



Promoting Physical Activity Among Older Adults Using Community-Based Participatory Research With an Adapted PRECEDE-PROCEED Model Approach: The AEQUIPA/OUTDOOR ACTIVE Project

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Abstract

Purpose: The PRECEDE-PROCEED model (PPM) is a community-based participatory research (CBPR) framework for health promotion, yet the direct application of the PPM into practice is unclear. This paper describes how the PPM was adapted for the development and application of a pilot intervention study to promote outdoor physical activity (PA) in older adults (OUTDOOR ACTIVE). We illustrate the steps and adaptations we applied to put the PPM into practice and present the developed interventions.

Design: The PPM was adapted by incorporating a socio-ecological model. This ensured the design of any resultant intervention would explicitly address multi-level determinants of physical activity. The list of possible program components to select from for the design of an intervention was also extended.

Setting: Bremen, Germany.

Participants: Participants in the intervention development were 924 noninstitutionalized older adults, aged 65-75 years (response: 25.2%), living in Bremen-Hemelingen, Germany. For implementation of the intervention and to ensure sustainability, several groups of stakeholders were involved throughout the process.

Methods: A mixed method design was employed (e.g., focus groups, quantitative survey) to identify determinants. A round table and participatory workshops were held to involve the target group and community stakeholders in the design of an intervention using the adapted PPM model.

Results: A conceptual model was developed illustrating the integration of a socio-ecological model into the PPM. The model received ecological validity, as it was affirmed by community stakeholders as an appropriate method for designing a community-level PA intervention. Target goals to address PA determinants were selected by target group members. An intervention to meet the goals was developed and implemented with target group input.

Conclusion: The adapted PPM is a promising starting point for developing multi-level interventions. Steps should be taken to ensure all social groups are participating in the process and all levels of determinants are addressed.

Keywords

built environment, health in all policies, implementation science, public health

Purpose

The proportion of older adults in Europe is increasing, raising the need for strategies to promote healthy ageing.¹ Meta-analytic evidence from longitudinal studies suggests that physical activity (PA) is an important contributor to healthy ageing²; yet PA declines with age.³ For example, more than 80% of older adults in Germany aged 60 to 79 do not meet World Health Organization (WHO) recommendations of at least 150 minutes moderate PA per week.⁴

Increasing levels of PA through PA promotion programs, however, remains challenging which is reflected by highly

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heterogeneous effect sizes.^{5,6} One promising approach for PA intervention development is community-based participatory research (CBPR), as it actively involves the community as well as communal stakeholders,⁷ and therefore has the potential to reduce health inequalities.⁸ This approach is considered to be particularly effective, if a socio-ecological model (SEM) is applied that takes into account the interplay of individual and environmental determinants of PA.⁷

The PRECEDE-PROCEED model (PPM)⁹ is a framework that helps identifying specific intervention targets, allows the integration of individual and environmental factors into one concise program, and includes consideration of organizational, administrative and policy aspects that might hinder or support the practical implementation of a program. Research using the PPM approach for development of PA interventions¹⁰⁻¹² shows promising preliminary first results regarding outcome, as well as reach of the implemented programs.^{13,14} However, the precise steps on how to apply the PPM are not outlined in detail: For instance, the PPM lacks a framework for the concrete development of the intervention.^{12,15} Moreover, transfer of the PPM phases into action has been realized in different ways across studies since a comprehensive guide is missing,¹⁶ underlining the need for methodological work in this field.

The present paper aims to describe how the PPM was adapted for the development and application of a pilot intervention study to promote outdoor PA in older adults (OUTDOOR ACTIVE). Specifically, we illustrate the steps and adaptations we applied to put the PPM into practice and present the developed interventions and their outcomes. The research project OUTDOOR ACTIVE is 1 of 5 subprojects forming the AEQUIPA (physical activity and health equity: primary prevention for healthy ageing; <http://www.aequipa.de/>) health promotion network.¹⁷ The central aim of OUTDOOR ACTIVE is to promote outdoor PA in older adults, aged 65-75 years, applying a CBPR approach based on an adapted PPM.⁹ In the first part of OUTDOOR ACTIVE (OUTDOOR ACTIVE pilot study, 2015-2018) this approach was further developed, made explicit, and applied in one community.

Approach

In the following, we describe the adapted PPM that we developed in the preparatory phase and that guided the OUTDOOR ACTIVE project. These adaptations were done such that the adapted PPM allows incorporating recent literature on determinants for physical activity.

In general, the PPM is carried out in 2 distinct steps: Firstly, the 4 PRECEDE phases serve as a thorough needs assessment and the development of an intervention program customized to the needs and situation of the community. Secondly, the 4 PROCEED phases comprise the implementation and evaluation of the developed intervention program.^{9,16} In OUTDOOR ACTIVE, we extended the PRECEDE phases of the classical PPM regarding its underlying theoretical models. Consequently, we re-named some of the phases of the PPM to reflect these changes (see Table 1).

In the classical PPM approach, the intervention outcome is identified as part of the research process in phase 1. However, often the outcome has to be fixed in the research proposal and in this case the authors of the PPM suggest “to start in the middle of PRECEDE and work in both directions (p.86),”⁹ which seems a somewhat unclear instruction. To improve clarity, we decided to keep the process of identifying the outcome completely in phase 1. This explicitly includes the classical approach of identifying the most dominant health problem that impacts the quality of life of the target population, but it also allows to choose the outcome solely based on own research findings or the literature. In OUTDOOR ACTIVE, the intervention outcome outdoor PA was fixed beforehand in the research proposal.

In phase 2 of the PPM approach, the main determinants of the selected health problem are identified. The most current version of the PPM distinguishes between behavior, environment, and genetics, a categorization that stems from the classical risk factor definition in epidemiology.⁹ However, the PPM does not include all socio-ecological determinants, suggested by contemporary theory and research.^{18,19,20} For example, interpersonal factors are missing in the list of determinants provided by the PPM. Taking into account more recent theoretical and empirical contributions with regard to determinants of health, we re-wrote the set of categories according to an integrated behavioral model.²¹

- Societal / structural factors, comprising organizational, institutional, or cultural factors
- Community factors, comprising the physical and social environment
- Interpersonal / household factors, comprising interactions between individuals
- All individual factors, except habitual factors
- Habitual factors, referring to all factors related to habit formation of an individual

All 5 categories presented in the previous list comprise elements that are fixed (e.g. age), coined “contextual factors” by Dreibelbis and colleagues,²¹ and potentially modifiable factors. The extension of categories in phase 2 required re-writing of phases 3 and 4 because these could no longer be based on health behavior models alone. Moreover, we wanted to allow integration of modern health behavior models.²² Models for phase 3 derive from a broader range of models as for instance health behavior models, policy models, or generic change models.²³⁻²⁶ Key is that the selected model is suitable for changing the selected determinant. Lastly, we extended the categories for phase 4 where the measures for the health program are developed and put into practice. Our approach relies on the Ottawa Charter of the World Health Organization²⁷ and the work of Whitelaw²⁸ to ensure that all elements of a health program are covered. The new categories are:

- Development of personal competencies and skills
- Building and implementing healthy public policy

Table 1. Adaptations and Application of the PRECEDE-PROCEED Model in OUTDOOR ACTIVE.

Classical PPM	Adapted PPM	Changes	Practical approach in OUTDOOR ACTIVE pilot study
PRECEDE			
Phase 1: Social assessment	Phase 1: Outcome definition	More flexibility regarding the choice of an intervention outcome	Outcome (outdoor physical activity) was fixed in research proposal
Phase 2: Epidemiological assessment	Phase 2: Determinants research	Change of underlying model to a socio-ecological model	<ul style="list-style-type: none"> • Literature research and empirical studies • Scientific literature • Community-specific documents (as e.g. land use plans, meeting protocols, city traffic concept) • Small area statistics from the regional statistical office • Walkabouts and documentation of all streets in the district (walkability, bikeability, infrastructure) • Postal survey of all 110 registered clubs of the pilot district to collect already available offers and member statistics • Informal talks with key informants, including district parliament • Population-based cross-sectional survey: physical activity (accelerometer), physical fitness (Senior Fitness test), blood pressure, basic anthropometry, self-administered questionnaire • Walking interviews and focus groups • Kick-off event: presentation of phase 2 results to the community • Initial participatory workshop: Choice of 3 broader determinants to be targeted and discussion on how to bring change to each of these determinants • Participatory workshops for actions development • Participatory walkabouts to re-assess situation and generate ideas for action (e.g. to a badly designed park)
Phase 3: Educational and ecological assessment	Phase 3: Model selection	Adaptation necessary due to change of underlying models in phases 2 and 4	<ul style="list-style-type: none"> • Participatory workshops to generate ideas and gather information for implementation ideas • Community round tables for networking and to generate and discuss implementation opportunities • Personal contacts to discuss implementation with actors (e.g. sports club to initiate a specific offer for older adults) • Documentation of all contacts with actors in the community (actor, initiator of contact, type of contact) • Evaluation of participatory actions (baseline statistics, short evaluation questionnaire) • Qualitative interviews with key informants • Follow-up survey[§]
Phase 4: Administrative and policy assessment and intervention alignment	Phase 4: Actions development	Change of underlying model	<ul style="list-style-type: none"> • Participatory workshops to generate ideas and gather information for implementation ideas • Community round tables for networking and to generate and discuss implementation opportunities • Personal contacts to discuss implementation with actors (e.g. sports club to initiate a specific offer for older adults) • Documentation of all contacts with actors in the community (actor, initiator of contact, type of contact) • Evaluation of participatory actions (baseline statistics, short evaluation questionnaire) • Qualitative interviews with key informants • Follow-up survey[§]
PROCEED			
Phase 5: Implementation	Phase 5: Implementation	see phase 4	<ul style="list-style-type: none"> • Participatory workshops to generate ideas and gather information for implementation ideas • Community round tables for networking and to generate and discuss implementation opportunities • Personal contacts to discuss implementation with actors (e.g. sports club to initiate a specific offer for older adults) • Documentation of all contacts with actors in the community (actor, initiator of contact, type of contact) • Evaluation of participatory actions (baseline statistics, short evaluation questionnaire) • Qualitative interviews with key informants • Follow-up survey[§]
Phase 6: Process evaluation	Phase 6: Process evaluation	see phase 3	<ul style="list-style-type: none"> • Documentation of all contacts with actors in the community (actor, initiator of contact, type of contact) • Evaluation of participatory actions (baseline statistics, short evaluation questionnaire) • Qualitative interviews with key informants • Follow-up survey[§]
Phase 7: Impact evaluation	Phase 7: Impact evaluation	see phase 2	<ul style="list-style-type: none"> • Follow-up survey[§]
Phase 8: Outcome evaluation	Phase 8: Outcome evaluation	see phase 1	<ul style="list-style-type: none"> • Follow-up survey[§]

During phases 3 to 5 regular printed newsletters were sent to the target group to raise awareness and to invite joining the process at any time point.

[§] The OUTDOOR ACTIVE pilot did not have a regular trial design with control community as this was beyond the focus of the research project; we only did pre-post assessments.

- Re-orienting health services
- Re-shaping environments to become supportive
- Building partnerships for sustainable change
- Strengthening community action and facilitating ownership of change

Each selected determinant of phase 2 can now be translated into actions covering one or more of the generic categories of phase 4 by employing the model selected at phase 3. The adapted PPM, and its interrelation to SEM, is depicted in Figure 1.

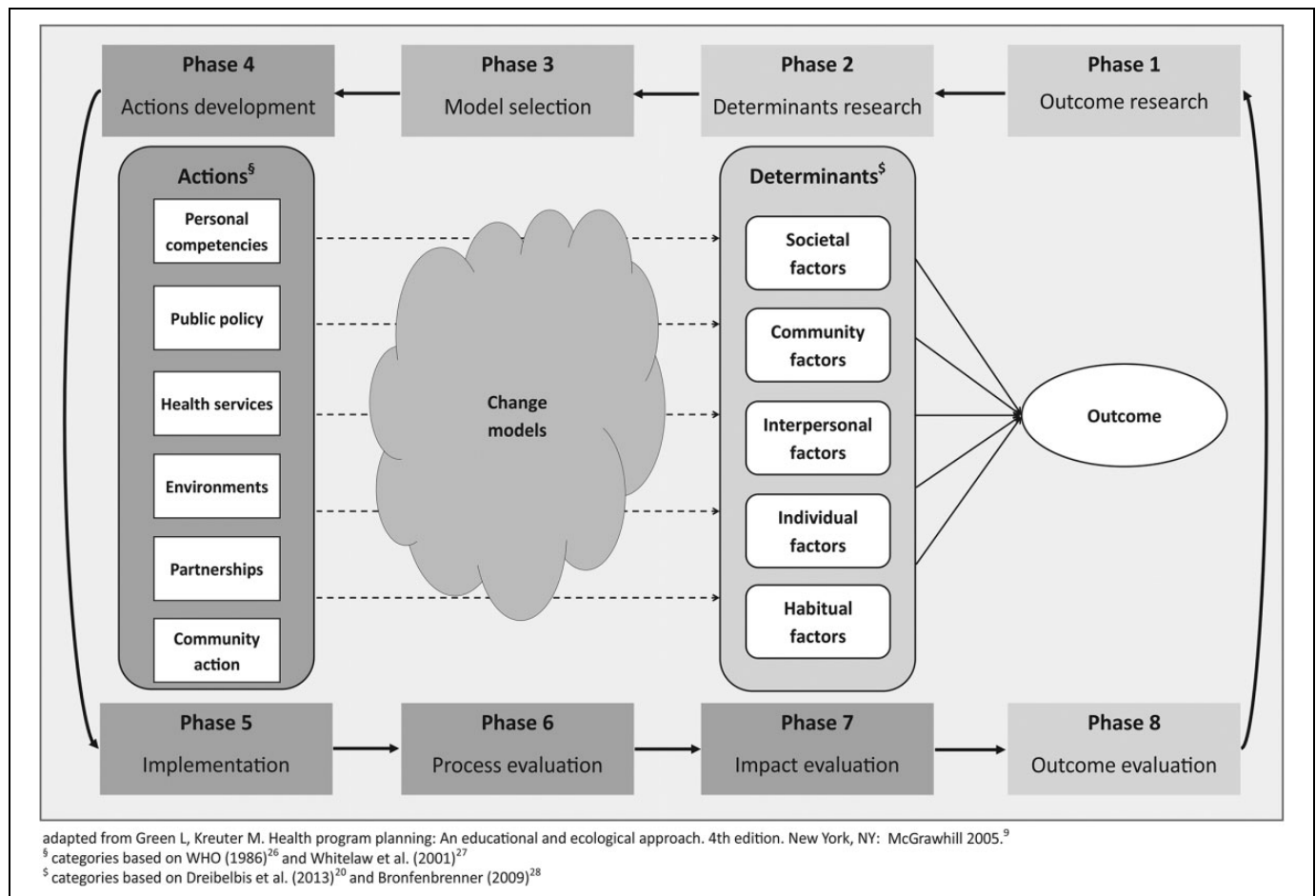


Figure 1. Adapted PRECEDE-PROCEED Model Used in OUTDOOR ACTIVE. The process starts with identification of the outcome (phase 1) and its main determinants (phase 2). One or more change model(s) are selected (phase 3) and actions for changing the determinants are chosen (phase 4). After implementation (phase 5), evaluation of the process (phase 6), impact (phase 7) and outcome (phase 8) take place. The cycle can be started again with the same or a different outcome.

Setting

Bremen is a commercial and industrial city of around 550,000 inhabitants located in the north-western part of Germany (former Federal Republic). The OUTDOOR ACTIVE pilot study was conducted in 1 of the 19 districts of Bremen, called Hemelingen, from 02/2015 to 01/2018. The pilot district Hemelingen currently has 42,415 registered inhabitants, 4,332 of these in the target age group of OUTDOOR ACTIVE, 65 to 75 years. Hemelingen consists of 5 sub-districts: Hastedt, Sebaldsbrück, Hemelingen (sub-district), Arbergen, and Mahndorf. Albeit directly bordering to each other, the 5 sub-districts are highly heterogeneous with regard to their history, socio-economic situation of their inhabitants, and their land use mix. Some key characteristics of the 5 sub-districts can be found in the supporting material (see S1 Table).

Participants and Method

A mixed methods approach was used in OUTDOOR ACTIVE (see Table 1).

We initially gathered district-specific relevant information from any existing available data (e.g. land use plans, meeting protocols, and traffic concepts). We obtained small area statistics from the regional statistical office to get **basic information about the district**. All relevant actors in the district, including the elected district parliament, the head of administration, sports clubs, and churches, were visited and informed about the project, and a **community round table** was established to discuss the research approach and results.

For phase 2, empirical data was collected using several approaches: To gather information on barriers and motivations for PA, 3 semi-structured **focus groups** were conducted, audio-taped, transcribed, paraphrased, and coded using the method of Mayring.²⁹ The 3 groups comprised members of the target group, including 1 active women's walking group ($n = 4$), 1 active men's shooting club ($n = 7$), and 1 group of inactive Turkish women ($n = 4$) that were chosen and contacted by community stakeholders. The findings were used as a basis for developing the subsequent assessments and participatory activities.

Additionally, 7 individual narrative **participatory walking interviews** were conducted with a convenience sample from residents of the pilot district, aged 65 to 75 years. The purpose was twofold, firstly to gain more insight into context-specific motivations and barriers of PA, and secondly to add a more intimate perspective that might be easily missed in focus groups. Interviewer and interviewee met at the house of the interviewed person. From there the walking interview started. The route and length of interview was chosen by the participants resulting in interview durations ranging from 29 to 76 minutes. The interviews were audio-taped, transcribed, paraphrased, and coded using qualitative content analysis by Mayring.²⁹

To document the built environment with regard to walkability, bikeability, presence of basic businesses (as e.g. shops), and infrastructure (as e.g. benches), the 383 streets in the pilot district were assessed on foot by observers using a **documentation sheet**. The documentation sheet was developed from scratch and pilot tested in another district of Bremen. All observers were given written notes with pictured examples on completing the documentation sheet, and new observers were accompanied by experienced ones for their initial trips.

To explore sports opportunities and level of participation in the target group, a short questionnaire was mailed to all 110 registered clubs in the district to assess available offers with regard to physical activity and participation of the target age group. 36 of the registered clubs were not considered eligible (18 associations with corporate members, 14 regional clubs not operating in the district, 4 youth clubs), 38 of the remaining 74 clubs did respond (response proportion: 53%), of these 17 sports clubs. All eligible larger clubs (>99 members) responded to the survey.

To investigate associations with level of physical activity, behavior and attitudes we invited the full sample of 4,332 residents of the pilot district, aged 65 to 75 years to participate in a **cross-sectional population-based survey** (10/2015-07/2016). The survey consisted of a self-administered questionnaire, anthropometry, blood pressure, fitness test, and a 7-day accelerometer measurement. The questionnaire was available in German as well as Turkish (note 1) and help was offered for filling in the questionnaire. To ensure reliability and validity of the survey measures and data, the observers were trained and handed an operational manual. Collected data were entered twice by different members of the project team. 666 participants were excluded (51 were institutionalized, 56 deceased, 295 permanently moved, 22 did not speak basic German, 242 were ineligible for health reasons), leaving 3,666 participants eligible for the survey. The study invitation, an informed consent form, and the questionnaire was sent by mail, followed by telephone contacts or written reminders for unregistered phone numbers. 908 participants took part in the study (24.8% response; 51.0% women).

Moreover, several **walkabouts** were undertaken by the research team, where photos were taken and informal talks with the population were held. These contacts helped promoting the project in the district.

The AEQUIPA / OUTDOOR ACTIVE study was approved by the Ethical Board of the University of Bremen.

Results

Application of the Adapted PPM

The determinants for outdoor PA identified in our formative work described above (e.g. quantitative survey, focus groups) are depicted in Table 2. The research team grouped them into targets and non-targets. All societal determinants and those community determinants related to industry (noise and smell) or to citywide factors (traffic regulations) were categorized as non-targets. On the interpersonal, individual, and behavioral/habit formation level, the following determinants were categorized as non-targets: a) determinants that were considered not changeable (age, sex, sports behavior in childhood), b) determinants that relate to a person's own health or that of others (prevalent diseases, caring for others), c) composition of household and household activities (walking the dog and gardening), d) personal values, and e) income (unsatisfied with financial situation). This left 31 out of 53 identified determinants as optional targets for intervention development. Using this approach, we identified potential targets from all but the societal level. For the community level, only barriers were identified. These encompassed a perceived neglected neighborhood, especially in the Hemelingen sub-district (54.7% in this district reported littering and 54.1% fear of crime), barriers to active travel (lack of crossings, poor state of bike lanes); lack of free and non-committal offers and offers for health-impaired persons. Lacking infrastructure in the environment as e.g. public toilets and benches for talking to other people or for resting opportunities were repeatedly pointed out as being barriers to active travel. In the baseline survey, 18.4% of women and 11.1% of men reported urinary incontinence and 34.1% of women and 24.0% of men were restricted in their mobility. Less than good subjective health was reported by 23.6% of women and 18.3% of men.

We identified several possible targets on the interpersonal level emphasizing the need for integrating this level into the PPM. An important driver is that sports activities and outdoor physical activities give opportunity for social contacts, which is especially important for those living alone (Women: 35.6%; Men: 12.8%). As one participant from a biking group puts it:

You want to socialize; everyone wants to be together, to exchange ideas. The physical activity on top is of course beneficial, that's clear.

Barriers can also be found on the interpersonal level. Apart from lack of a sports partner and lack of information, we found interpersonal conflicts as one important barrier to joining existing groups:

I didn't get warm there [the gymnastics club]. So I came in and hello, that's the new one, but that was it. And you wouldn't be talked to after that [...] I don't think they even noticed that I stopped going there.

Table 2. Determinants Identified in Phase 2 in OUTDOOR ACTIVE.

Level	Potential targets	Non targets
Societal/Structural Community	– Barriers: littering ¹ ; dog waste in streets ¹ ; state of present parks ² ; lack of public toilets ² ; lack of benches or opportunities for resting ² ; lack of outdoor meeting points ² ; lack of crossings ² ; lack of offers for health impaired persons ² ; lack of free offers ² ; lack of non-committal offers ² ; state of bike lanes ² ; fear of crime ²	Barriers: weather ¹ ; traffic concept of the city ² Barriers: amount of traffic ¹ ; ambient noise ² and smell ²
Interpersonal	Drivers: meeting other persons ¹ ; interacting with family ² ; Barriers: lacking sports partner ¹ ; lack of information on sports offers ¹ ; difficulty to join established groups due to hostility against new members ²	Barriers: single households ¹ ; caring for neighbours ¹ ; health status of relatives esp. spouses ²
Individual	Drivers: maintaining health ¹ , well-being ¹ , and fitness ¹ ; maintaining attractiveness ¹ ; having fun ¹ ; self efficacy ¹ ; source of energy ² ; losing weight ² Barriers: lack of energy ¹ ; lack of motivation ¹ ; shame ¹ ; fear of injuries ²	Barriers: health status ¹ ; unsatisfied with financial situation ¹ ; specific diseases: arthrosis ¹ , urinary incontinence ¹ , COPD ¹ , heart disease ¹ , rheumatism ¹ Other determinants: age ¹ ; sex ¹ ; personal values ¹
Behavioral/Habit formation	Drivers: transport mode for errands ¹ ; recreational activities ¹	Drivers: sports behavior in childhood ¹ ; walking the dog ¹ ; household activities ¹ and gardening ¹

¹ Quantitative data from OUTDOOR ACTIVE pilot study.

² Qualitative data from OUTDOOR ACTIVE pilot study.

Another participant observed:

[...] I know, also from the sports groups here in Hemelingen, because I also worked as a trainer that cliques like to form and that they're not always open to others.

As potential targets on the individual level, perceived positive benefits regarding health (89.6%), well-being (85.0%) and attractiveness (41.8%) were drivers for physical activity, whereas perceived lack of time (30.3%) and lack of motivation (13.2%) were among the barriers. Despite being in retirement, lack of time was not uncommon. A statement in one of the focus groups is typical for those participants that were more socially active:

That is just the pensioner's life. Pensioners, they say, pensioners never have time and I really do, that's really the case with me, so there's always a lot going on.

Another important level was habit formation. Using the bike for errands (50.9% men and 47.1% women reported that the bike is their usual mode of transport for at least one destination) and regularly going for walks in the neighborhood are among the habits that lead to higher physical activity levels. One participant explains that he still goes on the daily walks he used to go with his dog:

And I also love to go for a walk. Until 2 years ago I also had a dog. He is no longer with us, but I still go for a daily walk [...] I love to do it.

The process of agreeing on targets and developing intervention measures as well as the used methods are shown in Table 3. The results from phase 2 were presented to the community in an information event with 158 participants using a slideshow before conducting a world café³⁰ (see Figure 2). This method was used to narrow down the possible targeted determinants and to discuss ideas on how to address each PA determinant. It was then decided to conduct the participatory workshops of

phase 4 in the 5 sub-districts separately, because of the huge response. The meetings focused on actions development, where the results from the initial workshop were presented and discussed using mainly the Metaplan technique³¹ and group discussions. Moreover, knowledge and participants' connections within the community, that could be helpful for the implementation of the intervention measures, were gathered. Participatory walkabouts were carried out to re-assess the situation and generate further ideas for action. The results from the participatory workshops were regularly presented to the community stakeholders during round tables. To develop ideas and gather information for implementing the intervention measures in phase 5, the Metaplan technique and group discussions were used as well.

Eventually, 8 of the 31 generated targets for intervention development were chosen by the participants with no interference of the research team (see Table 4). Only barriers were chosen; 6 out of 12 on the community level (50%), 2 out of 3 on the interpersonal level (67%) and 0 out of 4 on the individual level (0%). Subsequently, intervention measures were developed with the participants, and ideas for their implementation discussed in the workshops as well as in the community round table. For ease of workflow, we decided to apply the same generic change model for all determinants, in our case the model by Kotter.³² For the implementation, a descending order of priorities was applied. The first priority was to utilize existing stakeholders and infrastructures, for example by integrating measures, such as starting a Nordic walking group in an existing sports club. Second priority was to establish new structures or groups within the district as for example the OUTDOOR ACTIVE scouts, a group that was founded to tackle the littering problem of the district. Last priority was to implement the measure ourselves. One example is the organization of district

Table 3. Methods Used in the Participatory Workshops for Agreeing on Targets and Developing Intervention Measures.

Phase	Meetings	Purpose	Methods
3 Model selection	Information event after completion of baseline survey	Presentation of phase 2 results to the community	PowerPoint presentation with plenary discussion
		Choice of broader determinants to be targeted and discussion on how to bring change to each determinant	World café
4 Actions development	Regular community round table	Presentation of results of phases 2 & 3 to the stakeholders	PowerPoint presentation with plenary discussion
	Participatory workshop	Presentation of results of phase 3 to the participants	PowerPoint presentation with plenary discussion
		Brainstorming on future visions for each of the selected determinants	Metaplan technique in smaller groups
		Discussion of results and first ideas for actions	Plenary discussion
	Series of participatory workshops	Update of current state of intervention development for the different actions	Plenary discussion
		Development of actions for each of the selected determinants	Metaplan technique in smaller groups
Series of participatory walkabouts	Re-assessment of situation and to generate ideas for action	Participatory walkabout	
5 Implementation	Series of participatory workshops	Presentation of results from participatory workshops	PowerPoint presentation with plenary discussion
		Update of current state of intervention implementation	Plenary discussion
	Regular community round tables	Exploring existing networks and ideas of participants for implementation	Plenary discussion
Series of participatory workshops	Update of current state of intervention implementation	Plenary discussion	
	Gathering knowledge about possibilities, offers and networks	Plenary discussion	

walks which none of the stakeholders was willing to organize. In total, 14 intervention measures were developed and implemented (see Table 4). Of these, the majority (11 of 14: 78.6%) was on the community level, 2 measures dealt with the interpersonal level, and one concerned habit formation.

Discussion

Mounting evidence suggests that the PPM is a well-suited framework for the development of health interventions.³³⁻³⁶ While the PPM is a generic framework that can be applied flexibly, it does not provide clear guidelines regarding its translation into practice.¹⁵ The aim of this paper was to illustrate how we adapted and applied the PPM to develop a physical activity intervention for older adults in a large pilot study and to present the results of this study. With regard to the PPM, we incorporated a socio-ecological model and adjusted the classical PPM accordingly. While the PROCEED step (phases 5 to 8) remained unchanged, we extended the set of categories for health determinants in phase 2 and made explicit that determinants have to be selected from the large range of possibilities for a specific program. Due to our extension of potential health determinants, we further generalized the model incorporated in phase 3 from a health behavior model to a broader range of models, so that, depending on the health determinant, a suitable change model can be chosen. If, for example, the aim is to

change the speed limit in a district, a policy model which involves agenda setting and coalition building is more appropriate than a human behavior model. Lastly, we updated the list of action categories in phase 4 according to current WHO practice and further work by Whitelaw^{27,28} (see Figure 1).

Applying the adapted PPM to develop a physical activity intervention targeted at 65-75 years-old residents of the OUTDOOR ACTIVE pilot community, a large heterogeneous district in Bremen, Germany, resulted in a set of 14 intervention measures from 3 of the 5 categories of determinants. Overall, our experiences with the adapted PPM have been very positive. The adapted PPM captured the wide range of determinants of outdoor PA in our sample and allowed for a nuanced categorization of potential intervention targets. We were successful in ensuring sustainability for most of the implemented intervention measures by utilizing existing clubs and infrastructures whenever possible. It worked in our favor that we were welcomed very generously in the community and that we had 3 years of time for the OUTDOOR ACTIVE pilot study, as our approach was time intensive. Especially establishing a good network within the community, which is a vital task for success, is time consuming and it also takes time to build trust. We visited all relevant local stakeholders to present and discuss the project, we presented several times to the district parliament, we engaged in existing local networks and activities, and we held contact to the local press. All empirical work, including the population-based



Figure 2. Information Event in Phase 3, 09/26/16. Photograph taken by the OUTDOOR ACTIVE team, all participants gave consent to publish.

surveys, and all participatory workshops were not done in the university but in the district (participatory workshops and focus groups) or even in each of the sub-districts (survey and walking interviews). Apart from lowering the barrier to participate the choice of locations also helped shifting power from researcher to participants. One participant stated during process evaluation:

That [participation in the survey] was a home game for me. It took place at our parish hall, where I totally feel at home.

Despite these positive experiences, we noticed a number of limitations when applying the adapted PPM. The selection of optional intervention targets from quantitative data was based on p-values. Thus, we might have missed determinants that are relevant for physical activity but that failed reaching statistically significance (false negatives). This might introduce bias,³⁷ however, since we also drew information from the qualitative studies, and included determinants that were mentioned in these studies, although they did not reach statistical significance in the quantitative study, the danger of omitting variables is reduced compared to purely quantitative studies.

Even though the sample of the survey was overall representative of the population of Hemelingen, and we thus got a clear and unbiased picture on the key determinants for physical activity in the age group 65 to 75 years, the participants of the intervention development and implementation in phase 3 to phase 5 were mainly outspoken and active members of the district (e.g. members of the church or politically active individuals). While these participants were very active and helpful during the workshops and beyond, helping us to get in contact to different stakeholders in Hemelingen, they only represented a small proportion of the population of Hemelingen. This is a common problem of participative research designs.³⁸

When selecting intervention targets, participants only chose targets on the community (e.g. littering, lack of free offers) and interpersonal level (e.g. lack of a sports partner). Determinants at the individual or behavioral/ habit formation level remained largely unaddressed. Considering that individual and behavioral/ habitual factors are important determinants of PA,¹⁸ interventions should ideally include these determinants as well. Participants' decision to focus on community-related and interpersonal determinants could have been affected by the design of the intervention. For instance, participants in the OUTDOOR ACTIVE pilot study decided upon intervention targets in a group setting. First of all, it might have been easier to find consensus on determinants at the community and interpersonal level. Second, it is possible that participants thought that they could work on individual and behavioral/ habitual factors themselves and perceived the group setting as a chance to tackle community-related and interpersonal determinants. As one participant put it:

OUTDOOR ACTIVE is not only about physical activity of older residents. It is about how we take care of our district and this is also a very important topic. (Workshop participant, OUTDOOR ACTIVE process evaluation).

Third, participants may felt hesitant to admit that individual and behavioral/ habitual factors had kept them from being physically active, as they might perceive these factors (e.g. lack of motivation) as a personal weakness they do not wish to deal with or share with others. Alternatively, they might have been worried that advocating for individual factors such as a lack of motivation as intervention target implies that others have the same issue.

Further research is necessary to gain insights into why participants focused on determinants at the community and

Table 4. Intervention Measures Developed and Implemented With Participants.

Level	Determinant	Measure and implementation	Sustainability
Community	Littering	New-founded citizen's group: OUTDOOR ACTIVE Scouts; Group is reporting littering to the city's waste management and regularly collects smaller amounts of waste; acquisition of initial funding by OUTDOOR ACTIVE	Ongoing (regular meetings)
		Participation in city program: flowers against littering; OUTDOOR ACTIVE and OUTDOOR ACTIVE Scouts successfully applied for 2 places of the district to be included in the program	Finalized
	Lack of benches or opportunities for resting	Acquisition of funding for 3 benches by OUTDOOR ACTIVE; placement by participants	Finalized
	Lack of public toilets	Policy brief written by OUTDOOR ACTIVE; printed and distributed among actors of the district; presented to district parliament	Single event
		German initiative "Nette Toilette": Participating caterers open their restrooms to the general public; the community is paying a flat fee to cover for added costs; OUTDOOR ACTIVE: Map listing all participating caterers; acquisition of an additional caterer in the district	Finalized
	Lack of offers for health impaired persons	Physical activity courses for arthrosis patients offered by community center	Ongoing
		Physical activity courses for health impaired and senior persons offered by private club	Ongoing
	Lack of free offers	District walks organized by OUTDOOR ACTIVE	No actor or participant was willing to carry on with organizing the walks
		Offers paid by statutory health insurance (prevention courses) were integrated into the compilation of offers (see below)	Ongoing
		Nordic walking offered by private club	Not enough participants
Interpersonal	Lack of a sports partner	Outdoor games offered by local sports club	Not enough participants
		Networking organized by community center: bulletin board and electronic file for matching persons with similar interests	Ongoing
	Lack of information on sports offers	Compilation of available offers; OUTDOOR ACTIVE: printed brochure (also online available); district marketing agency updates regularly and publishes the compilation online and in printed district calendar	Ongoing
Habit formation	-§	Feedback on fitness test and small leaflet with exercises to be integrated into daily routine	Single event

§ The determinant was not chosen by participants, implementation was decided by the OUTDOOR ACTIVE project team.

interpersonal level and on participants' decision process on intervention targets. Apart from investigating the underlying mechanisms, different practical approaches should be studied for this crucial point in the PPM process. One possibility is to bring the levels of determinants more actively into the discussion process, for example addressing them from community level to individual level.

Past research has highlighted a number of strategies that, while time intensive, may help to ensure that community members that belong to minorities or socially disadvantaged groups are better represented in CBPR projects. These include word-of-mouth recruitment and contacting potential participants from these groups multiple times through language-congruent members of the research team.³⁹⁻⁴¹ Future research should further experiment with these possibilities. A different route might be to explore methods that do not require such a high level of language skill

as e.g. the Metaplan technique is demanding. Possibilities comprise participatory walkabouts, community maps, community art or brick-building.⁴²⁻⁴⁵ These methods could also help give introvert characters a voice that would otherwise be silent at group meetings.

From our experiences, key to a successful CBPR approach are trust building and networking within the community.^{8,46} Especially, gathering basic information and current administrative and political plans and topics of the district at the start of the study; this was an important step for gaining credibility within the pilot district when talking to stakeholders or participants. Moreover, this knowledge was important for ensuring sustainability of the implemented intervention measures. Equally important, researchers and practitioners have to be open to the process and its outcomes, and commit to the general rules of participatory research. This includes that researchers

So What?

What is already known on this topic?

Developing effective PA promotion programs for older adults remains challenging. Health interventions employing community-based participatory research (CBPR) frameworks, such as the PRECEDE-PROCEED model (PPM) have provided some encouraging results. While the PPM is a widely used framework for health interventions, it lacks clarity regarding its translation into practice.

What does this article add?

This article illustrates how the classical PPM was adapted to incorporate modern theory on health determinants and health promotion practice. It showcases the practical application of the adapted PPM by presenting the OUTDOOR ACTIVE pilot study, a project that uses the adapted PPM to promote outdoor PA in older adults.

What are the implications for health promotion practice or research?

The adapted PPM is a promising starting point for developing multi-level interventions using a CBPR approach. In practice, steps should be taken to ensure all social groups are participating in the process and that all levels of determinants are addressed. Further research is needed on decision-making in such complex situations.

continuously critically reflect on their roles, which was a regular topic of discussion in our research team meetings.

Conclusion

In this pilot study, we adapted the PRECEDE-PROCEED model (PPM) to conform to modern theory. A socio-ecological model (SEM) was incorporated to ensure multi-level PA determinants were addressed, resulting in the list of possible program components to be extended to encompass components suitable for all levels of the SEM. The adapted PPM was applied to develop an outdoor physical activity intervention for older adults in an urban community in Germany, where interventions were developed on multiple levels. Future work should focus on involving all social groups in the process and addressing all SEM levels of PA determinants.

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Supplemental Material

Supplemental material for this article is available online.

Note

1. People of Turkish origin are the largest migrant group in Bremen-Hemelingen (9% of the population). We found for our sample that this age group the majority resides in Turkey the full year. The remainder usually share residency between Turkey (around April to November) and Germany (rest of the year).

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