Cities & Health

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rcah20

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To cite this article: Heike Köckler, Rehana Shrestha, Atif Bilal Aslam, Tania Berger, Susanne Börner, Clement Cheung, Carlo Fabian, Hiranmayi Shankavaram, Reshma Shrestha, Sadichchha Shrestha & Daniel Simon (01 Mar 2024): Physical activity in public space: insights from a global community of practice applying photovoice as a tool for digital participatory place analysis, Cities & Health, DOI: 10.1080/23748834.2024.2307739

To link to this article: https://doi.org/10.1080/23748834.2024.2307739

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CITIES & HEALTH
https://doi.org/10.1080/23748834.2024.2307739

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Physical activity in public space: insights from a global community of practice applying photovoice as a tool for digital participatory place analysis

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ABSTRACT

Physical activity in open spaces is a crucial topic of urban health around the globe. As cities and everyday life differ a lot in specific urban contexts, places for physical activity may vary in shape, perception and use by local people. A group of researchers from eight countries in Europe, South America and Asia used the same online-photovoice application to explore places in their cities regarding physical activity in public spaces. Using the same application in eight countries with diverse local participants, we collected a rich basis for a reflection on methodological issues, the usability of the online-photovoice application and determinants of physical activity in public spaces in contrasting cities. The paper aims to provide traceable documentation of a collaborative learning activity with an online-photovoice application. In doing so, results are presented from researchers' self-reflection as a global community of practice on how the online-photovoice approach can be applied to place analysis for healthy urban development at different places with practitioners, communities, and scientists from diverse backgrounds. The paper contributes to a broader problem understanding of physical activity in public open spaces. As one result, we find that including aspects of safety and conflict in public space is highly relevant.

ARTICLE HISTORY
Received 16 September 2023
Accepted 13 January 2024

KEYWORDS
Physical activity; healthy urban development; knowledge co-production; public space; online-photovoice

Introduction

Physical activity in open space is a key topic of urban health around the globe. As cities and everyday life differ a lot in specific urban contexts, places for physical activity may differ in shape and perception of local people. A group of researchers from eight countries from Europe, South America and Asia used the same online-photovoice application to explore places in their cities with regard to physical activity in public space. Using the same application in eight countries with diverse participants from different disciplines, we collected a rich basis for a reflection on methodological issues and the usability of the online photovoice application for comparing public open space for physical activity in contrasting cities.

The aim of the paper is to provide a traceable documentation of a collaborative learning activity with online-photovoice application presenting results from researchers' self-reflection on how the online-photovoice approach can be applied to run place analysis for healthy urban development at different places with practitioners, communities and scientists from different disciplines thereby, contributing to a broader problem understanding of physical activity in public open space.

Physical activity in open space as an essential topic of healthy urban development

Physical activity is a crucial element of health promotion and contributes to reducing non-communicable diseases such as cancer, diabetes, cardiovascular disease, and mental stress (WHO 2022, p. 3). It includes any kind of physical activity such as walking, cycling, sports, working, and playing. The World Health Organisation (WHO) pursues its promotion through the Global Action Plan on Physical Activity 2018–2030 (WHO 2018). The plan follows four strategic objectives to create active 1) societies, 2) environments, 3) people and 4) systems. Strategic objective 2, aiming at environments, seeks the following: 'Create and maintain environments that promote and

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/23748834.2024.2307739

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safeguard the rights of all people, of all ages, to have equitable access to safe places and spaces, in their cities and communities, in which to engage in regular physical activity, according to ability' WHO (2018, p. 30) stresses both the relevance of the built environment and the specificity of needs of different communities with different abilities, needs and interests.

Promoting physical activity through active environments impacts the design of open spaces. Open public space can be designed for the public and is more easily accessible for different groups than indoor and private spaces. Moreover, various forms of open space can be distinguished, considering how accessible they are (accessibility) and who owns them (property rights). Thus, we can distinguish 1) public open space: owned by the public (e.g. municipality) and accessible for everyone (street, park), 2) semi-public open space: property of institutions, companies with limited access, (school-yard, allotment gardens in Germany or Switzerland) or 3): private open space: private ground (private gardens in residential areas, open space of enterprises).

Walkability is a theoretical and conceptual approach addressing one mode of physical activity. Five determinants have proven significant relevance regarding walkability, especially for cities in the USA and Europe: Diversity, Density, Design, Destination, and Distance to travel (called the 5-D-concept) (Ewing and Cervero 2010). The framework conditions for walkability differ by country, culture and settlement structure (Baumgart and Köckler 2021). For example, Lukenangula (2017) transferred the 5-D-concept to Dar es Salaam, Tansania and different types of settlement structures. He describes a 'chaotic mix of various modes of transport which is unsafe. Pedestrians compete for road space with many other non-motorized and motorized transport means. In areas where the infrastructure is provided, its management is lacking. Pedestrian walks are usually covered with collected garbage, hawkers selling their wares, construction materials and overflowing storm drains' (Lukenangula 2017, p. 23). Here, a conflict over public space becomes apparent: 'The mixture of pedestrians and motor vehicles increases accidents in urban roads in low and medium income countries' (Lukenangula 2017, p. 24).

However, walkability can also be limited by the design of public spaces in countries with a high standard of infrastructure. For example, a study with older women (75+) in Switzerland showed that there are conflicts between motorised traffic and certain population groups. For example, it was shown that pedestrian crossings with traffic lights can be dangerous for people with motoric limitations, as the green phases are usually too short and pedestrians are suddenly left standing in the middle of the crossing when the light turns red. Pedestrian crossings without traffic lights would be more suitable, as there would be clear rules of priority. Accordingly, the subjective feeling of safety can be reduced, which in turn leads to the avoidance of certain places or streets (Süsstrunk *et al.* 2018). Such avoidance behaviour, which is fostered by the limited walkability, leads to the situation that the affected persons will be less physical active.

Moreover, conflicts arising due to differences in the needs of different groups of users and intended uses in public space also occur in open green spaces, as described by Haase and Schmidt (2019) for arrival city neighbourhoods. Overall, physical activity in open spaces is a multi-dimensional place-related topic of health promotion, urban planning and community participation.

Photovoice, a method for participatory place analysis

Specific participatory methods can be applied to understand different communities' abilities, needs and interests concerning their use of open public space. These methods should be easily accessible by groups with diverse skills to provide insight into the settings of these communities and their specific spatial context. Photovoice is one such method to give voices to people and is therefore relevant for participatory research on physical environments as determinants of health. Photovoice is a qualitative research method through which different (often marginalised and underrepresented groups), are invited to document and critically reflect on their everyday experiences with the local environment by taking photographs (Zuch *et al.* 2013; Börner *et al.* 2017). These images are then used as a basis for group discussions and storytelling sessions to reflect on everyday experiences and perspectives, discuss their meanings and explore social issues. The photovoice method gives participants a relatively large degree of freedom to express their perception while also creating room for the 'unexpected' (Börner et al. 2017). It furthermore aims to empower participants to voice their concerns and raise awareness, whereby the visual medium can become a powerful tool for social transformation (Börner 2023). Petersen and Ostergaard (2003) distinguish between different kinds of applications, depending on whether photos are taken by researchers or participants (a specific target group or community), whether they are seen as 'data per se' and analyzed in a qualitative approach by researchers themselves, or if photos are used as elicitation to give voices to a specific target group. Applying photovoice to have photos taken by participants and using these photos for elicitation to give voice to participants is a meaningful approach to gaining deep insight into physical activity in different communities. Therefore, photovoice is being applied to include perspectives of

varied groups, especially of those to whom it is challenging to articulate their needs, including the context of environmental injustice (Annang *et al.* 2016), people with diverse abilities, such as so called cognitive disorders (Köckler and Simon 2020), gender nonbinary young adults (Cosgrove *et al.* 2021) or sexual and gender-expansive youth experiencing homelessness (Forge *et al.* 2018).

Traditionally, the participatory photovoice method has involved participants using disposable, non-disposable, or digital cameras to capture visual images (Börner *et al.* 2015, Crabtree and Braun 2015). Participants can either use a camera to take photographs on their own or have them taken together in a guided photoshoot. The photographs are then printed and used to generate conversation among groups in one-to-one sessions or workshops on various aspects of specific themes, such as identifying community-level problems to create change strategies. So, Foster *et al.* (2022, p. 2) conclude: 'Ultimately, photovoice is about leveraging participant-taken photographs and discussions to raise community consciousness and promote community-level change.'

The emergent use of digital technologies such as smartphones, social media, and online platforms is changing how researchers conduct research. They are opening immense opportunities and possibilities for participatory research and practice in general as well as concerning the photovoice method more specifically. Such technologies enable various participatory formats on how participants collect and share photos and engage in discussions and analysis with researchers or groups. For instance, as smartphones are almost ubiquitous among many communities across the world (Silver 2019), it is argued to be well integrated seamlessly into the daily life of participants, unlike in traditional photovoice methods when participants need to carry an additional device (i.e. camera) (Foster *et al.* 2022). Using a smartphone and social media alongside, Foster *et al.* (2022) demonstrate how a part of the photovoice method could be redesigned for the immediate sharing of perspectives on urban neighbourhoods, thus, generating conversation throughout the study period not only among the research group but also with a broader audience. Likewise, in line with the increasing number of ways mainly young people use online platforms and smartphones, Volpe (2019) shows the promising option of applying photovoice employing digital diaries to capture visual representations of everyday lives. Nonetheless, researchers have also raised challenges of using digital technologies in participatory research context. These challenges are related to the potential exclusion of participants who did not have internet access (Oliffe *et al.* 2023). Oliffe *et al.* (2023) further pointed out the risk of using web-sourced images by the participants instead of capturing their own images, thus eroding away traditional photovoice essence of building photography skills. Chen (2022) further reported about the loss of physical presence and opportunities for exchange among participants and researchers in a shared environment. In urban health, it is essential not just to discuss a general situation but to refer to the specific context of place (Köckler 2019). Photovoice is a powerful method to capture information on nuances of the relationships between individuals and their environment and, therefore, to better understand the role of the environment in shaping people's abilities to engage in physical activity. This information is even richer if the specific situation the photography represents is clearly located. The important 5-D-concept underlines that photos can be better understood in their spatial context. Furthermore, clear location support is warranted to devise any future interventions. In this regard, digital geo-referencing in the photovoice method offers a richer analysis (Köckler and Simon 2020).

To conclude, digitalization is offering new ways of using the photovoice method giving access to diverse participants and potentially repositioning them as co-producers of knowledge more than before. Research exploring how places shape and interact with people's physical activity across various urban forms, cultures and societies must be grounded in person-place relationships. In this context, combining digital geo-referencing that actively involves participants in collecting data related to places complimented with the photovoice method of capturing meaning and interpretations, could directly ground the research in producing knowledge on how spatial context interacts with people's social and perceptual experiences.

This paper aims to provide traceable documentation of an online-photovoice application. It presents self-reflection results by a global community of practice on how the photovoice approach can be applied online to place analysis for healthy urban development. Based on this conclusion, determinants of physical activity in open spaces are discussed.

Methods

A photovoice learning activity on physical activity in public open space was conducted within the online learning platform Urban Health digiSpace. Urban Health digiSpace is a platform provided by the Hochschule für Gesundheit, University of Applied Science, Bochum, Germany. It offers open educational resources under the creative commons licence on Urban Health in German and English. Therefore, everyone having internet access can continue learning independently and at any time. The Urban Health digiSpace provides a basis for easy-to-access learning materials for transdisciplinary processes of knowledge production amongst science, practice, and society. It is

run by the Department of Community Health, Hochschule für Gesundheit Bochum (https://urbanhealth-digispace.de/).

While the literature on participatory action research (PAR) has widely highlighted the importance of co-producing knowledge with (marginalized) communities and a diversity of stakeholders (de Toledo and Giatti 2014, Fabian and Huber 2019, Giatti 2019), discussions about participatory methods still fall short on proposals for learning together as a global community of practice. A collaborative international study involving researchers from the global South and North (Fekete *et al.* 2021) even pointed out that the term, participation' itself is not entirely clear from its operationalization point of view, even though it is much-demanded in the application of the global frameworks such as the Sustainable Development Goals (SDGs). We must generate a global dialogue to reflect together in a world disrupted by multiple global crises and multi-faceted challenges to healthy urban development and urban wellbeing (Roe and McCay 2021). Collaborative international research on participatory methods led by a community of 15 scholar-activists from the global South and North (Auerbach *et al.* 2022) shows the importance of learning with and from differences, challenges and similarities in cities and countries around the globe – despite the complexity and diversity of experiences.

Here, we draw on the understanding of participatory practices as collaborative and place-based processes of reflective learning and adaptation (Rappaport 2020) to foster knowledge co-creation in global communities of practice. By bringing together a heterogeneous group of researchers from the global South and North around the joint photovoice methodology in a collaborative cycle of learning, reflection and solution-seeking, we generate transformative understandings of the relevance of public space for physical activity. Within the local implementation of photo-voice in eight countries,

The whole learning activity comprised of three major elements (see Figure 1): A: single participant taking a photo with online device, B: local group discussion with participants, C: discussion of global community of practice on results of local groups. To implement these three major elements seven steps have been carried out (see textbox 1).

Textbox 1: steps of photovoice application

(1) Set up global community of practice
(2) Building up local groups of research participants
(3) Group learning on photovoice
(4) Collecting photos and related information
(5) Group discussing photos with SHOWED approach in each local groups
(6) Discussion of experiences in global joint online meeting
(7) Follow-up deliberations meetings and writing of this paper

First a global community of practice was set up within the research network of the first author of this paper. The aim was to set up local groups which represent various countries from the global North and South to apply and learn from the online-photovoice method for observing environmental determinants of physical activity and to elicit debate on possible change/interventions. Researchers and teachers at universities around the globe have been asked to be local contacts for photovoice analysis at their place. In the end, the authors of this paper functioned as the final local contacts. Local groups in Austria, Brazil, China, Germany, India, Nepal, Pakistan and Switzerland joined the activity. Though contacts were initially established in North

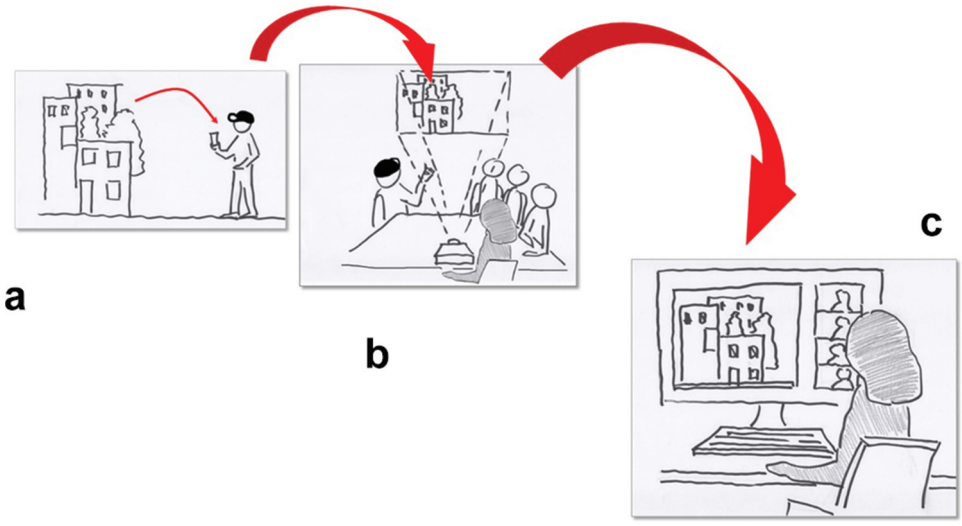

Figure 1. Major elements of our research process.

America and Africa, no group from these continents joined at the end due to Covid restrictions.

Secondly, the local contacts built up local groups of research participants being students, researchers or other residents. In step 3 each local group learned about the method and the online application. Learning on photovoice was supported by material in German and English language, which was provided via the online learning platform. The learning content on photovoice consists of videocasts on physical activity and photovoice, and a link to the online survey and training manual for the Kobo Toolbox.

Fourth participants took photographs of environmental determinants for physical activity in their own country. Implicit knowledge of the place guides the participant's decision what to include in the photo and what to leave out. Photos and related information were collected with the Kobo Toolbox. This digital tool allows for the immediate presentation of collected survey data in charts, including geo-referenced data on a map which uses Open Street Map as base-map. A survey was set up by the first and last authors, which asks research participants to upload photos of places that they like to be physically active/do not like to be active in/or which could be used for physical activity in an open space. These places were qualified through a few further questions; the demographics of participants were collected, too. This questionnaire was based on other photovoice experiences of the first and the last authors (Köckler and Simon 2020). Taking one photo and adding the information was very easy which did not take more than a few minutes (see survey supplementary information A). Each local group was run as an individual project in the Kobo Toolbox. Each local group independently applied the online photovoice application to their particular context in November/December 2021.

In step five discussion of photos with the SHOWED method took place in a local group discussion. The SHOWED method provides a structured and action-oriented method to discuss photos in a group. Research participants are asked to describe (a) What do you See in the photograph? (b) What is Happening in the photograph? (c) How does this photograph relate to Our lives or other community members? (d) Why do these issues currently Exist within your community? and (e) What can we Do about these issues? (Shore *et al.* 1986, Annang *et al.* 2016). In the discussion the photographer (=research participant) makes his/her implicit knowledge of (certain aspects of) the determinants of physical activity in the environment explicit to the group which adds their views and knowledge.While in some local groups, data collection and application of SHOWED method were carried out on the same day (e.g. Germany), other groups collected photos beforehand and met afterwards for discussion (e.g. China, Pakistan, Switzerland). The results of the discussion were documented. In some places, the SHOWED method application took place face-to-face (e.g. in Germany, Pakistan), but in other local groups, it was done in online meetings (e.g. Nepal).

As a sixth step different local experiences were discussed in a global joint online meeting in December 2021 where all global researchers and some of the research participant participated. The local groups from the different case study cities discussed both the online-photovoice application and the results of applying the SHOWED method in the context of physical activity in an open public space. Selected results have been shared on the online-learning platform. The team from Pakistan was not able to join.

The finals seventh step was the follow-up deliberation among the global researchers, which continued after the online session as it was deemed necessary and insightful to analyze the results across cases. Several online sessions took place among the global researchers who are the authors of this paper to develop a suitable structure for analysis by bringing in their different expertise. These activities are intended to enable learning together as a global community of practice.

Results

This section first provides essential information on the eight case studies based on the work of the local groups (Table 1); results on maps are shown in Figure 2 and in supplementary information B. In supplementary information C (table S1 and table S2), selected photos are described comparably for two topics – conflict over the space and safety in public space – regarding two land use categories studied here – street and public space. These two topics were found to be prominent across all the case studies and therefore were selected after deliberation during group discussion. The authors chose the photos purposively as examples that triggered a debate on safety and conflict over space in their local groups.

Most research participants in the application of the photovoice and SHOWED method were students. This is mainly due to the scientific network and recruitment through the universities. The recruitment of other groups was too challenging in most case studies in November/December 2021 owing to the Covid-pandemic. Some local groups also included researchers (Austria) or community social workers and youth (Brazil) recruited through ongoing research projects. All participants took part voluntarily. Students participated during regular lessons and some of them received credit points for their attendance. The method was applied in different places, including recreational areas, universities, parks and local neighbourhoods in the centre and

Table 1. Basic information on each case.

Country	Austria	Brazil	China	Germany	India	Nepal	Pakistan	Switzerland
Place	Public park, a street in Vienna; recreational area along the riverbank in Krems/ Austria	The everyday environment in a marginalized community in the urban periphery of Sao Paulo	Daily urban life around campus in Hong Kong	Campus and surrounding in Bochum	Public Park in the city of Bengaluru	The everyday environment in Dhulikhel	Daily urban life in Lahore	Public park in the city of Zurich
Number of photos taken	22	55	25	79	134	34	48	12
Participants	Researchers	Community social workers and young people from the community	Students	Students	Students	Students	Students	Students, urban development expert from the field, Professor
No of participants	6	4	8	20	14	4	5	4
Gender	83% female	100% female	*M* = 1, F = 7	100% female	*M* = 5, F = 9	*M* = 2, F = 2	*M* = 5	*M* = 1, F = 3
Recruitment of participants	Casual exchange among colleagues	Through an ongoing research project	During a lecture of a module in a master course	Through DigiSpace and teaching	As part of an elective Studio as an assignment for students	Direct contact was made with a group of participants from the university	Through teaching and training	Students in the context of a teaching module. Working with the professional: personal network.
No of days for taking photos	no joint photo-taking assignment > individual sessions	2 afternoons	3 weeks	1 afternoon	1 afternoon	2 weeks	1 week	1 afternoon
Application of SHOWED	Joint online session	One week later (hybrid face-to-face and online discussion)	Immediately after 3-week of collecting photos online	On the same day face to face	After two months	Immediately after two weeks of photovoice session (online discussion)	After 6 Months	2 weeks later
COVID-19 regulations under power at the time of data collection	No relevant restrictions outdoors (while lockdown in place for most businesses)	Wearing masks (both outside and inside) and social distancing when indoors	No restrictions in the open space	No restrictions for the participants outside	No movement restrictions; only Wearing masks was mandatory	No restriction for the participants outside. Wearing masks as being self-conscious	Wearing of masks	No restrictions in the open space (pictures). Online meetings for all other steps.
Note on the specific context	In Vienna/Europa, car dependency is high	Taking photos with a mobile was challenging due to safety reasons	The participants were asked to take photographs in a place that they were familiar with	The University Campus is monofunctional (education and business)	A public park and an ample lung space interspersed with thoroughfares in Bengaluru	Urban core areas of the municipality, including in/around the university	Many street vendors around	Although it was raining, it was no problem to take photos.

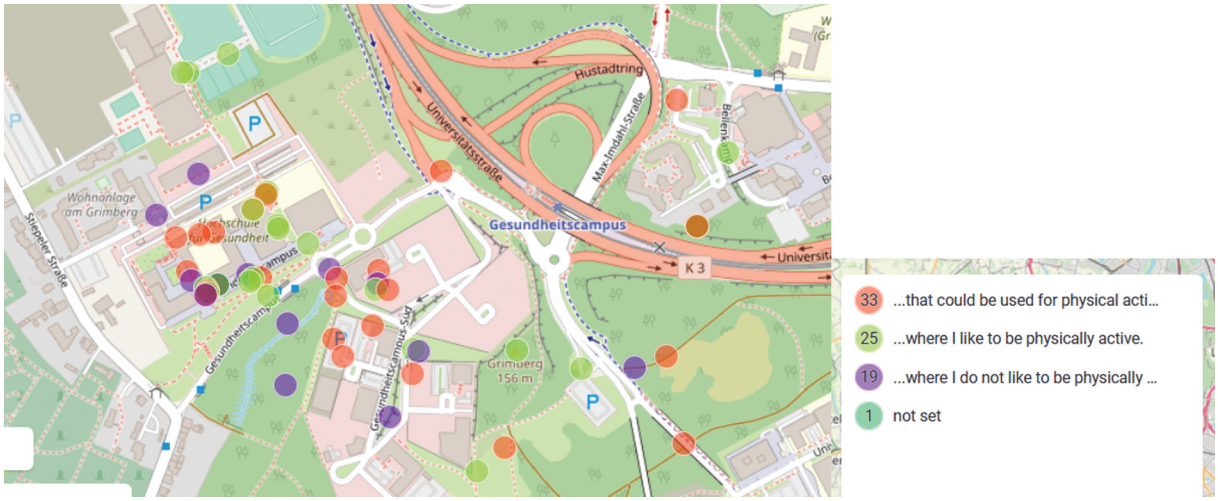

Figure 2. Map representing results in three main categories, an example of Bochum.

periphery of urban spaces. The number of participants varied from 4 to 20 in each group, with women forming the majority. Photos were discussed online and face to face immediately after taking them or within some time lapse. This reflects on the application variability of a same photovoice method applied in different contextual settings. Aspects relevant to contextualization while discussing the international group are presented in the last row of Table 1.

Figure 2 displays results for the area of investigation in Bochum, Germany, close to the university campus. The map form the backend of KoboToolbox shows geo-locations of the three basic categories visualized using three colours— (1) places that could be used for physical activity (red), (2) places that participants liked to be physically active (green), and (3) did not like to be physically active (purple). This map shows that 33 places could be improved (category 1), 25 have been assessed as positive (category 2), and 19 as unfavourable (category 3). The maps for the other 7 cases are available as supplementary information B. All maps in the KoboToolbox use OpenStreetMap as baselyer. The maps are without scale and additional geographic information available.

After several online deliberations, the authors focused on discussing the photos from specific regional contexts to identify similarities and differences in environmental determinants for physical activity in public spaces. Despite the differences in context, the authors deduced inductively that participants in each case pointed out similar challenges to urban mobility during the SHOWED discussion. During the discussion among the authors, it became evident that competition in public space/over space and safety were two significant factors determining physical activity. Other factor like gender, urban form and car availability were discussed, also, but not brought to discussion in each case-study. Therefore, street and public space have been selected as land use categories where competition over space and safety issues were most prominent across all eight case studies. Sports fields or university campuses have not been part of each study area and were, therefore, not integrated into this comparative learning experience. So, reflecting on the discussion, each local group selected photos representing competition over space and safety in streets (supplementary information C – table S1) and parks/public places (supplementary information C – table S2). The photos and notes from the SHOWED discussion are reported in the table in supplementary information C.

Discussion

Results are discussed here mainly regarding two topics: environmental determinants of physical activity in open space and photovoice as a general knowledge creation method and its online application in detail.

To frame this discussion, the strengths and limitations of our procedure are initially reflected on: the whole activity took place as a learning activity rather than research with a uniform study design. Nonetheless, participants in all eight countries used the identical learning material, online questionnaire as well as the SHOWED method to discuss photos. The variety of recruitment strategies may be a limitation (see Table 1). Furthermore, the SHOWED discussions were carried out differently, as time lag after actual photo taking and the mode of discussion varied (face-to-face vs online sessions). We are unaware of any study dealing with a time lag in photovoice or comparing online versus face-to-face discussion. We assume that Covid may also have influenced the situations observed in (semi)public spaces while taking

photos. The specific Covid restrictions in place in the case study cities have been documented in Table 1.

Physical activity in open space

The lack of adequate infrastructure for safe walking and cycling, particularly in open spaces (as exemplified in Germany, China, India, Pakistan, Nepal and Brazil, see supplementary information C), was highlighted as a cross-cutting issue by the photovoice exercise. Moreover, confirming the results of Lukenangula (2017), the case studies point out the competition over the use of public space by cars, cyclists, pedestrians and shops (e.g. China, Nepal) which causes the obstruction of sidewalks for pedestrians. After the 2015 earthquake, public space became a storage space for construction materials in Nepal. Participants from China, Brazil and India noted the absence of inclusive leisure spaces for different users. Participants in China and Brazil particularly noted the lack of leisure spaces for youth in (semi-)public spaces. In contrast, participants from India observed that public parks were not yet inclusive for multiple users with disabilities, the elderly, etc.

However, although the competition over the use of space might seem more 'evident' in the pictures taken in countries such as Nepal or Pakistan, similar problems were reported through the SHOWED method when discussing the selected photos in Austria and Germany. Participants equally observed a lack of safe walking and cycling lanes at the expense of car-friendly urban development, which gives priority to vehicles over pedestrians.

Regarding proposed solutions, participants requested improved law enforcement by the authorities (Nepal, Brazil and India) and the provision of necessary infrastructure to make cities and public community spaces more walkable. Participants from Brazil, for instance, pointed to the excessive bureaucracy that delays change, despite the potential for improvement, such as the availability of public space that could be converted into a leisure area for youth. Participants from India furthermore pointed out a lack of awareness of the concepts of universal design in the right to open space in a city. Here, the Swiss example provides learning on how awareness of green spaces' importance for people's health in urban contexts can emphasize the demand for more recreational areas such as urban green zones. The example in Bochum shows that the semi-public space of a university campus can be used for physical activity such as jogging or walking dogs by the entire neighbourhood. As the example from Pakistan demonstrates, an awareness of the importance of 'visual aesthetics' in urban spaces is fundamental for initiating some necessary improvements.

Discussions in Austria showed, however, that a single measure mostly does not suffice; instead, a package of measures is always needed, as well as an openness to discuss and negotiate the use of space. As shown by the Brazilian example, it is essential to include different age groups in these discussions to avoid an adult-centric dialogue and empower young people to re-imagine different urban futures. Besides the focus on competition over space and safety, additional aspects, including gender and space, were discussed.

Photovoice as a participatory method in the field of urban health

In the group discussion, participants in China, Germany and Switzerland reported that photovoice was an effective and simple-to-use tool for everyone, with or without knowledge in community health sciences. Photovoice, including the SHOWED discussion, was experienced by all authors locally responsible for implementation as an easy-to-use method. This method needs one person with methodological knowledge and experience. Other participants can then join without prior knowledge. It functions well to let different people take part in participatory place analysis.

The SHOWED approach helps participants and researchers facilitate the discussion to organize their thoughts and communicate them in the group. As participants describe the photos, they consider the local contexts, histories, culture and relationships surrounding and impacting their understanding of the images. Participants brought their subjective points of view in first. The joint discussions did not lead to objectification, but a common understanding was created or, at best, the clarity that there is no common understanding. Participants in China reported the entire method to work better in describing what they felt in a particular space than merely telling by just words. Although some participants may not be very confident in taking photographs, at least they felt that using pictures with the guided questions of the SHOWED approach is a simple way of expressing what they felt. Therefore, participants were able to point out why a specific space is or is not suitable for physical activity.

Taking pictures and talking about the places where photos were taken sparked a more detailed reflection on the issues in the neighbourhood. Revisiting the photos with the SHOWED method brought up very relevant issues (connected to the photo and disconnected matters of great relevance). Tables S1 and S2 (supplementary information C) show that institutional aspects, participation, income and social norm have been discussed. Accordingly, not everything relevant is visible in the picture, but the photo can spark a discussion around pertinent additional issues that may not be visible. The questions of the SHOWED method help make explicit the implicit knowledge of

those who took the photos. The broader framework conditions under which the depicted situations are occurring on a daily basis may be well known and evident to those who experience them regularly (such as the omnipresence of individualized vehicular traffic in most European settings, the prevailing security concerns in Brazil or the diversity of uses coexisting in public spaces in Nepal, India and Pakistan). When compiling this paper's results across different geographic and cultural realms, the differences in the implicit background knowledge became relevant and evident: the influence of vehicular traffic, even in situations where no actual car is visible in the depicted scenes in Austria, needs to be pointed out as does the constant danger of one's camera been snapped by passers-by in the Brazilian context. Such influences and interdependences are not apparent to outsiders, and the SHOWED method applied in the international setting of this paper strongly supports making them explicit.

The photovoice method can empower the participants to express and reflect more clearly on their individual experiences. Taking into account that most participants were students one has to see that they might be more outspoken then other members of the society who could use photovoice as well. We have not been able to control for any power relations due to a potential teacher student hierarchy. Some participants in China suggested a list of adjectives to be provided to describe the public spaces to help better assess and evaluate the situations in the photos. Nonetheless, sometimes the different elements of SHOWED were not easy to distinguish: In most cases, the description of what can be seen and what is happening is near to identical. Therefore, participants sometimes got confused. Photovoice, in general, has a limitation. In Brazil, taking pictures at all places of interest was not always possible due to security concerns (drug, traffic etc.). Therefore, reflecting on the images that were not taken is also essential.

Despite many advantages of the robust photovoice method in eliciting the participants' perceptions regarding the usage of public spaces, some privacy and ethical issues arise in the process. Although the learning materials provided recommendations on how privacy and ethical issues can be addressed while taking pictures (e.g. avoiding taking pictures with people or asking for consent beforehand), we realized that this strategy might harness what Hannes and Parylo (2014) call coping strategies as 'avoidance behaviour'. Instead of going on lengthy processes of seeking consent from all who appear in the photographs, most participants opted for a safer choice, i.e. taking photos without people or pictures with people displayed generally small and distant (e.g. Germany, Switzerland), discarding recognizable images even though they have interesting insights (e.g. Nepal). However, some participants opted to mask the recognizability of people, thereby demonstrating 'approach behaviour' as a coping strategy (e.g. China). Assessment of whether these behaviours are motivated by participants' character traits and cultural aspects, as pointed out by Hannes and Parylo (2014), is beyond the scope of this paper.

Nonetheless, the authors agreed that obtaining informed consent from children who may not fully understand the privacy of data in research or from their parents (for example, in the case of countries within the European Union) is even more challenging. Further challenges in photovoice might also arise concerning many societies' cultural values and norms. Additionally, informed consent was discussed to be of different relevance in the countries included as some countries treat it as a legal requirement (such as in Europe and Hongkong/China). In the case of Switzerland, the photos were taken in such a manner that no person was recognizable.

Online approach

The KoboToolbox used in the collaborative learning experience required the participants to use their smartphone to take pictures, capture the location of the images and describe them in a short structured questionnaire. The geo-tagging possibilities with structured descriptions provided objective information on the site of the photos but also assisted in creating a geo-narrative while discussing those pictures via SHOWED approach in a group meeting. Overall, the proposed KoboToolbox supported place-based analysis in understanding opportunities and concerns related to physical activity in various contexts by combining the participants' objective spatial information and subjective personal emotion. Furthermore, in general, the researchers across all the case studies could employ the KoboToolbox in their specific context, which indicates that the proposed toolbox is simple, easy to use, and less burdensome in part for both researchers and participants. However, it is to be noted that this may be due to the selection of participants, as these were mostly students or young people from the community. This fact suggests that young people are good candidates with whom the proposed KoboToolbox-based photovoice approach can be applied as these groups are already familiar and competent with smartphones and digital maps.

Regardless, in a few cases, for example, in Nepal and Brazil, participants reported facing technical challenges using the KoboToolbox, especially for capturing location. KoboToolbox was found to be difficult to use in cases where there was a limited internet connection and not all participants could access the toolbox. Although KoboToolbox has been designed to capture location offline, the absence of full internet coverage, especially in less technologically advanced countries, created difficulty in collecting GPS location accurately. Moreover,

participants in Brazil perceived that the toolbox took a long time to enter all the information (which was perceived as a problem in areas where it did not feel safe to use the phone in the street – e.g. peripheral areas of Sao Paulo). These situations were mitigated in the case of Nepal by allowing participants to collect the photos with their smartphones and upload them with geo-tagging retrospectively. In the case of Brazil, the participants preferred to send those collected photos to the researcher once they could connect to WiFi after the activity, which were then entered manually by the researcher using the toolbox. It is to be mentioned that some geo-locations may not be accurate for different, mainly technical reasons. So, while discussing the photo, the geo-location could be adjusted and improved in the database afterwards, if needed.

Conclusion and outlook

A joined learning activity of a global community of practice conducted photovoice sessions with local groups in cities of eight different countries around the globe, bringing a comparative perspective on physical activity in open space. Results show that participants in different countries have different points of focus on which part of public open space design can foster or discourage physical activities. While safe walking infrastructure is relevant in all countries it differs between safety to other modes of transport (esp. cars) in European countries, competion over space with street vendors (Nepal, Hong Kong), crime aspects (Brazil) or lack of accessibility for disabled people (India).

The whole activity took place during the COVID-19 pandemic. The online approach to collecting photos using the KoboToolbox and the availability of online meeting tools offered most groups the option to run the activity entirely online. In general, collecting photos, discussing photos with the SHOWED approach and discussing different local experiences could be carried out online. For the group of youth in Brazil, due to a lack of access to online tools, this opportunity did not exist. Remodelling the entire process of photovoice application to an online approach needs a precise analysis of the people addressed and the resources accessible to them. In further applications, the diversity of participants could be increased, including different ages, technical competencies, and knowledge in urban design and health. The international learning experience was run in an explorative group discussions by researchers. Learning from this, —according to our knowledge first international group learning process on applying photovoice in public open space – we suggest the following for future approaches:

- Concentration on a type of space with a more specific/concise land use (university campus, inner city area, adopt similar study design (time-period, participants) for increased comparability.
- Use photovoice as a method of participatory action research by including local decision makers that have the power to redesign spaces.
- Geo-location of the photo is of great relevance to understanding the context of the photo and to discussing 'What can we do about these issues'.
- SHOWED method questions one and two could be clubbed together. Some adjectives could be provided for people wanting words to describe what they see.
- A pilot testing of the digital application across various settings and local coordinator training should be carried out to mitigate technical difficulties.
- Feedback on technical challenges should be provided to the KoboToolbox development community.
- As described in this study, a global learning platform could open discussions in decolonizing approaches as it enables integrating local tacit knowledge from different perspectives in a global community of learning.

Reflecting our results on physical activity in open space, we suggest further research going deeper in understanding conflicts over space. What role do property rights, gender roles, social norms, existing rules and their adherence, and consequences to long-term effects of disasters play? It might be of value to extend the 5-D-concept, which is being widely used in active mobility concepts, by another D. In addition to Diversity, Density, Design, Destination, and Distance to travel (Ewing and Cervero 2010) it could be worth to consider De-escalation; De-escalation as a positive contrary to the identified conflicts and safety concerns. This could include safe side walks and bike lanes which are not just well designed, but also respected by other users of roads and looked after e.g. by police or school pilots. Therefore, further research, including photovoice asking about conflict over space at different places, could bring deeper insights.

Acknowledgements

The participants were:

Country	Name of participants
China	Students from University of HongKong
Germany	Students from the programme Place and Health as well as two citizens and one scientists took place. Names are not provided as anonymity was guaranteed to the participants.
India	Ms. Aena Saman, Ms. Alankreeta Bharali, Ms. Anjana Anna Poulose, Ms. Anwesha Saha, Ms. Arpitha N R, Ms. Aswathy M B, Mr. Bharath R, Mr. C S Manikrishna, Mr. Hisham Hussain, Ms. Kaddapagunta Sandhya, Mr. Kartik Angadi, Ms. Likhitha D, Ms. Namrata Dewanjee, Mr. Tejaswi Sajjan C R B

(*Continued*)

Country	Name of participants
Pakistan	Muhammad Usama Mushtaq, Muhammad Zeeshan Shafique, Muhammad Usman, Muhammad Azhar, Altaf Hussain
Switzerland	Divna Mata Pavia, Noemi Balsiger, Sabina Ruff, Carlo Fabian
Brazil	Young people from the community of Lago Azul, Franco da Rocha, as well as social assistants of the Social Assistance Reference Centres Lago Azul (Camila de Oliveira Souza) e Vila Bazu, Franco a Rocha, Brazil. Names of the young people are not provided as anonymity was guaranteed to the participants.
Austria	Christina Ipser, Gregor Radinger, Andrea Höltl, Sonja Brachtl, Christine Rottenbacher
Nepal	Sabin Nepal, Pragya Pant, Manisha KC, Rabi Shrestha

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Dr Susanne Börner's research was funded by the project "Building resilience in the face of nexus threats: local knowledge and social practices of Brazilian youth" [NEXUS-DRR]" [08/2019-02/2023] under the European Union's Horizon 2020 Research and Innovation Programme, Marie Sklodowska-Curie Grant Agreement No. 833401, NEXUS-DRR. Dr Rehana Shrestha was funded through the Leibniz Science Campus Digital Public Health Bremen [lsc-diph.de], which is jointly funded by the Leibniz Association [W4/2018], the Federal State of Bremen, and the Leibniz Institute for Prevention Research and Epidemiology-BIPS. The urban health digiSpace was funded by the North-Westphalian Ministry of research and the Department of Community Health, Hochschule für Gesundheit, Bochum, Germany.

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responsible citizen, she identifies the endless gamut of urban issues, the panacea for which requires efficient, effective, and people-centric initiatives to create conducive environments. Her research publications include topics such as urban informality, community resilience and citizen centric planning.

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Daniel Simon holds a master's degree in spatial planning. He has been a research assistant at the HS-Gesundheit University of Applied Sciences in Bochum since 2016. His research focuses on digital participation methods for healthy urban planning. Having supported the build-up and development of the DiPS_Lab, he was involved in developing and applying digital geospatial participation methods in several urban-health-related planning contexts. As a Member of the DiKomAll research project, he currently works on barriers to digital participation for people with cognitive impairments.

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