigorously active) – still stands and we hope the reviewer agrees with this contention.

HIGHLIGHTS

- Regeneration of natural urban areas might improve human's health and well-being
- We observed an overall increase in users of an urban riverside after renovation
- The proportion of females, adults, kids, and non-Caucasian population increased
- We observed an increase of sedentary and moderately active users in the renovated area
- We observed an increase of vigorously active users in the non-renovated area
- Locals perceived the river to be beneficial for their health and well-being

Impact of a riverside accessibility intervention on use, physical activity, and wellbeing: A mixed methods pre-post evaluation

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Abstract

Introduction: Access to natural outdoor environments can promote physical activity, social cohesion, and improved psychological well-being. In 2016, an urban riverside regeneration project to facilitate access to the riverbank for pedestrians and cyclists was conducted in Barcelona (Spain). We aim to evaluate its effect in terms of changes in use and physical activity of users, and changes in local's use and perception of the urban riverside, and their corresponding self-perceived health and well-being.

Methods: We conducted systematic observations, before and after the intervention, using the System for Observing Parks and Recreation in Communities (SOPARC) to quantify the use and physical activity levels of users and compared them over time. Qualitative assessment consisted of semi-structured face-to-face interviews with the locals.

Results: We observed a 25% increase in users of the renovated area of the river after the intervention. There was an increase in sedentary users and those engaged in moderate levels of physical activity [7.7% vs. 12.0% sedentary users, and 66.9% vs. 68.7% moderately active users before and after the intervention respectively, $p<0.001$]. The growth of users in the renovated area was mainly driven by females, adults, children, and the non-Caucasian population. Resident interviewees, in general, reported to be happy to live near the river, where they usually go for a stroll, and thought living near the riverside area might benefit their health and well-being. Overall, residents seemed satisfied with the intervention.

Conclusions: Nature-based interventions in socioeconomically-deprived neighbourhoods might reduce inequalities in access to natural areas, creating attractive destinations for residents, promoting physical activity and/or creating opportunities for social interactions, and improving their health and well-being.

1. INTRODUCTION

Urban planning plays an important role in the promotion of human health and well-being (Sarkar and Webster 2017). Urban design might influence human behaviour in terms of physical activity and social cohesion, which are both determinants of physical and mental health and well-being (Chuang et al. 2013; Nieuwenhuijsen 2018; Vries et al. 2013). Regular physical activity is positively associated with the prevention and treatment of non-communicable diseases like obesity, diabetes, cancer, cardiovascular diseases (CVD), as well as improved mental health and well-being (National Institute for Health and Clinical Excellence 2012; World Health Organization 2018). Physical inactivity is a risk factor for mortality and is linked with many non-communicable diseases (Lee et al. 2012). Despite the overwhelming evidence of the benefits of physical activity on health, in high-income countries 26% of men and 35% of women were insufficiently physically active in 2010 (World Health Organization 2019) and this trend has remained stable over time (Guthold et al. 2018).

Green spaces are considered to be open surfaces with vegetation such as parks or gardens (WHO Regional Office for Europe 2016), while blue spaces are considered "outdoor environments – either natural or manmade – that prominently feature water and are accessible to humans" (Grellier et al. 2017). There is evidence suggesting that access to these natural outdoor environments promotes physical activity, social cohesion, and improved psychological well-being (Gascon et al. 2017; Nieuwenhuijsen et al. 2017). However, cities do not always have sufficient, accessible natural outdoor environments for the population (Nieuwenhuijsen et al. 2018). Given the health benefits associated with access to these environments, urban planners and policy makers should ensure that all the population have access to them to facilitate regular physical activity, promote social cohesion, and reduce stress (World Health Organization 2018).

One way of achieving this is through the regeneration of natural urban areas. In this sense, a growing body of studies have been assessing the health benefits of a variety of urban regeneration projects (Hunter et al. 2015; Kramer et al. 2017; Macmillan et al. 2018; Moore et al. 2018; Stappers et al. 2018). A recent review of the impacts and effectiveness of urban green space interventions and health reveals that there is still inconclusive evidence on the effectiveness of some urban green space interventions (World Health Organization 2017). However, the same review acknowledges the powerful opportunities for public health improvements that these interventions might bring, given their capacity of providing environmental, social, and health benefits (World Health Organization 2017). Nature-based interventions might bring benefits for all the population, especially among lower socioeconomic status groups (World Health Organization 2017). This is particularly important given that socioeconomically-deprived populations tend to have worse health than their wealthier counterparts (Ball 2015; Marielle A et al. 2012).

Systematic evaluations of urban regeneration projects are key in providing professionals (e.g. urban planners, parks planners, housing development professionals, public health professionals, or medical practitioners) and policy makers with reliable information to properly design, implement, and maintain nature-based interventions, or to improve those that are already part of our cities, considering the health perspective and maximizing health benefits. The aims of the present study are (1) to quantitatively evaluate the impact of an urban riverside regeneration project in a socioeconomically-deprived neighbourhood in terms of changes in: i) use of the area and, ii) physical activity among users over time; and (2) to assess the local community's use and perception of the urban riverside and its surroundings before and after the intervention, as well as their self-perceived health and well-being, through a qualitative assessment.

2. METHODS

2.1. The intervention: an urban riverside regeneration project in the Besòs River

In August 2016, the Barcelona Metropolitan Area, a public administration responsible of social and environmental policies in the metropolitan territory of Barcelona, started an intervention (Farrero i Compte et al. 2015) to regenerate a section of *Parc Fluvial del Besòs* (Besòs Riverside Park), located in the northeast of Barcelona (Catalonia, Spain) (Figure 1A). The section of the riverbank affected by this intervention was between "La Ribera" neighbourhood and a water treatment plant (right and left side of the river downstream, respectively) (Figure 1B). "La Ribera" neighbourhood is in Montcada i Reixac, a city in the Barcelona metropolitan area with 35,599 inhabitants (Idescat 2018). As with other parts of the city, the creation of this neighbourhood was the result of a quick expansion of the city in the 60s and 70s to accommodate immigration from Southern Spain. Currently, it is characterized by a high proportion of migrants of different nationalities (38.2%), with Moroccan and Pakistani constituting the largest percentage (March and Batllet 2015). The urban riverside regeneration project aimed to provide access to the riverbank to promote its use and enjoyment by the population. The intervention affected 735 meters along the right side of the river downstream, and a total surface area of approximately 52.619m². It included the construction of two paved walkways: one on the lower part of the river, and another one on the upper part (Figure 2A). Moreover, four new access points to the riverbank were provided: two wheelchair-accessible ramps and two sets of stairs connecting the upper and the lower parts of the river (Figure 2B) (Farrero i Compte et al. 2015). Before the intervention, the lower and the upper parts of the river were not connected as there was no access to the riverbank.

2.2. Pre/post-intervention evaluation

We conducted a mixed-methods pre/post-intervention evaluation to assess the number of users in the study area, their physical activity level, and the local community's use and perception of the new intervention over time. We followed the same procedure, described below, for both the pre- and post-evaluation.

2.2.1. Systematic observations of riverside users

We employed the System for Observing Parks and Recreation in Communities (SOPARC) (Mckenzie and Cohen 2006) to conduct systematic observations which quantified the number of users and their socio-demographic characteristics and current physical activity levels. The reliability and feasibility of the SOPARC tool has been shown previously (McKenzie et al. 2006), and it is widely used in similar studies (Cohen et al. 2014, 2015, 2011; Evenson et al. 2017; King et al. 2015; Van Hecke et al. 2017). For this study, four researchers were trained using the SOPARC protocol and training videos, whose methodology has been adapted for this study (Mckenzie and Cohen 2006).

We divided the study area into two target areas: i) the renovated area, on the right side of the river downstream, where "La Ribera" neighbourhood is located, and; ii) the non-renovated area, on the left side of the river, next to the water treatment plant. Target areas were sub-divided into two locations: i) the lower part, at the riverbank level; and ii) the upper part, above the riverbank level (Figure 1B). The observations were conducted in November-December 2016 (pre-evaluation: during the implementation of the intervention, although this did not affect normal use of the area) and then again in November 2017 (post-evaluation: when the intervention was finished). Observations were conducted in 13 one-hour sessions for each period of evaluation (i.e. pre and post) in largely comparable timeframes (Figure S1 – Supplementary Material). Sessions were spread across weekdays and weekend days, and between different time slots: 5 sessions in the morning (8:30-

9:30h), 5 sessions in the midday (11:30-12:30h), and 3 sessions in the afternoon (16:30-17:30h) (Figure S1 – Supplementary Material). Each one-hour session included 6 observation periods of 7 minutes each, with breaks of 3 minutes in between. Observations were performed from a predefined position (on each side of the river), allowing the visibility of the whole study area (Figure 1). Observers worked in pairs (two observers per position) visually scanning from left to right within the defined area to document the following characteristics of each observed user: location (upper or lower), perceived gender (female or male), perceived age group (child=0-12 years old; teenager=13-20 years old; adults=21-59 years old; or seniors≥60 years old), perceived ethnicity [Caucasian – i.e. white-skinned, of European origin –, Latin-American, Black, Asian, North African, or other (these are the predominant ethnic groups in the study area)], and activity level (sedentary=lying down, sitting or standing; moderate (walking)=walking at a casual pace; or vigorous=any activity that expended more energy than casual walking). The type of activity (e.g. running, cycling, skating, etc.) was only specified for vigorous physical activity (Figure S2 – Supplementary Material). Temperature and weather conditions were also reported for each session. Observations were not conducted on rainy days but were rescheduled for another day.

2.2.2. Physical activity assessment

To assess the energy expended by the observed users, for each target area, period of evaluation, and location (i.e. lower and upper part of the river) we summed the total number of sedentary, moderate, and vigorous users and we multiplied it by the respective Metabolic Equivalent of Task (METs) for each category. For sedentary observations, corresponding to the specific activity “sitting quietly, general” of the compendium of physical activities developed by Ainsworth et al. 2011, we used a score of 1.3 METs; for moderate observations, corresponding to “walking for pleasure”, we used a score of 3.5

147 METs; and for vigorous observations, corresponding to "bicycling, general", we used a
148 score of 7.5 METs. We summed the respective values for each category and divided the
149 total by the observed number of users in each assessment area; a convention used
150 previously (Van Dyck et al. 2013; Van Hecke et al. 2017).

151 **2.2.3. Interviews with the local community**

152 We conducted semi-structured face-to-face interviews to assess the attitudes of the
153 residents of "La Ribera" in relation to the natural environment around their neighbourhood,
154 and particularly the Besòs Riverside Park and the urban riverside regeneration project.
155 Interviews were also conducted to evaluate potential changes in self-perceived health and
156 well-being of the local community over time. The interview content was based on in-depth
157 semi-structured interview protocols developed by the PHENOTYPE project
158 (http://www.phenotype.eu/en/) and was adapted to our study. It included questions on the
159 use and perception of green and blue spaces and about the neighborhood, on how
160 participants interact with these spaces, health and well-being status of the participants,
161 physical activity behavior, and social interactions (Table S1 – Supplementary Material).
162 For the pre-evaluation, study participants were recruited by contacting the municipality and
163 organizing informative talks about the project. We also recruited participants in the
164 neighbourhood streets, the local civic centre, and other relevant public spaces of "La
165 Ribera" neighbourhood until theoretical saturation. This is a criterion for discontinuing
166 data collection when more data do not provide more information related to the research
167 question (Saunders et al. 2018). For the post-evaluation, the same participants were
168 contacted by phone and researchers arranged a meeting with them to conduct the interview.
169 All participants were 18 years old or older and resided in "La Ribera" neighbourhood.
170 These interviews were mainly conducted on the street, but also in the civic centre, in a bar,
171 or at the participant's residence. Interviews were conducted in Spanish or Catalan and were

audio recorded. Information about the project was given to the participants, and before enrollment in the study all participants were asked to indicate their informed consent to participate. Participants did not receive any financial incentive for their participation in this study. All the methods were approved by the Clinical Research Ethics Committee of the Parc de Salut MAR.

Interviews were transcribed verbatim and coded using ATLAS.ti 7.5 computer-assisted qualitative data analysis software. We identified significant quotes in the transcriptions, and developed thematic codes (grouped in different categories and sub-categories). Codes were created inductively, based on the identification of relevant topics during the interview assessment. Interviews were separately coded and compared by two different researchers to ensure consistency and reliability. If necessary, codes were merged, deleted, created, or renamed if both researchers agreed. Based on the grounded theory approach (Noble and Mitchell 2016), we theorised about the main topics identified within the interviews and ended up with an explanatory statement summarizing the most relevant information extracted from the interviews. We used ATLAS.ti to count the frequency that codes were discussed before and after the intervention. We also assessed potential differences between genders, age groups, and ethnicities.

2.3. Data analysis

SOPARC observations were manually recorded on a paper form, entered into a Microsoft Excel database, and then imported into STATA version 14. We measured the degree of agreement between observers using the Intraclass Correlation Coefficient (ICC) (Hallgren 2012). Then, for each day, time slot, and target area we randomly selected one of the two observations in order to avoid duplicates. If there were missing values for the selected observer, we replaced them with the values provided by the excluded partner observer.

196 Otherwise, we coded missing observations as men, adults, Caucasian, and walking because
197 these were the main characteristics of the study population. Observations were summarized
198 by year and target area, and stratified by location, gender, age group, ethnicity, and activity
199 level. We employed chi-square tests to compare categorical variables describing socio-
200 demographic characteristics of the users before and after the intervention. We also assessed
201 if the weather conditions and temperature significantly varied between assessment periods
202 using chi-square tests and Student's t-test, respectively. Moreover, we have used
203 multinomial logistic regression models to assess the effects of the urban riverside
204 regeneration project (i.e. pre/post intervention) and the target area (i.e. renovated and non-
205 renovated area) on the user's physical activity levels. We assessed effect modification
206 using likelihood ratio test (LRT). We also assessed the influence of other covariates (i.e.
207 gender, age, ethnicity, location, day of the week, and time slots). Our analysis was based
208 on the methodological approach proposed by SOPARC (Mckenzie and Cohen 2006).

209 ## 3. RESULTS

210 ### 3.1. Agreement between observers and good reproducibility of the procedure

211 For each SOPARC evaluation session there were two observers assessing the same target
212 area. Before assuming that missing values corresponded to adult Caucasian males walking,
213 the overall ICC between observers was 0.996 (95% CI; 0.994, 0.998), showing the highest
214 agreement for activity level [0.998 (95% CI; 0.997, 0.999)], and the lowest agreement for
215 ethnicity [0.866 (95% CI; 0.806, 0.908)]. After replacing missing values, results were very
216 similar (data not shown). For gender we replaced 0.7% missing values, 1.6% for age, 4.4%
217 for ethnicity, and 0.3% missing values for activity level (data not shown). In any case, ICC
218 values ranged from 0.866 to 0.999 indicating high agreement between observers and good
219 reproducibility of the procedure.

3.2. Use of the urban riverside area

Following the completion of the urban riverside regeneration project, the total number of users in the whole Besòs riverside area slightly increased from 3,478 to 3,631 (Table 1). The number of users significantly increased in the renovated area (30.2% in 2016 vs. 36.1% in 2017, $p<0.001$), while significantly decreased in the non-renovated area (69.8% in 2016 vs. 63.9% in 2017, $p<0.001$]. More specifically, in the lower part (riverbank) of the renovated area, we observed a noticeable increase of users (1.7% in 2016 vs. 15.9% in 2017, $p<0.001$), whereas in the upper part the number of users decreased (98.3% in 2016 vs. 84.1% in 2017, $p<0.001$) (Table 1). However, the total number of users was higher in the non-renovated area both before and after the intervention compared to the renovated area (Table 1).

Overall, more males were observed in the riverside area than females, both before and after the intervention. However, after the intervention, we observed a 43% increase in females at the renovated area of the river while the number of females decreased 26% in the non-renovated area (Table 1 & Table S2 – Supplementary material). The pattern for males was the opposite (Table 1 & Table S2 – Supplementary material). When looking at both areas of the river, gender differences over time were not statistically significant ($p=0.227$) (Table 1).

The most prevalent age group was adults (59.8% and 59.5% of the users in 2016 and 2017, respectively), followed by seniors (34.1% and 36.1% of the users in 2016 and 2017, respectively). Teenagers and children were underrepresented (i.e. from 6.1% in 2016 to 4.4% in 2017 of the total users), although the percentage of children in the renovated area significantly increased after the intervention (1.7% in 2016 vs. 4.0% in 2017, $p<0.001$), whereas in the non-renovated area the percentage of children decreased (1.8% in 2016 vs.

1.2% in 2017, p<0.001) (Table 1 & Table S3 – Supplementary Material). To ensure that our results were not strongly influenced by the presence of a school group (N children=23; N teenagers=50) conducting an organized activity on the upper part of the non-renovated area during one session in the pre-evaluation, we conducted a sensitivity analysis excluding these users. Results were similar when compared to the full sample (Table S4 – Supplementary Material).

More than 90% of the users were coded as Caucasians. However, a significant increase of non-Caucasian users was observed in the renovated area after the intervention (2.6% of non-Caucasian users in 2016 vs. 7.8% in 2017, p<0.001) (Table 1).

We observed 110 and 209 users with at least one dog in 2016 and 2017, respectively. These users were mainly Caucasians, adults or seniors, and predominantly males (data not shown). Although the intervention was designed to enable use by people of all physical abilities, we only observed 8 disabled users (6 in 2016 and 2 in 2017) during the whole study period (data not shown).

Finally, regarding the potential influence of temperature and weather conditions, the proportion of sunny days in 2016 was exactly the same as in 2017 (i.e. 61.5%) (data not shown). However, the mean temperature in 2016 was higher than in 2017 [12.8ºC (95% CI; 10.9, 14.6) in 2016 vs. 9.3ºC (95% CI; 6.0, 12.6) in 2017, p=0.056]. And the minimum values reported in 2016 were also higher than in 2017 (6ºC and 2ºC, respectively). The maximum values were similar for both years (18ºC in 2016 and 19ºC in 2017) (data not shown).

3.3. Energy expenditure

On average, for the pre- and post-evaluation period and for both areas of the river, users were most often moderately (46.5%) or vigorously (47.0%) active, while a smaller proportion were sedentary (6.5%) (Table 1). The most predominant activity among vigorously active users in both study periods was cycling (84.5%) followed by running (11.7%). The rest of the vigorously active users practised other activities such as roller skating, skateboarding, or playing with a dog (data not shown). When pooling data from both sides of the river, the percentage of users engaging in sedentary, moderate, or vigorous levels of physical activity barely changed from 2016 to 2017 ($p=0.447$) (Table 1). However, when we looked at each side of the river (i.e. renovated and non-renovated area), we observed a significant increase of users engaging in sedentary and moderate levels of physical activity in the renovated area (7.7% of sedentary users in 2016 vs. 12.0% in 2017; and 66.9% of moderately active users in 2016 vs. 68.7% in 2017, $p<0.001$), and a significant increase of users engaging in vigorous levels of physical activity in the non-renovated area (56% in 2016 vs. 62.4% in 2017, $p<0.001$) (Table 1). Thus, in the post-intervention evaluation period, the risk being sedentary and moderate compared with vigorous was significantly higher for users in the renovated area (e.g. RRR for sedentary users = 1.78 (95% CI 1.26; 2.51)), and lower for those in the non-renovated (e.g. RRR for moderately active users = 0.67 (95% CI 0.58; 0.78)) (Table 2). Sedentary users in the renovated area mainly used the stairs to sit or lie on, although some users also sat on the benches, or leant against the fence, both in the upper and the lower part of the river (Figure 2-A.2.).

Even though in both areas of the river females and males were mainly moderately and vigorously active users respectively (Figure S3 – Supplementary Material); in the post-intervention evaluation period sedentary use of the renovated area increased for both females and males (Figure 3). Nevertheless, females had a significant higher risk being

291 sedentary and moderately active both in the renovated and in the non-renovated area,
292 compared with males (Table 2).

293 Of all the age groups identified in this study, children had the highest risk being sedentary
294 (e.g. RRR for sedentary children in the renovated area = 5.22 (95% CI 2.23; 12.26)) in
295 both areas of the river (Table 2). Despite this, the increase of moderately active users over
296 time in the renovated area was mainly driven by children (38.9% in 2016 vs. 57.7% in
297 2017) and adults (53.3% in 2016 vs. 60.9% in 2017), although the proportion of
298 moderately active seniors also increased (Figure 4). In the non-renovated area, teenagers
299 experienced the highest increase of vigorous physical activity levels (from 15.0% in 2016
300 to 71.4% in 2017) (Figure 4). We also observed an increase of vigorous levels of physical
301 activity for adults and seniors, but not for children (Figure 4).

302 Non-Caucasians had a significantly higher risk of being sedentary and moderately active
303 users than Caucasians (Table 2). The risk was higher in the non-renovated area than in the
304 renovated area (e.g. RRR for moderate non-Caucasian in the non-renovated area = 6.17
305 (95% CI 3.43; 11.08)) (Table 2). However, in the post-evaluation, the proportion of
306 sedentary non-Caucasian users increased in both the renovated (from 0% in 2016 to 18.6%
307 in 2017) and the non-renovated area (from 2.6% in 2016 to 16.3% in 2017) (Figure 5).
308 Likewise, the proportion of Caucasian vigorously active users increased in the non-
309 renovated area (from 56.8% in 2016 to 63.4% in 2017), while the proportion of non-
310 Caucasian vigorously active users decreased (from 35.9% in 2016 to 11.6% in 2017)
311 (Figure 5).

312 Users in the lower part of the renovated area had a significant higher risk being sedentary
313 and moderately active than those in the upper part. In the non-renovated area the pattern
314 was the opposite (Table 2). The users' risk being sedentary and moderately active,

compared with being vigorously active, decreased in the weekend (e.g. RRR for moderately active users in the weekend in the renovated area = 0.50 (95% CI 0.39; 0.65)), compared with the rest of the week, in both areas of the river (Table 2).

Overall, we did not observe changes in energy expenditure (expressed in METs/observation) after the intervention (Table 3). However, we observed an 8% decrease of METs/observation in the renovated area and 5% increase in the non-renovated area (Table 3). This was mainly driven by the decrease of energy expended in the lower part of the river, and the increase of energy expended in the upper part of the river in the renovated and non-renovated area respectively (Table 3). Nevertheless, moderately active users were the most prevalent activity group in the renovated area, whereas in the non-renovated area it was vigorously active users (Table 1).

3.4. Local community's use and perception of the urban riverside

For the qualitative assessment of the intervention we interviewed a total of 17 participants in the pre-evaluation, and 6 of them were interviewed again in the post-evaluation period (Table S5 – Supplementary Material). The rest of the participants did not participate in the post-evaluation due to different reasons: they moved to another neighbourhood (N=2), they experienced health problems or hospitalizations (N=2), they did not answer phone calls (N=4), or they were not willing to participate due to incompatibility with their workday schedule (N=3). The length of the interviews ranged between 15 and 40 minutes.

3.4.1. Socio-economic context

All the participants were residents of "La Ribera" neighbourhood, and most of them mentioned they were living there due to affordable housing. Some participants had been living in "La Ribera" for a long time, and others were newcomers (mainly from outside

Spain). Most of the participants reported to be satisfied with the neighbourhood. They liked the area, they were familiar with it, and they had many social interactions, either in the street or the civic centre. In fact, participants highlighted social cohesion among residents, especially among those who had lived there for longer. However, many participants also complained about anti-social behaviour of the residents (e.g. offensive language, disrespectful behaviour, noise, dirtiness, etc.).

3.4.2. Use and perception of the urban riverside

Most of the participants reported using the riverside area, especially for walking or walking the dog, but also for cycling, running, or playing with their children:

"I always follow the same route because, as I told you, hmm...we walk, then we stop, we look at...in the river, we look at some ducks...you know...we look at them for a while, then we keep walking a little bit more, and so on. And we like it...to walk and...looking around" (Adult, female, Caucasian)

A few elderly people mentioned they used to go to the riverside area but no longer visited it due to health reasons. Some participants expressed their discomfort of sharing the area with dogs mainly due to the presence of animal excrement ~~on the floor~~, but also because they considered that dogs damaged the riverside area:

"Another of the measures that they would have to do is not to let people walk the dogs by the river, because...because there are nests, because there are animals and they break them down. Also, they should stop bringing the dogs [to the riverside] because it seems to me that it does a lot of damage to the river" (Senior, male, Caucasian)

Frequency of visits to the riverside varied among participants (from daily to sporadic visits). However, participants usually used the riverside more during the summer months

than during the winter months. The majority of the participants went to the riverside with someone else (e.g. relative, friends, their children, etc.), and only a few of them went alone. Nevertheless, the reasons given for visiting the riverside with others varied amongst participants. Thus, we do not know whether this was due to safety reasons or other factors. However, most of the participants thought the riverside area was a safe place, at least during the day because there was light. Participants did not report going to the riverside area at night, indicating the lack of lighting as a reason:

"Yes, it is safe [the riverside area] Well...yes, it's safe during the day. At night I do not know... It must ...that must be as insecure as anywhere else..." (Adult, male, Caucasian)

Although most of the participants mentioned the affordable cost of the apartments as the main reason to move to "La Ribera" neighbourhood, the majority acknowledged the proximity to the river as a plus for the neighbourhood. They liked either seeing the river from home (if possible), walking along it, or even observing and playing in the river being in contact with the water. In their opinion, having the river close to their home might benefit their health and well-being. In fact, many participants highlighted the importance of having natural environments around their residence:

"Well...as I told you it's a troubled neighbourhood...When I feel comfortable, when I go up the mountain...When I go to the Serralada la Marina or when I'm walking along the river. Then I feel comfortable" (Senior, male, Caucasian)

It gave them a sense of restoration, calmness and enjoyment. The self-perceived health and well-being benefits of practising physical activity along the river versus practising it in urban areas were also mentioned by several participants.

One of the participants' favourite aspects of the river was the presence of a variety of animals and vegetation. They highlighted the importance of preserving the nature of the area:

"Well... [I like] the vegetation, the animals that have come, like the seagulls, the ducks...Since...in the eighties...there were not [animals], not at all! In the nineties either" (Senior, female, Caucasian)

Other participants though, complained about wild boars because there are many of them and they perceived that their presence is encouraged by residents who continue to feed them. Also, some participants complained about the maintenance of the vegetation:

"Well there are too many plants...too many herbs...that's what I do not like...I would like them [those responsible for park maintenance] to come more often to take care of what is the, the herbs of the river... And that they could cut them...they might take care of them to keep nature alive, right?" (Adult, female, Caucasian)

In general, long-time residents of "La Ribera" neighbourhood perceived the quality of the river water as improved compared to its past condition, when it was more polluted. They thought the river and riverbank had improved over time, in terms of cleanliness, beauty, flora, and fauna of the area. However, other participants considered the river and its surroundings as dirty, and most of them reported this as a result of anti-social behaviour of some people who threw rubbish in the river or did not respect the area. In line with this, many participants reported annoyance at the bad odour that came from the river. Some of them suspected it originated from the water treatment plant located next to the river. The bad odour was worse in summer and sometimes residents of "La Ribera" reported that this caused throat irritation.

"I don't like the odour...well, when you walk along the river...I don't know...the odour...it's horrible next to the river!" (Adult, female, non-Caucasian)

Another concern of the participants using the riverside area was the presence of both walkers and cyclists, using the same lanes. They thought there should be a bicycle line separate from the walkway because they perceived it to be unpleasant or even dangerous to share the space with cyclists. For some participants this was a reason to not use the riverside.

Nevertheless, one of the main complaints reported by the participants before the intervention was that access to the riverbank was not properly provided, and they wanted it to be improved. Before the intervention, some people jumped the fences to reach the riverbank, which was a dangerous practice:

"When it is not cold, we go on a picnic with my children down there [lower part of the riverside area]...it's fine (...). What happens, of course... is that we have to jump the fence, and it is uncomfortable. Otherwise you have to walk for...I don't know, about 1 kilometre!" (Adult, female, Caucasian)

3.4.3. Assessment of the urban riverside regeneration project

As mentioned before, the main aim of the urban riverside regeneration project was to facilitate access to the riverbank. In general, participants knew that an intervention was being conducted, but they did not know about the details. Among participants, it was very common to both positively and negatively compare this urban riverside regeneration project with another one conducted some kilometers further away, next to Barcelona, which was larger and more ambitious than the one assessed in this study. For this one, some participants highlighted the necessity of keeping the river as natural as possible,

respecting the original fauna and flora, and avoiding the incorporation of artificial elements such as paved walkways, or newly planted grass.

Overall, participants were satisfied with the renovation. They said that the access to the riverbank significantly improved. They liked the appearance of the riverside park, and some participants mentioned that more people were going to the riverbank after the intervention:

"[The access provided by the renovation] It's good for the people... for...for the children...for everything...for doing sport. Also for the residents of the neighbourhood" (Adult, female, non-Caucasian)

Participants highlighted the fact that riverside users were mainly physically active along the river. They mainly walked for pleasure, although some users also reported to run or cycle:

"My reason [to go to the riverside area] is...because I like it, I've already told you that I like so much the river, the birds and so, but I also go [to the riverside area] because...I like walking. I go for a stroll with my husband" (Adult, female, Caucasian)

Nevertheless, many participants had the feeling that the intervention was unfinished (e.g. unconnected walkway, some access points were closed, lack of equipment like benches, toilets, etc.). Also, some participants thought some users may not respect the renovated area. Finally, a participant mentioned that the walkway could be closer to the river to be able to see and listen to the water when walking.

4. DISCUSSION

4.1. Main findings

According to our assessment, the urban riverside regeneration project undertaken in a section of the Besòs Riverside Park, in the municipality of Montcada i Reixac, showed increased use, mainly due to a greater presence of females, adults, children, and the non-Caucasian population. The highest increase of users was observed in the lower part of the renovated area, indicating that users employed the stairs and ramps dedicated to facilitate access to the riverbank. Our results also suggest an increase in vigorously active users in the non-renovated area, and an increase of users engaging in sedentary and moderate levels of physical activity in the renovated area. Thus, in this study, the renovation of the Besòs Riverside Park seemed to mostly facilitate relaxation rather than increased physical activity. However, previous studies have suggested that a number of strategies such as introducing signage, organised activities, and promotional incentives, may increase the physically active use of a park, at least in the short-term (Roberts et al. 2018).

A study examining the effect of improved safe access to a park in a low-income and majority African-American neighborhood in the USA reported similar results (Schultz et al. 2017). This is also in line with a realist review suggesting that urban regeneration projects might stimulate leisure-time walking (i.e. moderate physical activity) among adults in deprived areas (Kramer et al. 2017). A predominance of sedentary and moderate physical activity behavior in the renovated area (closer to “La Ribera” neighborhood) might indicate this area is being used as a destination for residents for activities such as leisure or strolling. Moreover, the segregation of types of physical activity practiced on each side of the river might ease concerns the local community has about cyclists and walkers sharing the same space. Our findings indicate that vigorously active users prefer to use the upper part of the non-renovated area, whereas moderate and sedentary users prefer to use the renovated area ~~(mainly the lower part)~~, thus reducing the potential conflicts of uses, particularly between cyclists and walkers. Sedentary activities in parks or other open

spaces may promote social benefits and so improve human's mental health and well-being (Van Hecke et al. 2017). Moreover, reaching the Besòs Riverside Park promotes physical activity among those users walking or cycling to the park, even if they are sedentary once they arrive to their destination (Cohen et al. 2007; Van Hecke et al. 2017). According to this, it may be equally important to provide appropriate infrastructure that supports active travel (e.g. walking or cycling) to the river, as it is providing activity-supportive infrastructure at the river.

The demographic profile of the users was slightly different from before to after the intervention. First, we observed a significant increase of female users – adults and children – in the renovated area. In line with other studies (Joseph and Maddock 2016), they were mainly engaged in moderate physical activity, although we observed an increase of female users engaged in sedentary activities as well. A potential hypothesis to explain the increase of adult females could be that these were at the riverside park together with their children, whose age group significantly increased in the renovated area as well. Findings of the interviews conducted in this study did not suggest that the increase of females in the renovated area was due to improved perceptions of safety after the intervention. However, having an outdoor natural space available and accessible closer to their homes might be more convenient to use, especially if they go with their children. Moreover, a qualitative review reported that females viewed parks as safe places to meet and socialize with each other (McCormack et al. 2010). In any case, our results suggest a reduction of gender inequalities in the park after the intervention even though the number of males was substantially higher than females on both sides of the river, and males were more engaged in vigorous physical activity than females, which are similar results to those reported by other similar studies (Evenson et al. 2017; Joseph and Maddock 2016; King et al. 2015; McKenzie et al. 2006; Van Dyck et al. 2013; Van Hecke et al. 2017). Second, we observed

that adults and seniors were more likely to visit the Besòs Riverside Park than children and teenagers. This is consistent with other studies, although not for seniors which are usually an underrepresented group of users in the parks (Evenson et al. 2016; Joseph and Maddock 2016; Schultz et al. 2017). As children and teenagers were also not frequent users, strategies to engage them to actively use the riverside area (e.g. skate park, climbing wall, organization of dancing events, etc.) might be considered to ensure that the area appealing to different age groups. Finally, we observed a large difference in the amount of Caucasian and non-Caucasian users in the whole riverside park, non-Caucasians being less prevalent, which does not reflect the population characteristics of "La Ribera" neighborhood. However, our findings suggested an increase over time on the engagement of non-Caucasian users, both in the renovated and in the non-renovated area. Reducing inequalities of access to natural environments for different ethnic groups remains a public health priority.

Our results do not seem to be influenced by weather conditions because, as mentioned before, we did not conduct observations on rainy days, and the proportion of sunny days was the same in the pre and post-evaluation period. Moreover, temperatures were similar in both periods of evaluation. Thus, the increase of users reported in the post-evaluation period was not influenced by warmer temperatures in this period.

4.2. Limitations

Our study faced some limitations. First, we conducted the pre-evaluation during the construction period and thus were not able to obtain a true baseline. However, we do not think this affected our results because characteristics of the study area during the construction work were similar to those before the job started (e.g. access to the riverbank was not provided in either situation). Nevertheless, we acknowledge the construction could

deter people from visiting due to presence of – for example – noise, dust, or debris. Second, in line with other studies (Evenson et al. 2017), we conducted systematic observations only in one season (autumn). Thus, it may not be representative of the use of the park during the whole year. However, this does not affect our results because the aim of this study was to compare the use of the park between two comparable periods of evaluation. Future research might investigate how improvements to natural environments might differentially affect its use according to seasonality. Third, SOPARC is a feasible and reliable tool, but sometimes it was difficult to identify the gender, age group, or ethnicity of the users due to the distance between them and the researchers, or because users were obscured by a scarf, hat, coat, etc. This was acknowledged, and two researchers did the same observations at the same time in order to avoid misclassification. Fourth, although researchers tried to obtain a representative sample of the local community, interviews were mainly conducted with females, adults, and Caucasians of the "La Ribera" neighborhood. This implies that different recruitment strategies are needed in order to recruit "harder-to-reach" demographic groups (i.e. non-Caucasians). Finally, we acknowledge the risk of gentrification as in any other urban regeneration project (Cole et al. 2017; McCartney et al. 2017). Urban regeneration projects should be always accompanied with policies and regulations (e.g., to safeguard affordable housing, protect senior homeowners, to regulate land use, etc.) that impede or reduce potential gentrification effects.

4.3. Strengths

An important strength of the current study is that it combines quantitative and qualitative methodologies. It helps interpreting the results given that each method is complemented by the other one, exploiting the benefits, and reducing their own limitations (Shenton 2004a).

Moreover, triangulation by using different methods may be a strategy to ensure credibility of the results (Gaber and Overacker 2012; Shenton 2004b). On the one hand, we used the SOPARC tool, which has been typically used in the USA (Evenson et al. 2017; Joseph and Maddock 2016). This is one of the first studies employing SOPARC in a European country (Pawlowski et al. 2017; Van Dyck et al. 2013; Van Hecke et al. 2017). SOPARC allowed us to easily quantify the number of people using the park before and after the intervention and to estimate their levels of physical activity in the park, using a non-invasive technique. It is a non-expensive method, although it is time-consuming. Further studies may consider other technological options to avoid this problem [e.g. apps that facilitate data collection and management (Evenson et al. 2017)]. On the other hand, interviews allowed us to better understand the behaviour, needs and concerns of the local community. This is an effective method widely used in other studies evaluating health effects of nature-based interventions (World Health Organization 2017). Moreover, in this study we have mainly focused on the benefits related to the use of and practice of physical activity in the Besòs Riverside Park, but, thanks to the qualitative assessment, we have also considered some risks or concerns related to it (e.g. pollen allergies, vandalism, or incidents with cyclists). Another strength of the current study is that, given the study design, it is relatively easy and affordable to conduct a follow-up to assess the persistence or not of the effects of this intervention. Moreover, the design of this study allowed us to conduct a pre/post-evaluation and assess changes produced after the intervention. Finally, a key strength of this study is the ability to compare the renovated area with the non-renovated area, which has been used as a control.

Results of this study will be shared with stakeholders (including the local community, the municipality, healthcare professionals, and those responsible for the civic centre, etc.)

because these findings might be helpful to identify the strengths and desired improvements for the Besòs Riverside Park, and thus underline its importance as a public health resource.

5. Conclusions

We found that the urban riverside regeneration project undertaken in the Besòs Riverside Park in "La Ribera" neighbourhood in Montcada i Reixac, promoted the use of this area by improving the accessibility to the riverbanks. Results suggest a reduction in inequalities, mainly in the renovated area, in terms of gender and ethnicity. Physical activity levels did not increase after the intervention because of the redistribution of uses in each side of the river: increase of vigorously active users in the non-renovated area, and increase of moderately active and sedentary users in the renovated area. Nature-based interventions in socio-economically-deprived neighborhoods might reduce inequalities in access to natural areas for deprived communities, thereby creating destinations for residents, promoting physical activity and/or creating opportunities for social interactions, and thus improving their health and well-being.

References

588 Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR, Tudor-Locke C, et al.
589 2011. 2011 Compendium of Physical Activities. Compend. Phys. Act. Track. Guid.
590 Heal. Lifestyles Res. Center, Coll. Nurs. Heal. Innov. Arizona State Univ. 17;
591 doi:10.1249/MSS.0b013e31821ece12.

592 Ball K. 2015. Traversing myths and mountains: Addressing socioeconomic inequities in
593 the promotion of nutrition and physical activity behaviours. Int. J. Behav. Nutr. Phys.
594 Act. 12:1–7; doi:10.1186/s12966-015-0303-4.

595 Chuang Y, Chuang K, Yang T. 2013. Social cohesion matters in health. Int. J. Equity
596 Health 12: 1–12.

597 Cohen D, Han B, Isacoff J, Shulaker B, Williamson S, Marsh T, et al. 2015. Impact of Park
598 Renovations on Park Use and Park-based Physical Activity. J Phys Act Heal. 12:289–
599 295; doi:10.1016/j.jsr.2014.05.003.A.

600 Cohen D, Marsh T, Williamson S, Han B, Derose K, Golinelli D, et al. 2014. The Potential
601 for Pocket Parks to Increase Physical Activity. Am J Heal. Promot 28:S19–S26;
602 doi:10.4278/ajhp.130430-QUAN-213.The.

603 Cohen DA, McKenzie TL, Sehgal A, Williamson S, Golinelli D, Lurie N. 2007.
604 Contribution of public parks to physical activity. Am. J. Public Health 97:509–514;
605 doi:10.2105/AJPH.2005.072447.

606 Cohen DA, Setodji C, Evenson KR, Ward P, Lapham S, Hillier A, et al. 2011. How Much
607 Observation Is Enough? Refining the Administration of SOPARC. J. Phys. Act. Heal.
608 8:1117–1123; doi:10.1123/jpah.8.8.1117.

609 Cole HVS, Garcia Lamarca M, Connolly JJT, Anguelovski I. 2017. Are green cities
610 healthy and equitable? Unpacking the relationship between health, green space and
611 gentrification. J. Epidemiol. Community Health 0:1–4; doi:10.1136/jech-2017-
612 209201.

613 Evenson KR, Jones SA, Holliday KM, Cohen DA, Mckenzie TL. 2017. Park
614 characteristics, use, and physical activity: A review of studies using SOPARC
615 (System for Observing Play and Recreation in Communities). Prev. Med. (Baltim).
616 86:153–166; doi:10.1016/j.ypmed.2016.02.029.Park.

617 Farrero i Compte A, Ténez i Ybern V, Munsó i Griful A, Oliva Heras J, Bergés Bertran M,
618 Villasur Millan C, et al. 2015. Projecte executiu d'arranjament del Parc Fluvial del
619 Besòs en l'àmbit urbà de Montcada i Reixac. Primera.

620 Gaber J, Overacker T. 2012. Establishing mixed method research design guidelines in
621 health impact assessment investigations. Impact Assess. Proj. Apprais. 30:275–283;
622 doi:10.1080/14615517.2012.743243.

623 Gascon M, Zijlema W, Vert C, White MP, Nieuwenhuijsen MJ. 2017. Outdoor blue spaces
624 , human health and well-being : A systematic review of quantitative studies. Int. J.
625 Hyg. Environ. Health; doi:10.1016/j.ijheh.2017.08.004.

626 Grellier J, White MP, Albin M, Bell S, Elliott LR, Gascón M, et al. 2017. BlueHealth: A
627 study programme protocol for mapping and quantifying the potential benefits to

628 public health and well-being from Europe's blue spaces. BMJ Open 7:1–10;
629 doi:10.1136/bmjopen-2017-016188.

630 Guthold R, Stevens GA, Riley LM, Bull FC. 2018. Worldwide trends in insufficient
631 physical activity from 2001 to 2016: a pooled analysis of 358 population-based
632 surveys with 1·9 million participants. Lancet Glob. Heal. 6:e1077–e1086;
633 doi:10.1016/S2214-109X(18)30357-7.

634 Hallgren KA. 2012. Computing Inter-Rater Reliability for Observational Data: An
635 Overview and Tutorial. Tutor Quant Methods Psychol. 8:23–34;
636 doi:10.1080/11035896009449194.

637 Hunter RF, Christian H, Veitch J, Astell-Burt T, Hipp JA, Schipperijn J. 2015. The impact
638 of interventions to promote physical activity in urban green space: A systematic
639 review and recommendations for future research. Soc. Sci. Med. 124:246–256;
640 doi:10.1016/j.socscimed.2014.11.051.

641 Idescat. 2018. Padró municipal d'habitants de Montcada i Reixac. Available:
642 https://www.idescat.cat/emex/?id=081252 [accessed 9 January 2019].

643 Joseph RP, Maddock JE. 2016. Observational Park-based physical activity studies: A
644 systematic review of the literature. Prev. Med. (Baltim). 89:257–277;
645 doi:10.1016/j.ypmed.2016.06.016.

646 King DK, Litt J, Hale J, Burniece KM, Ross C. 2015. "The park a tree built": Evaluating
647 how a park development project impacted where people play. Urban For. Urban
648 Green. 14:293–299; doi:10.1016/j.ufug.2015.02.011.

649 Kramer D, Lakerveld J, Stronks K, Kunst AE. 2017. Uncovering How Urban Regeneration
650 Programs May Stimulate Leisure-time Walking among Adults in Deprived Areas: A
651 Realist Review. Int. J. Heal. Serv. 47:703–724; doi:10.1177/0020731417722087.

652 Lee I-M, Shiroma EJ, Lobelo F, Puska P. 2012. Impact of Physical Inactivity on the
653 World's Major Non- Communicable Diseases. Lancet 380:219–229;
654 doi:10.1016/S0140-6736(12)61031-9.Impact.

655 Macmillan F, George ES, Feng X, Merom D, Bennie A, Cook A, et al. 2018. Do natural
656 experiments of changes in neighborhood built environment impact physical activity
657 and diet? A systematic review. Int. J. Environ. Res. Public Health 15;
658 doi:10.3390/ijerph15020217.

659 March A, Batllet J. 2015. Monografia comunitària. Visió conjunta de La Ribera.

660 Marielle A B, Carlijn BM. K, Katrina G, Johannes B, A.E. K, A. B, et al. 2012.
661 Socioeconomic inequalities in occupational, leisure-time, and transport related
662 physical activity among European adults: A systematic review. Int. J. Behav. Nutr.
663 Phys. Act. 9: 1–23.

664 McCartney G, Hearty W, Taulbut M, Mitchell R, Dryden R, Collins C. 2017. Regeneration
665 and health: a structured, rapid literature review. Public Health 148:69–87;
666 doi:10.1016/j.puhe.2017.02.022.

667 McCormack GR, Rock M, Toohey AM, Hignell D. 2010. Characteristics of urban parks
668 associated with park use and physical activity: A review of qualitative research. Heal.

669 Place 16:712–726; doi:10.1016/j.healthplace.2010.03.003.

670 McKenzie T, Cohen D, Sehgal A, Williamson S, Golinelli D. 2006. System for Observing
671 Play and Recreation in Communities (SOPARC): Reliability and Feasibility
672 Measures. J Phys Act Heal. 3 Suppl 1:S208–S222; doi:10.1021/nl061786n.Core-
673 Shell.

674 Mckenzie TL, Cohen DA. 2006. System for Observing Play and Recreation in
675 Communities. Description and Procedures Manual. Sci. York.

676 Moore THM, Kesten JM, López-López JA, Ijaz S, McAleenan A, Richards A, et al. 2018.
677 The effects of changes to the built environment on the mental health and well-being of
678 adults: Systematic review. Heal. Place 53:237–257;
679 doi:10.1016/j.healthplace.2018.07.012.

680 National Institute for Health and Clinical Excellence. 2012. Walking and cycling : local
681 measures to promote walking and cycling as forms of travel or recreation.

682 Nieuwenhuijsen MJ. 2018. Influence of urban and transport planning and the city
683 environment on cardiovascular disease. Nat. Rev. Cardiol.; doi:10.1038/s41569-018-
684 0003-2.

685 Nieuwenhuijsen MJ, Gascon M, Martinez D, Ponjoan A, Mueller N, Espinosa A, et al.
686 2018. Air Pollution, Noise, Blue Space, and Green Space and Premature Mortality in
687 Barcelona: A Mega Cohort. Int. J. Environ. Res. Public Health 15:1–12;
688 doi:10.3390/ijerph15112405.

689 Nieuwenhuijsen MJ, Khreis H, Triguero-Mas M, Gascon M, Dadvand P. 2017. Fifty
690 Shades of Green. Epidemiology 28:63–71; doi:10.1097/EDE.0000000000000549.

691 Noble H, Mitchell G. 2016. What is grounded theory? Evid. Based Nurs. 19:34–35;
692 doi:10.1136/eb-2016-102306.

693 Pawlowski CS, Winge L, Carroll S, Schmidt T, Wagner AM, Nørtoft KPJ, et al. 2017.
694 Move the Neighbourhood: Study design of a community-based participatory public
695 open space intervention in a Danish deprived neighbourhood to promote active living.
696 BMC Public Health 17:1–10; doi:10.1186/s12889-017-4423-4.

697 Roberts H, McEachan R, Margary T, Conner M, Kellar I. 2018. Identifying Effective
698 Behavior Change Techniques in Built Environment Interventions to Increase Use of
699 Green Space: A Systematic Review. Environ. Behav. 50:28–55;
700 doi:10.1177/0013916516681391.

701 Sarkar C, Webster C. 2017. Urban environments and human health: current trends and
702 future directions. Curr. Opin. Environ. Sustain. 25:33–44;
703 doi:10.1016/j.cosust.2017.06.001.

704 Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. 2018. Saturation
705 in qualitative research: exploring its conceptualization and operationalization. Qual.
706 Quant. 52:1893–1907; doi:10.1007/s11135-017-0574-8.

707 Schultz CL, Wilhelm Stanis SA, Sayers SP, Thombs LA, Thomas IM. 2017. A
708 longitudinal examination of improved access on park use and physical activity in a
709 low-income and majority African American neighborhood park. Prev. Med. (Baltim).

95:S95–S100; doi:10.1016/j.ypmed.2016.08.036.

Shenton AK. 2004a. Strategies for ensuring trustworthiness in qualitative research projects. Educ. Inf. 22:63–75; doi:10.1111/j.1744-618X.2000.tb00391.x.

Shenton AK. 2004b. Strategies for ensuring trustworthiness in qualitative research projects. Educ. Inf. 22:63–75; doi:10.1111/j.1744-618X.2000.tb00391.x.

Stappers NEH, Van Kann DHH, Ettema D, De Vries NK, Kremers SPJ. 2018. The effect of infrastructural changes in the built environment on physical activity, active transportation and sedentary behavior – A systematic review. Heal. Place 53:135–149; doi:10.1016/j.healthplace.2018.08.002.

Van Dyck D, Sallis JF, Cardon G, Deforche B, Adams MA, Geremia C, et al. 2013. Associations of neighborhood characteristics with active park use: An observational study in two cities in the USA and Belgium. Int. J. Health Geogr. 12:1–9; doi:10.1186/1476-072X-12-26.

Van Hecke L, Van Cauwenberg J, Clarys P, Van Dyck D, Veitch J, Deforche B. 2017. Active use of parks in flanders (Belgium): An exploratory observational study. Int. J. Environ. Res. Public Health 14:1–15; doi:10.3390/ijerph14010035.

Vries S De, Dillen SME Van, Groenewegen PP, Spreeuwenberg P. 2013. Streetscape greenery and health : Stress , social cohesion and physical activity as mediators. Soc. Sci. Med. 94:26–33; doi:10.1016/j.socscimed.2013.06.030.

WHO Regional Office for Europe. 2016. Urban Green Spaces and Health. A review of evidence.

World Health Organization. 2018. Global action plan on physical activity 2018-2030. More active people for a healthier world.

World Health Organization. 2019. Physical activity. Available: https://www.who.int/news-room/fact-sheets/detail/physical-activity.

World Health Organization. 2017. Urban green space interventions and health: A review of impacts and effectiveness. Full report (2017).

LIST OF TABLES

Table 1. Characteristics of the total number of users observed in Besòs Riverside Park by target area, for the pre and post-evaluation SOPARC assessment

	Renovated area			Non-renovated area			Both areas		
	PRE (2016) **N=1,049**	POST (2017) **N=1,312**	p-value[b]	PRE (2016) **N=2,429**	POST (2017) **N=2,319**	p-value[b]	PRE (2016) **N=3,478**	POST (2017) **N=3,631**	p-value[b]
Location [N, (%)]									
Upper	1,031 (98.3)	1,103 (84.1)	0.000	2,072 (85.3)	2,047 (88.3)	0.003	3,103 (89.2)	3,150 (86.6)	0.001
Lower	18 (1.7)	209 (15.9)		357 (14.7)	272 (11.7)		375 (10.8)	481 (13.3)	
Demographic characteristics of the users [N, (%)]									
Gender									
Female	282 (26.9)	403 (30.7)	0.041	484 (20.0)	356 (15.4)	0.000	768 (22.1)	759 (20.9)	0.227
Male	767 (73.1)	909 (69.3)		1,943 (80.0)	1,963 (84.7)		2,710 (77.9)	2,872 (79.1)	
Age group									
Children[a]	18 (1.7)	52 (4.0)	0.000	43 (1.8)	27 (1.2)	0.000	61 (1.8)	79 (2.2)	0.000
Teens[a]	71 (6.8)	36 (2.7)		80 (3.3)	42 (1.8)		151 (4.3)	78 (2.2)	
Adults	484 (46.1)	734 (56.0)		1,595 (65.7)	1,428 (61.6)		2,079 (59.8)	2,162 (59.5)	
Seniors	476 (45.4)	490 (37.3)		711 (29.3)	822 (35.4)		1,187 (34.1)	1,312 (36.1)	
Ethnicity									
Caucasian	1,022 (97.4)	1,215 (92.6)	0.000	2,390 (98.4)	2,276 (98.1)	0.147	3,412 (98.1)	3,491 (96.1)	0.000
Latin-American	9 (0.9)	23 (1.8)		13 (0.5)	4 (0.2)		22 (0.6)	27 (0.7)	
Black	2 (0.2)	8 (0.6)		5 (0.2)	5 (0.2)		7 (0.2)	13 (0.4)	
Asian	10 (0.9)	26 (1.9)		8 (0.3)	14 (0.6)		18 (0.5)	40 (1.1)	
North-African	6 (0.6)	23 (1.8)		10 (0.4)	16 (0.7)		16 (0.5)	39 (1.1)	
Other	0 (0.0)	17 (1.3)		3 (0.1)	4 (0.2)		3 (0.1)	21 (0.6)	
Physical activity level [N, (%)]									
Sedentary	81 (7.7)	158 (12.0)	0.000	130 (5.4)	89 (3.8)	0.000	211 (6.1)	247 (6.8)	0.447
Moderate	702 (66.9)	901 (68.7)		928 (38.2)	782 (33.7)		1,630 (46.8)	1,683 (46.3)	
Vigorous	266 (25.4)	253 (19.3)		1,371 (56.4)	1,448 (62.4)		1,637 (47.1)	1,701 (46.9)	

[a] During one sampling session in 2016, observers observed a group of scholars (N child=23; N teen=50) doing an organized academic activity along the study setting. We conducted a sensitivity analysis excluding these users (Table S4 – Supplementary material).

[b] P-values based on Chi-squared tests to compare the distribution of sociodemographic characteristics of users between the pre (year 2016) and post (year 2017) intervention evaluation.

Table 2. Association [Relative Risk Ratio (RRR) 95% CI] between post intervention evaluation period (year 2017) – having the pre-intervention evaluation period (year 2016) as the reference – and covariates, with user's physical activity level [i.e. sedentary, moderate and vigorous (reference)], for the renovated and non-renovated area.

	Renovated area		**Non-renovated area**	
	Physical activity level (Reference=Vigorous)		Physical activity level (Reference=Vigorous)	
	Sedentary RRR (95% CI)	Moderate RRR (95% CI)	Sedentary RRR (95% CI)	Moderate RRR (95% CI)
POST (2017) [Reference=PRE (2016)]	1.78 (1.26; 2.51)*	1.25 (0.99; 1.57)*	0.68 (0.49; 0.94)*	0.67 (0.58; 0.78)*
Covariates				
Females (Ref=males)	2.73 (1.74; 4.29)*	6.55 (4.68; 9.17)*	8.23 (5.66; 11.96)*	10.12 (8.19; 12.51)*
Age group (Ref=adults)				
Children	5.22 (2.23; 12.26)*	1.57 (0.70; 3.55)	41.84 (18.89; 92.65)*	11.06 (5.70; 21.48)*
Teens	0.78 (0.33; 1.83)	1.18 (0.69; 2.01)	19.95 (11.53; 34.51)*	1.08 (0.61; 1.91)
Senior	2.41 (1.66; 3.51)*	4.80 (3.71; 6.22)*	7.26 (5.03; 10.46)*	8.30 (7.06; 9.75)*
Non-Caucasian (Ref=Caucasian)	2.99 (1.44; 6.21)*	2.19 (1.24; 3.88)*	8.77 (3.55; 21.65)*	6.17 (3.43; 11.08)*
Lower location (Ref=Upper location)	4.14 (2.21; 7.77)*	4.40 (2.62; 7.38)*	0.33 (0.16; 0.67)*	0.39 (0.30; 0.51)*
Weekend (Ref=weekday)	0.48 (0.33; 0.70)*	0.50 (0.39; 0.65)*	0.27 (0.18; 0.40)*	0.43 (0.37; 0.51)*
Time of the day (Ref=midday)				
Morning	0.18 (0.11; 0.30)*	0.54 (0.42; 0.69)*	0.11 (0.06; 0.21)*	1.02 (0.86; 1.21)
Afternoon	0.66 (0.40; 1.08)	0.94 (0.65; 1.36)	0.79 (0.54; 1.15)	1.49 (1.20; 1.85)*

RRR: Relative Risk Ratio
Ref=Reference
*Statistically significant ($p<0.05$)

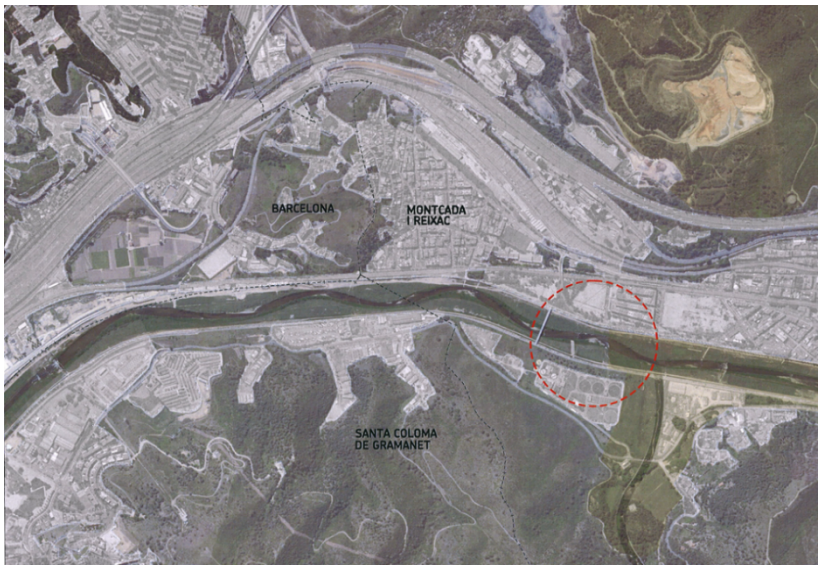
Table 3. Energy expenditure (in mean METs/observation) by target area and for the pre and post-evaluation SOPARC assessment

	Renovated area			Non-renovated area			Both areas		
	PRE (2016)	POST (2017)	Comparison between years [% of change]	PRE (2016)	POST (2017)	Comparison between years [% of change]	PRE (2016)	POST (2017)	Comparison between years [% of change]
Mean METs/observation									
Upper	4,34	4,12	-5	5,44	5,80	7	5,08	5,21	3
Lower	4,59	3,41	-26	6,79	6,74	-1	6,69	5,29	-21
Total	4,34	4,01	-8	5,64	5,91	5	5,25	5,22	0

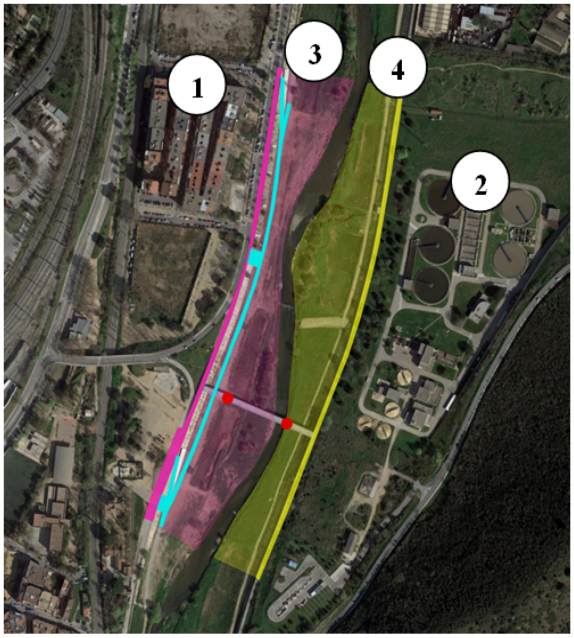
LIST OF FIGURES

Figure 1. Setting of the study area: A) Location of the section of the Besòs Riverside Park affected by the urban riverside regeneration project; B) Renovated and non-renovated area of the Besòs Riverside Park.

A) Location of the section of the Besòs Riverside Park affected by the urban riverside regeneration project (Farrero i Compte et al. 2015).



B) Renovated (pink) and non-renovated (yellow) area of the Besòs Riverside Park. Dark and light colours indicate the upper and lower location of the area, respectively. The intervention (i.e. paved walkway, ramps, and stairs) is marked in blue. Red dots indicate the position at which observers made their recordings (Adapted from the Map of Newnham Campus, Seneca College from: "Toronto, Ontario." Map, Google Maps. Accessed 23 Apr. 2014).



Legend Figure 1:

1. "La Ribera"
2. Purifying plant
3. Renovated area (right side of the river)
4. Non renovated area (left side of the river)

Figure 2. Images of the renovated area of the Besòs Riverside Park: A) Renovated area of the Besòs Riverside Park, before and after the intervention; B) Provision of access to the riverbank.

A) Right side of the Besòs Riverside Park (renovated area), before and after the urban riverside regeneration project [Photos taken by: XXX in June 2016 (image A.1.) and XXX in November 2017 (image A.2.)].

Image A.1.: before intervention

Image A.2.: after intervention

B) Ramps and stands stairs, constructed on the right side of the Besòs Riverside Park (renovated area), to provide access to the riverbank (Photos taken by XXX, November 2017).

Figure 3. Levels of physical activity by target area (i.e. renovated and non-renovated area) and period of evaluation (i.e. pre/post-evaluation), and stratified by gender (F=female; M=male).

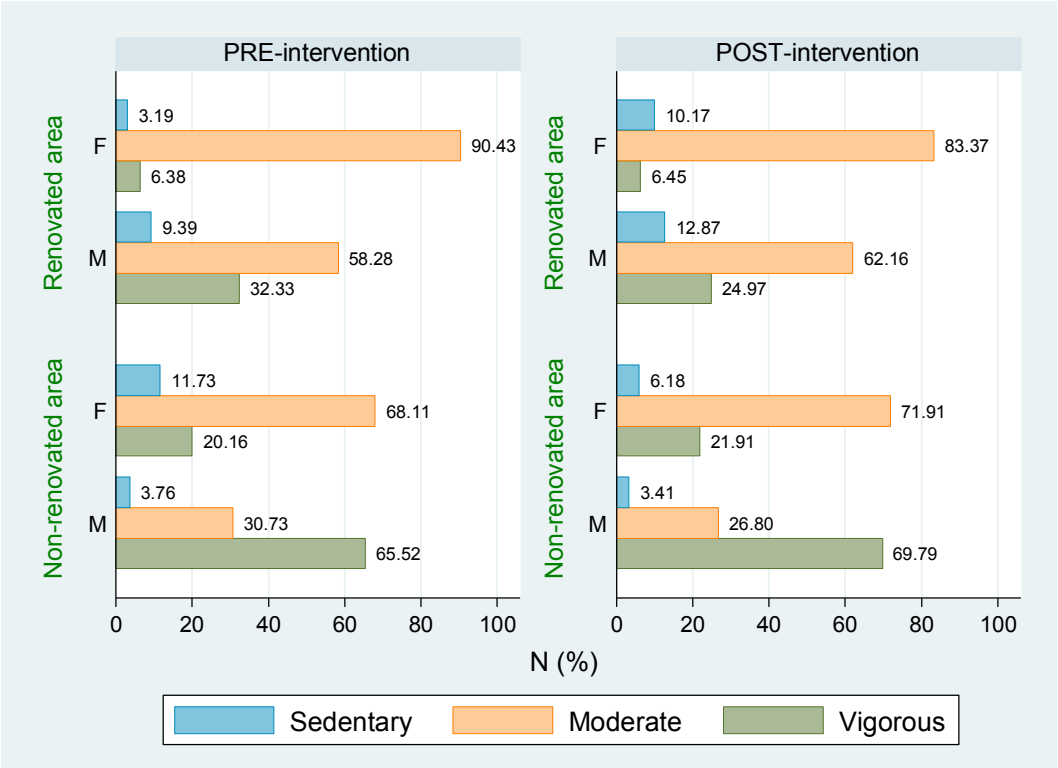


Figure 4. Levels of physical activity by target area (i.e. renovated and non-renovated area) and period of evaluation (i.e. pre/post-evaluation), and stratified by age group.

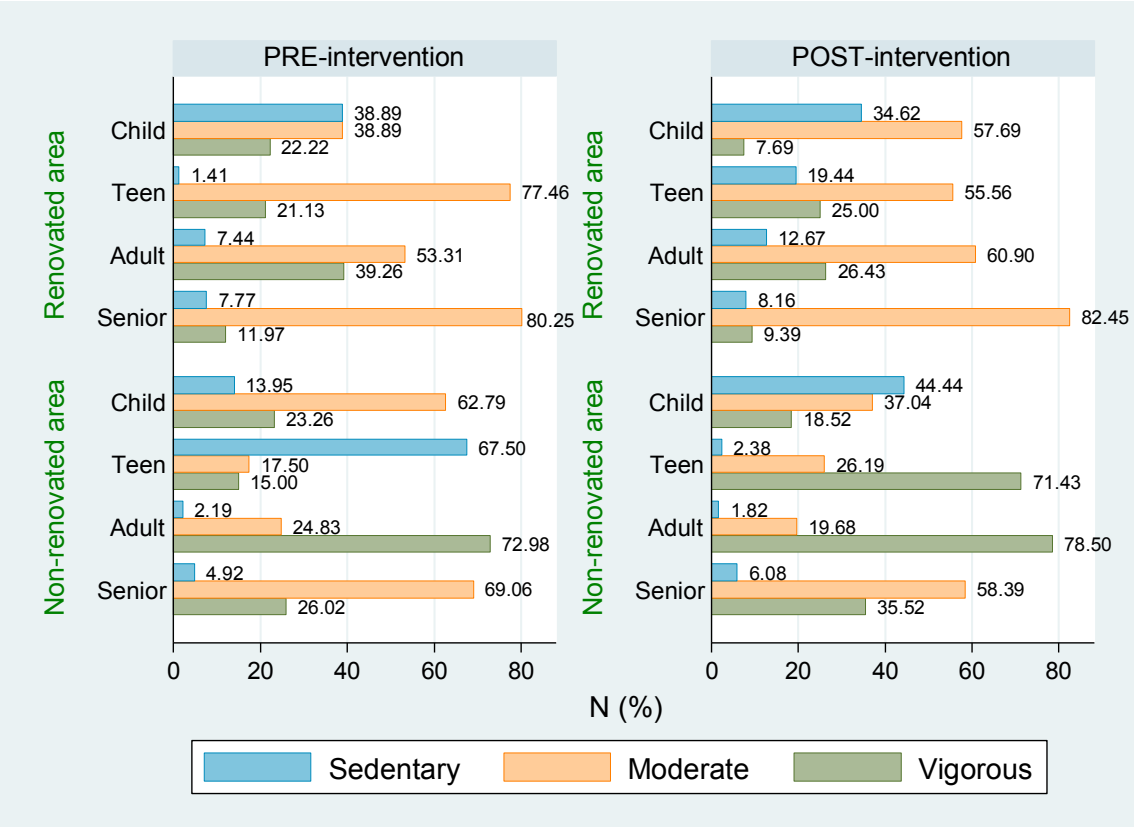
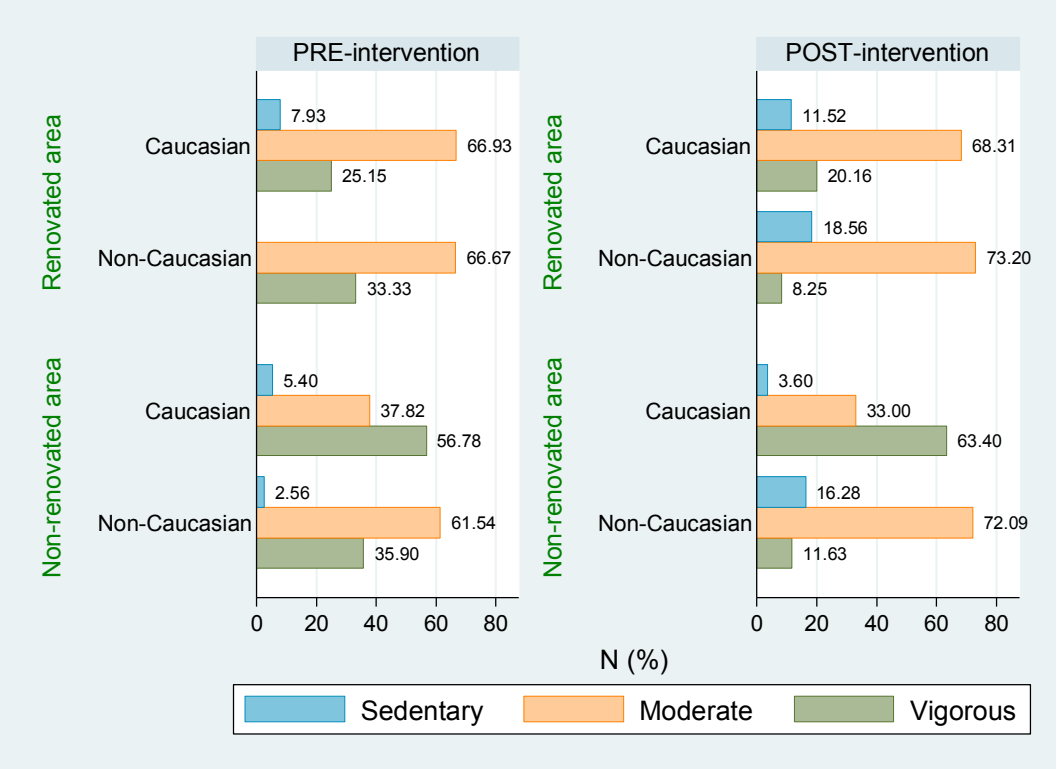


Figure 5. Levels of physical activity by target area (i.e. renovated and non-renovated area) and period of evaluation (i.e. pre/post-evaluation), and stratified by ethnicity.



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Acknowledgments

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SUPPLEMENTARY MATERIAL

LIST OF FIGURES AND TABLES

- **Figure S1.** Calendar of days doing systematic observations at the Besòs Riverside Park

PRE-EVALUATION (2016)

NOVEMBER

Mon	Tue	Wed	Thu	Fri	Sat	Sun
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

DECEMBER

Mon	Tue	Wed	Thu	Fri	Sat	Sun
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

POST-EVALUATION (2017)

NOVEMBER

Mon	Tue	Wed	Thu	Fri	Sat	Sun
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Legend*

Morning

Midday

Afternoon

*Different colors indicate whether systematic observations were conducted in the morning, midday or afternoon.

- **Figure S2.** SOPARC coding form

DATE: _____ **OBSERVER** (Name):_____ Observations: 1 2 3 4 5 6

START TIME: _____ **END TIME**: _____ **Temperature and weather**:_____

TARGET AREA: A (La Ribera Neighborhood) B (purifying plant)

# P	Location		Gender		Activity level			Activity (specify)	Age group				Ethnicity					Notes
1	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
2	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
3	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
4	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
5	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
6	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
7	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
8	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
9	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
10	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
11	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
12	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
13	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
14	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
15	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
16	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
17	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
18	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
19	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
20	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
21	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	
22	U	L	F	M	S	W	V		Child	Teen	Adult	Senior	C	LA	B	A	O	

NOTES:

Observation: each observation will last 7 minutes (in total we will have 6 observations of 7 minutes each, so 42 minutes observation time, with breaks of 3 minutes between sections, in total 60 minutes).
Start time: time at which the observation process starts.
End time: time at which the observation process ends.
#P: number of subject observed.
Location: U=upper part of the section (sidewalk), L=lower part of the section (near the river)
Gender: F=female, M=male
Activity level: S=sedentary (lying down, sitting, standing in a place), W=walking, V=vigorous (increasing heart rate, sweating: jogging, biking…)
Activity specify: indicate the specific activity the person is doing.
Age group: Child (<12 years), Teen (13 to 20 years), Adults (21 to 59 years), Seniors (>60 years)
Ethnicity: C=Caucasian, LA=Latin-American, B=Black, A=Asian, O=others
Note: Please indicate any events or observations of interest, including close calls, unlawful behavior, or any other information that may affect your count, or observed behaviors such as significant events or background information, i.e. free zoo day, formal event at park, etc.

- **Table S1.** Semi-structured face-to-face interviews

MONTCADA Qualitative interviews – Guide questions

Introduction

- Interviewer's introduction
- Description and objectives of the interview
- Permission to record the interview and sign of the informed consent
- Choice of language: Spanish or Catalan

Attitudes to the natural environment, use and perception

- What do you think about natural environments (green/blue spaces) in your neighbourhood? And in particular, the Besòs River.
- What do you like/dislike of these natural environments, and especially of the Besòs River? (E.g. accessibility, facilities, beauty, security, etc.)
- Do you use these spaces (and in particular the Besòs River)? Why? Why not? What activities do you do?
- What do you think about the non-natural (artificial) environment in your neighbourhood? (E.g. buildings, streets, services, traffic, etc.)
- Why do you live in this neighbourhood?
- Was the natural environment (quantity/quality) a reason to move to this neighbourhood? Why? Could you explain this?
- How much is natural environment in your neighbourhood important for you? Why? Could you explain this?
- Has natural environment in your neighbourhood changed over time? How has it changed? Has it improved/get worse?
- What would your "ideal neighbourhood" be like? Describe the main characteristics (e.g. green/blue spaces, buildings, services, facilities, civic responsibility, traffic, etc.).
- Do you do group activities (e.g. workshops, courses, neighbourhood association, etc.)? Do you interact with your neighbours?
- Do you go to the river alone or with someone else?
- Do you think your behaviour or well-being is related to the type of environment in which you are? How do you think it is related? Could you tell me an example?
- Do you feel good/satisfied with your live? Is there anything that worries you?
- Did you use to spend much time outdoors when you were a child?
- What is your main mean of transport (to commute, to go shopping, to take children to school, etc.)?

- Do you ever walk or cycle? If yes, why do you walk/cycle (to commute, or for pleasure)? Where do you go? Do you usually use a route next to green/blue spaces? Why (faster, nicer, shorter...)? If not, why not? Security reasons, lack of facilities, mobility problem...?
- What other places do you usually visit during the week/weekend (e.g. parks, forest, canals, lakes, beach, etc.)? Why? Could you describe it?

Table S2. Comparison (% of change) of the number of users in the renovated area, the non-renovated area, and in both areas of the river before (year 2016) and after (year 2017) the urban riverside regeneration project

	Renovated area			Non-renovated area			Both areas		
	PRE (2016)	POST (2017)	**Comparison between years [% of change]**	PRE (2016)	POST (2017)	**Comparison between years [% of change]**	PRE (2016)	POST (2017)	**Comparison between years [% of change]**
	1049	1312	25	2429	2319	-5	3478	3631	4
Location [N]									
Upper	1031	1103	7	2072	2047	-1	3103	3150	2
Lower	18	209	1061	357	272	-24	375	481	28
Demographic characteristics of the users [N]									
Gender									
Female	282	403	43	484	356	-26	768	759	-1
Male	767	909	19	1943	1963	1	2710	2872	6
Age group									
Children	18	52	189	43	27	-37	61	79	30
Teens	71	36	-49	80	42	-48	151	78	-48
Adults	484	734	52	1595	1428	-10	2079	2162	4
Seniors	476	490	3	711	822	16	1187	1312	11
Ethnicity									
Caucasian	1022	1215	19	2390	2276	-5	3412	3491	2
Latin-American	9	23	156	13	4	-69	22	27	23
Black	2	8	300	5	5	0	7	13	86
Asian	10	26	160	8	14	75	18	40	122
North-African	6	23	283	10	16	60	16	39	144
Other	0	17	0	3	4	33	3	21	600
Physical activity level [N]									
Sedentary	81	158	95	130	89	-32	211	247	17
Moderate	702	901	28	928	782	-16	1630	1683	3
Vigorous	266	253	-5	1371	1448	6	1637	1701	4

Table S3. Distribution [N (%)] of riverside park users according to their age group, by gender and period of evaluation (i.e. pre/post-evaluation).

	PRE (2006)				POST (2007)			
[N (%)]	Children	Teens	Adults	Senior	Children	Teens	Adults	Senior
Females	6 (2.1)	29 (10.3)	114 (40.3)	133 (47.2)	17 (4.2)	20 (5.0)	235 (58.3)	131 (32.5)
Males	12 (1.6)	42 (5.5)	370 (48.2)	343 (44.7)	35 (3.9)	16 (1.8)	499 (54.9)	359 (39.5)

Table S4. Sensitivity analysis excluding a group of scholars [N(child)=23; N(teen)=50] observed during one session in 2016 conducting an organized academic activity on the upper part of the non-renovated area.

	Renovated area			Non-renovated area			Both areas		
	PRE (2016) **N=1,049**	POST (2017) **N=1,312**	p-value*	PRE (2016) **N=2,356**	POST (2017) **N=2,319**	p-value*	PRE (2016) **N=3,405**	POST (2017) **N=3,631**	p-value*
Location [N, (%)]									
Upper	1,031 (98.3)	1,103 (84.1)	0.000	1,999 (84.9)	2,047 (88.3)	0.001	3,030 (89.0)	3,150 (86.7)	0.004
Lower	18 (1.7)	209 (15.9)		357 (15.1)	272 (11.7)		375 (11.0)	481 (13.3)	
Demographic characteristics of the users [N, (%)]									
Gender									
Female	282 (26.9)	403 (30.7)	0.041	450 (19.1)	356 (15.4)	0.001	732 (21.5)	759 (20.9)	0.542
Male	767 (73.1)	909 (69.3)		1,906 (80.9)	1,963 (84.6)		2,673 (78.5)	2,872 (79.1)	
Age group									
Child	18 (1.7)	52 (4.0)	0.000	20 (0.8)	27 (1.2)	0.000	38 (1.1)	79 (2.2)	0.000
Teen	71 (6.8)	36 (2.7)		30 (1.3)	42 (1.8)		101 (2.9)	78 (2.2)	
Adult	484 (46.1)	734 (56.0)		1,595 (67.7)	1,428 (61.6)		2,079 (61.1)	2,162 (59.5)	
Senior	476 (45.4)	490 (37.3)		711 (30.2)	822 (35.4)		1,187 (34.9)	1,312 (36.1)	
Ethnicity									
Caucasian	1,022 (97.4)	1,215 (92.6)	0.000	2,317 (98.4)	2,276 (98.1)	0.156	3,339 (98.1)	3,491 (96.1)	0.000
Latin-American	9 (0.8)	23 (1.7)		13 (0.6)	4 (0.2)		22 (0.6)	27 (0.7)	
Black	2 (0.2)	8 (0.6)		5 (0.2)	5 (0.2)		7 (0.2)	13 (0.4)	
Asian	10 (1.0)	26 (2.0)		8 (0.3)	14 (0.6)		18 (0.5)	40 (1.1)	
North-African	6 (0.6)	23 (1.8)		10 (0.4)	16 (0.7)		16 (0.5)	39 (1.1)	
Other	0 (0.0)	17 (1.3)		3 (0.1)	4 (0.2)		3 (0.1)	21 (0.6)	
Physical activity level [N, (%)]									
Sedentary	81 (7.7)	158 (12.0)	0.000	80 (3.4)	89 (3.8)	0.004	161 (4.7)	247 (6.8)	0.001
Moderate	702 (66.9)	901 (68.7)		905 (38.4)	782 (33.7)		1,607 (47.2)	1,683 (46.4)	
Vigorous	266 (25.4)	253 (19.3)		1,371 (58.2)	1,448 (62.4)		1,637 (48.1)	1,701 (46.8)	

*P-values based on Chi-squared tests to compare the distribution of sociodemographic characteristics of users between the pre (year 2016) and post (year 2017) intervention evaluation.

Figure S3. Levels of physical activity by gender (F=female; M=male).

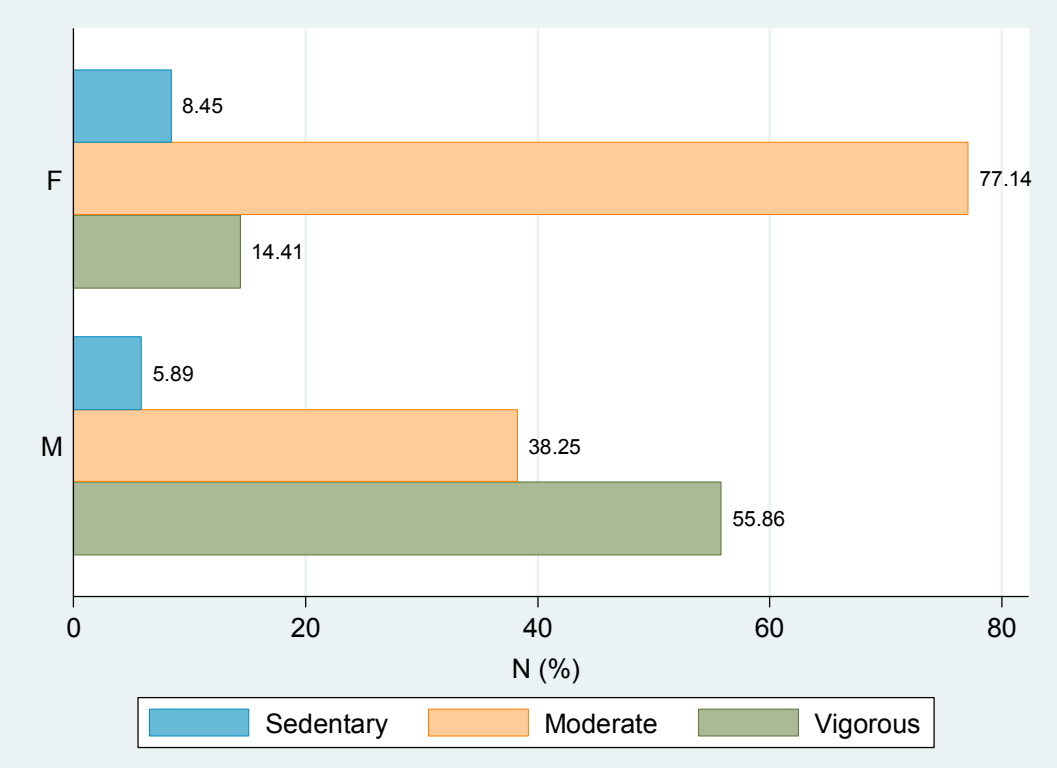

Table S5. Demographic characteristics of the participants interviewed.

	PRE (2016)	POST (2017)
Gender [N]		
Female	11	4
Male	6	2
Age group [N]		
Adult	13	4
Senior	4	2
Ethnicity [N]		
Caucasian	13	5
Non-Caucasian	4	1
TOTAL [N]	17	6