Peer-reviewed | Manuscript received: April 09, 2015 | Revision accepted: September 06, 2015

Community-based health promotion for prevention of childhood obesity

Study design of a project in Leipzig-Grünau

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Summary

The project *Grünau Bewegt Sich* (Grünau Moves) aims to develop behavioral and environmental approaches to obesity prevention in a disadvantaged area of the city and to evaluate their effectiveness. The project is based on the planning models of PRECEDE-PROCEED and intervention mapping. The project centers on a comprehensive analysis of the starting situation in the area of intervention, and continued involvement by relevant stakeholders from local institutions, government, and families, whom the development of appropriate, effective and sustainable prevention strategies aims to support. The study design presented in this article uses different methodological approaches which aim to illustrate changes on individual, institutional and environmental levels. One of the project's key strengths is the combination of various scientific, professional and real-world perspectives, which enable the capture and interpretation of processes and effects in the area of intervention.

Keywords: health promotion, community-based participatory research, behavioral prevention, environmental prevention, childhood obesity, community project, intervention mapping, PRECEDE-PROCEED

Citation:
Igel U, Gausche R, Lück M, Molis D, Lipek T, Schubert K, Kiess W, Grande G (2016) Community-based health promotion for prevention of childhood obesity. Study design of a project in Leipzig-Grünau. Ernahrungs Umschau 63(01): 8–15

This article is available online:
DOI: 10.4455/eu.2016.003

Introduction

In spite of stagnating rates of prevalence [1], the proportion of overweight and obese children and adolescents in Germany is still significant (currently 15 %) [2]. The latest publications report 5.1 % of overweight and 3.3 % of obese children starting school in Saxony [3]. At the same time, there has been only limited success in the treatment [4, 5] and prevention of overweight and obesity [6]. As described in a recent review, personalized intervention studies to treat overweight and obesity among children and adolescents have achieved only limited effects [5], although the "dose" of intervention is significantly higher than in setting-based preventive approaches. Socially-disadvantaged groups – usually those with the greatest obstacles and the greatest need for support – are particularly difficult to reach through "traditional" person-centered programs such as e.g. individual counselling services and courses [7], i.e. they rarely attend and are less likely to profit. Setting approaches to community-based health promotion, which focus particularly on lifestyle and political parameters, seem better suited to socially-disadvantaged people [8]. However, obtaining evidence of effectiveness is very difficult in these complex interventions, as various levels, such as individuals and institutions, are involved and the parameters can be difficult to control.

Grünau Bewegt Sich Project

The project *Grünau Bewegt Sich* was initiated jointly by the City of Leipzig (Health Department), Leipzig University (Pediatric Clinic), the *Hochschule für Technik, Wirtschaft und Kultur* (HTWK) in Leipzig and the statutory health insurance fund AOK PLUS. The project is aimed at children aged 4 to 12 in a socially-disadvantaged area of the city. All the inhabitants were reached through a connection to the city district. The aims of the project on an individual level are:

- behavioral changes (increase in movement and balanced diet),
- reduction in prevalence of overweight among children and adolescents in the area of intervention,
- improvement in quality of life in the area of intervention.

The aims on an environmental level are:

- better networking among local actors,

- creation of a coordinated structure for health promotion measures,
- capacity building in qualification and pooling of actors and development of a joint health promotion strategy on site,
- design of healthy living environments in schools and nurseries based on the modules, materials and experiences of the Leipzig project optiSTART [9],
- healthy design by industry and the public realm (for detailed project description see [10]).

The project observes the principles of action research [11] and community-based participatory research [12]. Different levels of stakeholders (local government, local institutions and associations, residents) are continuously involved [13]. They contribute knowledge of the district and the target group, decide jointly on required changes, implement these and evaluate effectiveness. This is all carried out in association with a scientific monitoring group which collects, classifies and evaluates objective data and subjective information on different levels, introduces and triggers discussions on evidence-based approaches to health promotion and obesity prevention, and reviews the implementation and effects of developed measures.

The project is expected to last five years. *Grünau Bewegt Sich* is sponsored by the City of Leipzig and implemented jointly by Leipzig University and HTWK Leipzig. In addition to project coordination, a social worker with a focus on community organizing and a research associate are employed on the project. The project is funded by AOK PLUS and supported by other health insurance funds (IKK classic, *Knappschaft*).

Scientific objectives and questions

In addition to evaluating the processes and effects of the project, the organizers also aim to pursue the following objectives:

1. **Understanding relations:** Which of the determinants already described in many studies (e.g. education, food quality, access to and quality of meals) have an effect on the development of overweight among children in the area of intervention, and how?
2. **Recognizing needs, exploiting potentials:** What problems and resources exist in the area of intervention? Which actors can be involved in the project, and how?
3. **Developing strategies:** Which strategies are able to trigger changes in support of obesity prevention and health promotion on a behavioral and environmental level?

a. Which strategies are able to reach target groups and achieve effects?
b. Is there a relation between the extent of participation and effectiveness?

4. **Measuring changes:** How can conditions and changes at different levels be recorded and illustrated?
5. **Reviewing effectiveness:** Does a change in factors (determinants) on an environmental level lead to behavioral changes and positive health development?

a. What effects does the project have at individual levels (micro-levels)? Are there changes in motor skills, physical activity, diet, and prevalence of overweight in the area of intervention?
b. What effects does the project have at organizational level (meso-level)? Are there changes in the interconnectedness between and measures employed by institutions and other actors in the area of intervention?
c. What changes does the project demonstrate at the environmental level (exo-level)? Are there changes in the design of public facilities and spaces (e.g. nurseries and school routes)?

6. **Identifying obstructive and supportive factors, evaluating transferability:** Which factors obstruct or support the implementation and effectiveness of individual interventions and the project as a whole?
7. **Ensuring sustainability:** What impact does the project have on local strategies and local political decisions?

Further questions and concrete hypotheses will be developed after the comprehensive analysis of the starting situations, which is planned for the first project year.

Methodology

Study design

The study design is based on two related models: PRECEDE-PROCEED [14] and intervention mapping [15]. These can be applied to action research and community-based participatory research [12] and are conducive to the systematic and theory-led development, implementation, and evaluation of complex intervention projects. The emphasis lies on a detailed and comprehensive description of the starting situation. To this end, determinants – in terms of risks and resources – at individual, institutional, and public levels are identified by means of different methodological approaches. Continued involvement by stakeholders (representatives from municipal government, local facilities, associations, and families) ensures that needs and potentials can be recorded, interventions suitable for the target group can be developed and implemented, and the sustainability of the project can be improved.

Phase 1: Analysis of the starting situation

The social and health problems and resources in the area of intervention were analyzed in the first project year. The most important influence factors on child overweight and its associated behaviors were identified and an understanding of the norms, values, limits etc. of the district was developed. Analysis of the starting situation

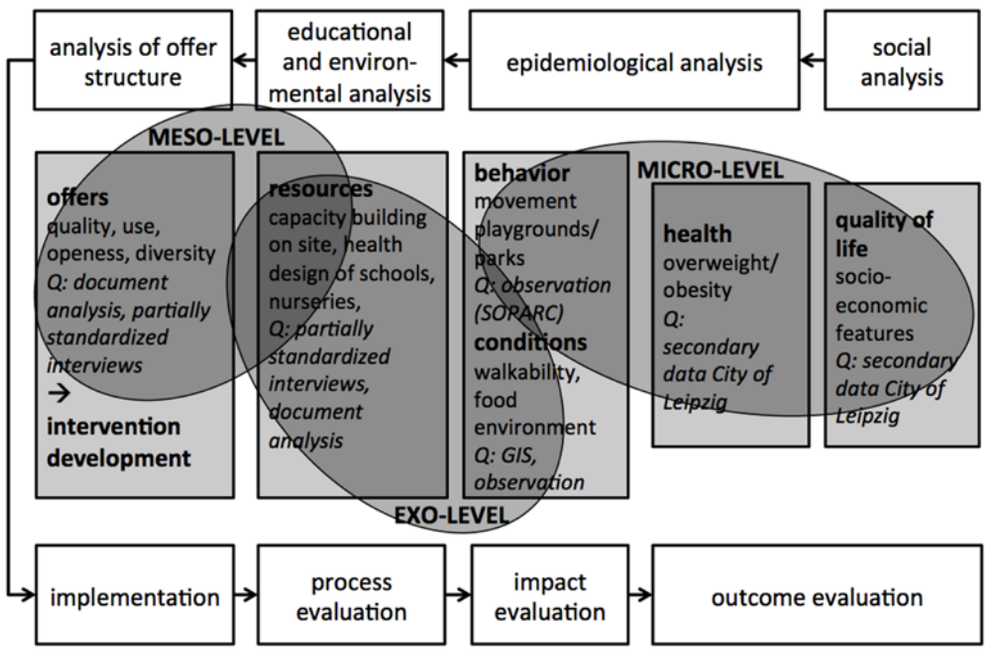

Fig. 1: ***PRECEDE-PROCEED* Planning Model** [own illustration]
GIS = geo-information systems; Q = data source; SOPARC = System for Observing Play and Recreation in Communities

was carried out in collaboration with local actors and also helped to build relationships, form networks and transfer knowledge between science and practice. The local community management (*Quartiersmanagement*) of one of the sites marked by municipal government for district development and citizen participation in Leipzig-Grünau was continuously involved in this process and helped to make contact with institutions and actors in the area of intervention. The establishment of a "health" network as the project planning group and as a representative of interests in the district council – an on-site communication tool which included representatives of different areas (e.g. industry, children, and youth work) as well as local citizens – was also planned as part of the first project phase.

Individual level – micro-level

Different data sources were used to describe individual health risks and resources:

- Prevalence of obesity and level of development: Quantitative secondary data on nursery and school entry screenings and mass screenings from the Leipzig Health Department provided information on the prevalence of overweight and obesity and motor and cognitive abilities and impairments in the area of intervention.
- Physical activity: The physical activity of children and adolescents in public playgrounds was recorded by means of standardized observations (SOPARC = System for Observing Play and Recreation in Communities) [16].
- Aggregated social data on education, unemployment and income in the individual districts of the area of intervention were also used to illustrate the social-structural framework conditions.

Organizational level – meso-level

Nurseries and schools were analyzed with regard to their healthy design. Standardized questionnaires were distributed to all managers in nurseries, schools, and afterschool centers. The main emphases were the promotion of movement and a balanced diet at nursery and school, staff and equipment, existing collaborations with health-promoting facilities within and outside of the area of intervention, communication with parents, and a subjective description of the most urgent needs for action from the viewpoint of the institution. The survey was based on practical tools which were developed and tested as part of the Active Living Research Program [17].

Existing offers and services provided by local associations, initiatives and facilities with a focus on nutrition and movement were recorded via document analysis, and information on use and capacity was gathered by means of written or verbal surveys.

Guided focus group discussions were carried out with actors from the area of intervention, discussing resources for and risks to the healthy development of children in the area of intervention. The aim was to determine the subjective perception of the situation in the area of intervention from the viewpoint of on-site actors and stakeholders. The group conversations also served to build relationships and transfer knowledge between practice and research. They were able to correct or support data and were important for the planning and implementation of effective intervention strategies in the district.

Environmental level – exo-level

In addition to individual, familial and institutional aspects, the wider environment also influences health and healthy behavior. Features of the built environment in the area of intervention were therefore also evaluated, with a focus on places relevant to movement and nutrition.

Playgrounds were recorded by means of a standardized observational tool (excerpt from EAPRS; Environmental Assessment of Public Recreation Spaces [18]) and assessed in terms of design and quality.

The food environment was analyzed based on official data from the City of Leipzig and additional data from online

databases such as e.g. Google Maps, OpenStreetMap and meinleipzig.eu. All the food providers in the area of intervention were therefore recorded and classified based on the schema by LAKE et al. [19].

Phase 2: Development and implementation of interventions

Analogous to the stages of intervention mapping [15], the previously-determined individual and situational objectives to prevent obesity were defined in greater detail in collaboration with the planning group *Netzwerk Gesundheit* (Health Network). Individual interventions were implemented according to a jointly-determined concept with support from the project employees and participating actors and institutions.

Phase 3: Evaluation

Evaluation is designed as a quasi-experimental control group study with a combined longitudinal and cohort design. Quasi-experiments are particularly suited to the evaluation of complex (multi-level) interventions in which randomized control group designs are not possible [20, 21]. The area of intervention (IG) is Grünau in the west of Leipzig (comprising five selected districts); the two control areas (KG1, KG2) are located in the east of the city and are comparable to Grünau in their socio-economic characteristics (◆ Table 1).

The **process evaluation** documents and controls the progress and implementation of the project, notes variations, makes the required changes and provides a basis for the interpretation of results. All the activities realized in the context of the project are recorded (content, time, target group, possible attendance figures, personnel and financial outlay). A Coordinated Action Checklist [22] also records information on cooperation and coordination in the context of project from the viewpoint of those involved. Two accompanying panels provide advisory support to the project in the area of practicability and scientific/ethical quality. An advisory board, comprising representatives from the municipal government, trade and commerce, the health insurance funds involved, the education agency (*Bildungsagentur*), and the city sport association (*Stadtsportbund*), helps to transfer knowledge and ensures critical evaluation and support for the implementation of project objectives. A scientific advisory board (scientists specializing in prevention, medicine, sociology, psychology, geography, architecture, and theology) advises on methodological and scientific/ethical questions. The project employees also produce research diaries [23], in which they document difficult and helpful experiences, and which reflect their own working methods. Information on the local situation and on the practicability and transferability of the project is thereby obtained.

Interventions developed and implemented as part of the project are then recorded in the **impact and outcome evaluation** according to the RE-AIM structure (RE-AIM = Reach, Effectiveness, Adoption, Implementation, Maintenance) [24] (◆ Table 2). The following aspects are thereby analyzed:

- Reach: Reaching the target group, i.e. how high is the proportion of participants compared to the entire target group?
- Effectiveness: i.e. to what extent are behavioral changes achieved?
- Adoption: i.e. how many of the addressed facilities are reached or excluded?
- Implementation: i.e. which components of the program are implemented, and how?
- Maintenance: i.e. are the interventions continued by institutions?

A series of sub-objectives are identified under the main objective of improving a balanced diet among children and young people in the intervention area. These include: higher consumption of fruit and vegetables, less high-calorie foods (sweets, chips, soft drinks), higher consumption of water at an individual level or improved availability and access to healthy foods, education of pedagogical personnel about a balanced diet (e.g. *aid-Ernährungsführerschein* [= a teaching module on food and cooking]) in schools, nurseries, and afterschool centers at an environmental level. The individual sub-objectives are in turn substantiated by performance targets, which describe in detail what is required for implementation. For the sub-objective of "higher fruit and vegetable consumption", it would be conceivable e.g. on a situational level to introduce shared fruit and vegetable mealtimes in schools and nurseries or to cultivate fruit and vegetables in nursery and school gardens and in public spaces. All the performance target determinants, which may support or hinder the realization of the respective performance, are identified in tabular form. So, for example, for shared fruit and vegetable mealtimes, you need personnel to prepare it, time for preparation and consumption, financial means to provide fruit, willingness of families to bring fruit and vegetables regularly, children willing to try fruits, etc. The determinants are identified by means of theoretical models, empirical findings, and prior analysis. The determinants are assessed in terms of relevance and changeability. This matrix of sub-objectives, performance targets and determinants forms the basis for the selection and development of concrete intervention strategies. Planning groups and other stakeholders, such as representatives of schools, nurseries, responsible offices, parents and children, are actively involved throughout the entire process.

Indicators	IG*[1]	KG1*[2]	KG2*[3]
	total or *mean value*		
socio-structural characteristics			
n (children aged between 0 and 15)	4 419	6 544	2 868
inhabitants with main residence	42 853	52 565	32 900
migrant proportion (%)	*7.0*	*17.3*	*5.9*
proportion of inhabitants with max. school leaving qualification (%)	*32.8*	*26.4*	*34*
proportion of benefit recipients under 15 years-of-age (%)	*48.9*	*50.8*	*42.4*
proportion of unemployed (%)	*13.4*	*13.4*	*11.7*
median personal net income (€)	*982*	*883*	*952*
structural characteristics			
surface area in hectares	1 007	794.5	1 163
proportion of settlement areas and traffic areas (%)	*82.3*	*96.2*	*87.9*
proportion of recreational areas (%)	*12.8*	*18.7*	*12.3*
proportion of buildings built 1949–1990 (prefabricated building) (%)	*78.3*	*14.8*	*47.7*
proportion of residences in buildings built 1949–1990 (%)	*96.3*	*17.2*	*76.3*
health-related characteristics			
	N = 339	N = 460	N = 218
overweight prevalence (%)*[4]	12.1	12.4	12.8
	N = 321	N = 447	N = 209
participation in all mandatory health examinations (%)*[5]	43	38.7	41.1
anomalies in fine motor ability (%)*[5]	39.3	35.6	31.6
anomalies in gross motor ability (%)*[5]	20.2	16.1	19.6
behavioral problems (%)*[5]	15.9	13.9	12.4

Tab. 1: **Overview of intervention area (IG) and control areas (KG) – selected indicators** (from *Ortsteilkatalog* 2012)
*[1] IG = intervention group (districts: Grünau-Schönau, Grünau-Ost, Grünau-Mitte, Grünau-Lausen, Grünau-Nord)
*[2] KG1 = control group 1 (districts: Neustadt-Neuschönefeld, Volkmarsdorf, Anger-Crottendorf, Sellerhausen-Stünz, Reudnitz-Thonberg)
*[3] KG2 = control group 2 (districts: Mockau-Nord, Schönefeld-Ost, Paunsdorf)
*[4] from *Schuleingangsuntersuchung* (School Entry Screening) 2010/11
*[5] from City of Leipzig [2013]

design	quantitative	quantitative
setting	intervention group (IG)	intervention group (IG)
sample size	associations, initiatives, etc. non-specified	cooperation partner n ≈ 20
dimensions	access (reach), adoption, implementation, sustainability (RE-AIM)	networking, working method etc.
data source	standardized survey	standardized survey (coordinated action checklist)
quantitative variables	number of participants, activities, personnel, qualification, resources, costs	task clarity, satisfaction with collaboration, communication, visibility, etc.
analysis	descriptive analysis	descriptive analysis

Tab. 2: **Process evaluation – program-level** (from *Ortsteilkatalog* 2012)
RE-AIM = Reach, Effectiveness, Adoption, Implementation, Maintenance

The aim of this structure is to describe the internal and external validity of interventions and thereby to enable statements on the generalization of results. The effects of the project are measured on all the addressed levels. Changes in environmental features, e.g. the design of playgrounds, and their effects on use behavior, are recorded before and after the intervention in parallel to phase 1 by means of standardized observations. Managers of schools and nurseries are repeatedly questioned on aspects of healthy design, and changes at institutional level are identified.
The effects of individual health-promoting parameters (outcome evaluation) on children are measured in the area of intervention and in both control areas based on research data (height, weight, BMI, gross and fine motor skills) from the Leipzig Health Department (◆ Table 3 and 4). Data on height, weight, BMI, and blood pressure is also continuously gathered by general medical practitioners and pediatricians in the respective areas via the *Cresc-Net-Datenbank*. Additional surveys of parents on the nutritional and physical behavior of children in the intervention and control areas are planned as part of the regular school entry screenings.

Analysis

Statistical analysis of quantitative data is predominantly descriptive. Differences in z-standardized BMI [25] between the intervention area and the control areas are analyzed by means of two-way t-Tests (cross section) and variance analyses with repeated measurements (longitudinal section). Categorical study variables such as e.g. impairments to fine and gross motor ability are only analyzed by cross section, as the tests used are difficult to compare. Prevalence in the intervention area and control areas is compared via Chi²-Tests. Power calculations

	individual (micro-level)			organization (meso-level)	environment (exo-level)	
design	quantitative pre-post	quantitative cross section	quantitative cross section longitudinal section	quantitative cross section longitudinal section	quantitative pre-post	quantitative
setting	IG	IG, KG	IG, KG	IG	IG, (KG)	IG, (KG)
sample size	park users N ≈ 300	parents n_{IG} ≈ 200 n_{KG1} ≈ 200 n_{KG2} ≈ 100	children (4–12) n_{IG} ≈ 300 n_{KG1} ≈ 400 n_{KG2} ≈ 200	schools, nurseries $N_{schools}$ = 12 $N_{nurseries}$ = 21	playgrounds, parks n_{IG} ≈ 39 n_{KG1} ≈ 40 n_{KG2} ≈ 11	
dimensions	physical activity	health behavior	weight height findings	design school/nursery	design	provider walkability
data source	standardized observation (SOPARC)	standardized survey	medical examination	partially-standardized survey	standardized observation (EAPRS)	GIS standardized observation
quantitative variables	gender activity level energy consumption	regular physical activity nutritional behavior SES (education, employment status)	gender age BMI-SDS overweight/ obesity findings fine and gross motor ability	minutes sport/movement per week facilities	rating of condition, facilities, etc.	number of different food providers length of streets number of crossings proportion of green spaces
analysis	descriptive analysis	descriptive analysis means comparisons	descriptive analysis multi-level regression analyses variance analyses	descriptive analysis qualitative content analyses (for open questions on needs, etc.)	descriptive analysis	descriptive analysis

Tab. 3: **Survey and evaluation plan (impact and outcome evaluation)**
BMI-SDS = Body Mass Index-Standard Deviation Scores; EAPRS = Environmental Assessment of Public Recreation Spaces; GIS = geo-information systems; IG = intervention group; KG = control group; SES = socio-economic status; SOPARC = System for Observing Play and Recreation in Communities

show that testing mean differences (adoption of two-way testing $\alpha = 5$ %, $1\text{-}\beta = 90$ %) is possible with the expected sample size of $N_{IG} = 300$, $N_{KG1} = 400$, $N_{KG2} = 200$.
Qualitative data material (open questions from interviews, focus groups, documents, research diaries) is analyzed according to content.

Results

The project officially began after a one-year preparation phase (2014) in January 2015. At present, data for T_0 is being gathered, the starting situation (phase 1) analyzed, needs from the viewpoint of on-site actors determined, and collaborations developed. The first results of the analysis of the starting situation and program development are expected in 2016.

Discussion

This project aims to develop and evaluate interventions suitable for the target group on a behavioral and environmental level through a comprehensive analysis of the starting situation in the area of intervention, continued involvement by stakeholders, and a systematic, theoretical, and empirical-based approach. This approach seems particularly promising for disadvantaged groups who are difficult to reach through educative personalized services [26].
The complexity of the envisaged interventions requires an evaluation concept which could adequately illustrate the changes and effects in the field. The quasi-experimental control group design, the use of process and effect evaluation, the mixture of methods, and the systematic and continuous capture and analysis of features at individual, institutional, and environmental levels provides a solid basis for the scientific evaluation of the project in terms of plausibility and suitability, and enables conclusions on its effectiveness [21].
Some difficulties are nevertheless still foreseeable: Can the effects on prevalence of overweight and obesity be clearly determined and anticipated? According to the Cochrane Analysis of 2011, only minimal changes in BMI emerge and there is a large heterogeneity between the individual studies [6]. In addition, it is difficult to make statements on "dose" and the corresponding effects in preventive measures [27]. This gives rise to uncertainty in relation to causality; i.e. if there are effects on an individual level, to what can these be ascribed? Synergy effects, i.e. effects which reinforce and interact between individual measures, are a key characteristic of complex interventions [28], and definitely desired from a theoretical perspective. Dealing with interaction effects and the "noise" of reality, i.e. the uncontrollable frame-

2013/14	2015	2016	2017	2018	2019	
	project duration					
				4-year		
			4-year		6-year	
		4-year		6-year		
	4-year	→	6-year	→	8-year	longitudinal section
4-year		6-year		8-year		
	6-year	→	8-year	→	12-year	longitudinal section
6-year		8-year		12-year		
	8-year		12-year			
8-year		12-year				
	12-year					
12-year						
cross section	cross section	cross section	cross section	cross section	cross section	
baseline					project end	

Tab. 4: **Combined longitudinal and cohort design**

work conditions, is however problematic from an empirical perspective [29].

It is therefore important that the context is adequately described and different perspectives included. This is taken into account through the interdisciplinary working method, the employment of a social worker with a focus on community organizing on site, the inclusion of various stakeholders, and continuous support from external advisory panels (advisory board and scientific advisory committee). Changes and adjustments to the evaluation design may nonetheless prove necessary.

Nevertheless, the greatest opportunities for the development of successful interventions suitable for the target group, and thus for sustainable healthy changes in the district, lie in the complexity and interdisciplinarity of the project.

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Conflict of Interest
The project was funded by AOK PLUS and supported by IKK classic and *Knappschaft*. The authors further declare no further conflict of interest.

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DOI: 10.4455/eu.2016.003