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SciELO

Health impact assessment in the process of implementation of hydroelectric plants: methodological contributions

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Abstract: Health Impact Assessment (HIA) is defined by the World Health Organization as a methodology that encompasses the identification, prediction and evaluation of expected changes in health risks. Objective: to analyze the contributions of experts on the stages of HIA. Research was carried out with Brazilian specialists on the stages of HIA with regard to the areas where hydroelectric plants are located using an electronic platform. Eighteen specialists from eight higher education institutions in five Brazilian states participated in the study. They indicate that the following aspects must be observed in the HIA: the need to create interdisciplinary and multiprofessional teams; participation of the affected population at all stages; special attention to mental health; and consider the scientific evidence. These aspects contribute to qualify the HIA stages in the implementation and monitoring of new hydroelectric projects.

Keywords: environmental health; health risk; affected population; socioenvironmental impacts

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Introduction

The Health Impact Assessment (HIA) is defined by the World Health Organization (WHO) as a methodology that encompasses the identification, prediction and evaluation of expected changes in health risks (which can be both negative and positive, individual or collective changes), caused by the implementation of a policy, a program, a plan or development projects. These changes can be direct and immediate, or indirect or delayed (WHO, 1999).

The HIA had its starting point in 1999, when the WHO published a document called the "Gothenburg Consensus". In this document, HIA is defined as the "a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects on the health of a population" (WHO, 1999, p. 4).

The Gothenburg Consensus made it possible to standardize techniques, stages and analyses of health effects that can be applied internationally and reinforced the centrality of the effects of social determinants on health, not always carried out systematically in the processes of environmental impact assessment (BALBY, 2012).

Since the formation of the world commission on dams in 1998, the assessment of social impacts has been required as part of the licensing of hydroelectric projects, as has the need to incorporate health impact analysis into all development policies.

According to Pan American Health Organization (PAHO, 2013), HIA is a systematic and flexible method that seeks information from the evidence available in a given region. In the document Conceptos y guía de análisis de impactos en salud para la Región de las Américas, PAHO brought together contributions from authors such as Bhatia (2010, 2011) and from international guides, such as the European Health Impact Policy report (EPHIA..., 2004), which deal with the step-by-step procedures and methods of HIA.

HIA is considered recent and some countries such as Canada, the United Kingdom, Spain, Sweden, Denmark, Australia, Italy, the United States and Thailand have guidelines for HIA, which deal with the implementation of large enterprises (BRASIL, 2014), however, they do not are specific to hydroelectric power plant.

In the field of hydroelectric plants, the implementation of the HIA in Slovakia, before the implementation of a small hydroelectric plant, stands out (ZELENAKOVÁ et al., 2018). Also, in Lesotho, South Africa, HIA was carried out prior to the implementation of hydroelectric projects, but the authors state that the lack of monitoring evidence may be limiting the overall effectiveness of HIA (GWIMBI; LEBESE; KANONO, 2020).

Although countries such as Italy (LINZALONE et al., 2017), the United States (SCHUCHTER et al., 2015) and Canada (ULMER et al., 2015) are protagonists in HIA, there is still a need for important advances in the use of this tool of research to understand the impacts of dams on human communities.

The HIA has been recommended as a tool to estimate socio-environmental impacts and health inequalities in the planning phase of projects. The principles of HIA are based on democracy, equity, sustainable development and the ethical use of evidence,

which describe the purpose of HIA, in response to the way in which the health outcomes resulting from the exploitation of resources and the modification of the territory can be treated (PEREIRA; HACON, 2017).

In Brazil, starting in the 1990s, some initiatives were developed, albeit incipient, from the perspective of HIA, such as actions to bring professionals from the health and environment areas together in the discussion and practice of prior assessment of impacts on health, arising from programs, projects and policies. An example of this was the creation of the Brazilian Environmental Justice Network to build processes and instruments for assessing environmental equity. Another example was the holding of the 1st National Conference on Environmental Health, in 2009 (BRASIL, 2010), but without continuity effects.

The first material produced in Brazil on this topic was the Ministry of Health's publication "Health Impact Assessment – HIA – Methodology adapted for application in Brazil" (BRASIL, 2014), an adaptation of the HIA methodology described by WHO and PAHO to the Brazilian territory. The document conceptualizes the HIA, describes the health impacts common to any type of large enterprise, addresses health in the environmental licensing process, and points out the stages for its application: "screening, scope/coverage, identification/data collection, situational analysis, decision making and recommendations and monitoring" (BRASIL, 2014, p. 27).

The choice of methods to carry out all stages of HIA, as recommended by the Gothenburg Consensus, PAHO and the Ministry of Health, is a challenge for the teams that propose to develop them. The guidelines are oriented towards the search for literature, scientific evidence, involvement of the affected population, researchers, entrepreneurs, health professionals and different other backgrounds to implement the interdisciplinary, holding forums, interviews, conferences, data from databases and the system (BRASIL, 2014; PAHO, 2013; WHO, 1999), among other methods that can guarantee the recovery of the perception and contribution of the universe of those directly and indirectly involved.

While acknowledging these initiatives by WHO, PAHO and the Ministry of Health, Abe and Miraglia (2018) report that there are few publications on the application of HIA in Latin America, contrary to what occurs in developed countries. This scenario indicates that there is a need to expand studies that can contribute to the organization, proposition of indicators and regulations for HIA.

Thus, this study analyses the contributions of specialists on the stages of assessment of health impacts in Brazil, described in the documents of the Ministry of Health, and aims to contribute to the improvement of HIA methods, especially for the areas of implementation of hydroelectric plants. The contributions of these specialists can complement the decision-making process by public and/or private managers, before, during and after the implementation of hydroelectric projects.

Methodological path

This is a qualitative, exploratory research carried out with Brazilian specialists who have produced researches related to the objective of this study and related topics. The search for specialists to participate in the study was based on authors of scientific productions available online in the SciELO databases, Portal of Periodicals of the Coordination for the Improvement of Higher Education Personnel (CAPES) and Virtual Health Library (VHL). The authors of articles were considered regardless of the year of publication, totaling 125 researchers. A presentation of the signatories and the project, containing the objectives of the study, and an invitation to participate in the research was sent to these researchers through electronic means.

The researchers were asked to contribute in the stages of the Health Impact Assessment, with regard to the areas of implementation of hydroelectric plants. The full description of the stages was sent to the researchers, which are contained in the document of the Ministry of Health (BRASIL, 2014). These stages are: 1) Screening; 2) Scope/Coverage; 3) Identification/Data collection; 4) Impact Assessment/Situation Analysis; 5) Decision making and Recommendations; 6) Follow-up/Monitoring (BRASIL, 2014). The systematization of the participants' contributions followed the guidelines of Bardin (2006), using the technique of content analysis.

The project that gave rise to this study was approved by the Ethics Committee in Research with Human Beings, under protocol number 3,430,172.

Results

Eighteen specialists from eight higher education institutions in five Brazilian states participated in the study. A specialist from a National Research Foundation and another from a publicly traded national research company also participated. The respondents contributed by describing their suggestions for each of the stages of the Health Impact Assessment, whose synthesis is presented in Table 1.

Table 1 – Contributions from experts regarding each of the stages of the Health Impact Assessment methodology.

Guidelines of the Ministry of Health		Contributions from study participants
Stage 1	Activities in the HIA	
Screening	To verify the need to carry out HIA based on potential impacts on the health of populations.	* To consider the expanded concept of health, its determinants and conditions. * To build indicators for diagnosis jointly, public power, private initiative and social representations. * To carry out an assessment before the project is approved. Health is a variable dependent on social factors. * To analyze studies and similar experiences in order to identify possible health problems. * To identify the disruption of biomes that allows "silent" dissemination of health risks. * To gather scientific evidence and survey with specialists. * To analyze the project of the enterprise of environmental studies. * To pay attention to the identification of issues related to mental health. * To consider potential positive impacts.
Stage 2	Activities in the HIA	
Scope/Coverage	To define the appropriate level of depth of the HIA and its area of coverage, elaboration of a specific Term of Reference (TR).	* To assign to official bodies of the health area and the Public Ministry the supervision of the Term of Reference (TR). * To list the entire area covered by the enterprise, from upstream to downstream. * To problematize who is "affected", covering the region beyond the reservoir installation. * To create qualitative and quantitative environmental health thematic indicators, according to health determinants and conditions. * To consider the circulating population, in addition to that living in the region. * To cover area directly and indirectly affected and special attention to psychosomatic diseases, environmental and socioeconomic characteristics. * To listen to the public opinion of those affected regarding the acceptability and life expectancy after the installation of the works. * To consider the positive and negative impacts on socio-environmental determinants and the population's quality of life. * To pay attention to social justice in order to minimize impacts on the most vulnerable. * To set up multiprofessional and interdisciplinary teams.

Stage 3	Activities in the HIA	
Identification/Data Collection	To determine the profile of the community to be affected and carry out information gathering to identify potential health impacts.	* Diagnosing the profile of the enrolled population should be the first step, with multidisciplinary teams. Determining the coverage area is the most difficult part of HIA. * Also using a qualitative approach that allows reaching information that escapes official data. * To build together with the community what data should be collected. * To raise indicators from questionnaires, interviews, focus groups with the affected population. * To consider culture, livelihoods, social ties and kinship, normally disregarded in environmental studies. * To consider the typology of the enterprise, mainly operations, technology, products and raw materials with potential health risk. * To identify income level and future perspectives of the population considering the conditions of reproduction of social life in other spaces.
Stage 4	Activities in the HIA	
Impact Assessment / Situational Analysis	Critically analyze the information collected in order to define the main health impacts, in the different sources, establishing priorities.	* To assemble a multidisciplinary team and the Public Ministry for situational analysis. * To articulate the issues that emerged from the analysis, together with specialist and academics. Prioritize multiprofessional and interdisciplinary approaches. * Based on historical data and knowledge produced in other regions already affected. * To create software for qualitative and quantitative calculations, according to indicator weights. * To perform the triangulation of data found in order to include in the scope of the project, including qualitative data. * To pay attention to vulnerable groups, social, economic, cultural and environmental aspects. * To conduct scientific studies to more accurately determine possible impacts. * To create a data validation and analysis committee. * To develop temporal baseline analysis of the epidemiological profile.

Stage 5	Activities in the HIA	
Making Decisions and Recommendations	To develop an Action Plan with a set of actions to achieve goals in compliance with the proposed recommendations and strategies for implementing the actions.	* To provide for community participation in the construction and development of the Action Plan. * To build the Plan along the lines of health conferences, forums. * To involve public bodies, previously affected communities, communities to be affected, and companies interested in the enterprise, as partners and not antagonists. * To involve affected enterprises and municipalities in participatory spaces composed of affected communities. * To consider the initial conditions of the community comparing them with the changes made. * Appointing health professionals to be part of the assessment and planning team. * To present the Plan to the community and directly impacted entities (city halls, health secretariats, organizations, community associations, etc.). * Make it clear who will manage and supervise the implementation of the Plan. * To determine that the execution and inspection are constant
Stage 6	Activities in the HIA	
Follow-up/Monitoring	To evaluate the processes involved in monitoring health impacts based on pre-established indicators, monitoring criteria and impact management plan.	* To relate the indicators to previous processes/stages organized by electronic means, software creation * To check, periodically, how the health of the population is evolving/behaving, if new diseases appear, and how prepared or not the communities are to face these risks. * Participation and social control in this process, in an equal way. * To contemplate strategies of attention to the physical, mental and emotional health problems of the affected people. * To establish a working committee made up of the affected communities, the project, social movements, researchers and professionals who work in public policy in the affected areas. * To monitor and follow up, in detail, the impacts foreseen and not foreseen in the evaluation phase. * To monitor for at least 5 years, comparing whether the impacts predicted in the assessment are compatible. If necessary, carry out new methodological approaches. * To monitor continuously by means of the indicators

Source: elaboration of the authors, 2022.

Discussion

Although recent, especially in Brazil, HIA has occupied spaces for discussion among researchers in order to produce subsidies for the construction of indicators and regulations for policies, programs and projects. The researchers who participated in this study, when commenting on the stages of the HIA (Table 1), were unanimous in some indications,

regardless of the stage in which the hydroelectric plant implementation project is taking place, whether before, during or after construction: *a) to form interdisciplinary and multidisciplinary teams; b) to encourage participation of the affected population at all stages; c) to give special attention to mental health; d) to consider the scientific evidence*. These consensuses are indispensable for the assessment of health impacts and they point to a new work agenda for both academic research and the decision-making process in public management.

Considering that the health-disease process of a population is multifactorial, that is, it includes socioeconomic and working conditions, the quality of the physical environment, social relationships, among others, interdisciplinary approaches are increasingly necessary to support local managers in health decision-making processes.

The analysis of the implications that a change in the environment can have on the health of a population, which is displaced due to the construction of an enterprise, such as hydroelectric plants, implies a process of assessment of impacts in a collaborative way with those involved in the change. Waltner-Toews (2001), in his ecosystem perspective, points out the identification of the main actors and community participation as essential factors in development policies and projects.

The systemic mode of health management, which comprises transdisciplinary and stakeholder participation in decision-making processes, is a premise for health promotion at a time when environmental degradation is an undesirable condition for the well-being of a community population (NIELSEN, 2001). It is in this interdisciplinary scope that an HIA in areas of hydroelectric power plant implementation can anchor its practice and contribute to a more robust diagnosis.

The specialists participating in this study reiterated the importance of interdisciplinary studies and actions and, in particular, the involvement of the population and social control, as essential conditions for carrying out continuous assessments of life expectations after the dam installation. This indication is in line with the guidelines of the Ministry of Health (BRASIL, 2014) and the Pan American Health Organization, which emphasize the need for continuous contact with representatives of social groups in the region covered by the project, with their participation in the preparation of the HIA, whose contributions are necessary to qualify the proposal (PAHO, 2013). For this participation, appropriate methodologies can be created for each location, whether interviews, working groups, focus groups, or others, in order to strengthen the participation and sense of belonging of different population groups.

The stages of the HIA can be different in each place of implantation of the projects, however, systemic analyses from the experiences of professionals from different areas, as well as the participation of those involved, whether entrepreneurs, public managers or directly and indirectly affected, will make it possible to create conditions to minimize health and socio-environmental impacts.

Health impact assessments are still incipient in Brazil and their methods need to be improved in order to make it possible to identify categories that can be measured at all stages of assessment of impacts on the health of a population, whether before, during or after the implementation of an enterprise. The need to constantly qualify the HIA,

together with other socio-environmental assessment processes, is evidenced in studies carried out in regions where large enterprises are installed (ROQUETTI; MORETTO; PULICE, 2017; PASE et al., 2016; ROCHA; PASE, 2015). The construction of a hydroelectric plant on the Uruguay River, according to Rosa et al. (2018), caused environmental, social and health transformations of the population directly involved, with the weakening of social relationships, community dismemberment and compulsory displacements, these are often conflicting although aspects related to health have remained on the periphery of the analyses.

The importance of paying attention to possible psychological consequences of the population affected by hydroelectric projects was pointed out by the researchers participating in this study as a basic premise for HIA. Although not always easily measurable, in the short or medium term, however, studies have shown signs of these conditions (ROSA et al., 2018; POZZEBON; FERREIRA, 2018; GIONGO; MENDES; WERLANG, 2016; QUEIROZ; MOTTA-VEIGA, 2012; among others), evidencing the weight of psychosocial illnesses generated due to the processes of negotiations with entrepreneurs, the need to leave the place where they constituted their *modus vivendi* and the (re)adaptation to new environments in which families are reinserted, sometimes, compulsorily.

In studies carried out after the implementation of projects, researchers show that some health conditions could be glimpsed with previous assessments and mitigation strategies, for example, problems related to the mental health of the population that were identified in regions of hydroelectric projects, as a triggering process for damage to health (MARQUES et al., 2018; SMITH et al., 2013). The repercussions on health as a result of changes in the physical environment and social relationships felt by families affected by the rupture of ties and social networks generate anxiety, depression, hypertension and lack of motivation to face the changes that were presented both in the period of negotiations of properties and in the period after the removal of the population (ROSA et al., 2018). These results are reiterated by the participants of this study when referring to the importance of special attention to mental health and the effective inclusion of the affected population in all stages of HIA.

In view of this, considering the scientific evidence of existing knowledge is indicated by the participants of this study in the sense that such evidence can support impact assessments of new projects. This practice of consulting specialists from different areas is one of the guidelines given by PAHO in which previous studies and experiences already lived in other regions, especially in the country, are considered, such as the profiles and perceptions of the population, statistical information on health, and socioeconomic conditions (PAHO, 2013). Likewise, the guiding principles of HIA value and emphasize the ethical use of scientific evidence and a global approach to health (IAIA, 2006).

Considering all the stages of the HIA, it is necessary to establish a propositional agenda that enables the collective and participatory construction of evaluation, analysis and formulation of strategies that aim to minimize the possible negative impacts or enhance the positive ones in project implementation processes. In this perspective, the participants of this study raise some concerns, for example: where to start? Who are those affected?

For the specialists participating in this study, the definition of the coverage area and the understanding of who are affected are the most complex parts of the HIA, because, in addition to the geographic scope, other elements not always measurable such as culture, social and work ties, enter the analysis. Even recognizing these difficulties, the definition phase is essential to move on to the region's "identification/data collection" phase.

The concept of the *affected*, in the context of hydroelectric plants, was analyzed in the classic article by Vainer (2008), where, in addition to the economic, financial and indemnity dimensions, the author included the appreciation of the affected as a subject of a social category in dispute. Although, according to the author, it is the water concept – which identifies as affected those who are flooded and, consequently, compulsorily displaced or resettled – that remains in the political decision-making processes. In any case, it is essential to identify and classify individuals and/or social groups as affected, because, as Vainer mentions (2008, p. 40), "to establish that a certain social group, family or individual is, or was, affected by a certain undertaking means recognizing as legitimate – and in some cases as legal – their right to some form of restitution or compensation, rehabilitation or non-pecuniary reparation." Likewise, Santos (2015) mentions that the term is used as an identity representation of those covered by water, those affected by construction sites, by the workers' camps and by the transmission lines. Thus, those affected are those who have suffered some impact, whose community to which they belong is affected in their cultural aspects, in community coexistence and who, through displacement, undergo transformations and social disruption (BARON, 2015). These conceptions demonstrate that the definition of the coverage area and definition of who are affected by an enterprise goes beyond the geographical area, which again refers to the importance of an interdisciplinary and multiprofessional HIA work.

The HIA stage related to "data identification/collection" is reiterated by the specialists, participants in this study, in order to give voice to those affected, as well as to all those involved, in order to know the profile of the population, from quantitative and qualitative approaches.

In the "impact assessment/situation analysis" stage, the data can be analyzed, according to the experts, using indicator software based on health determinants and conditions, in addition to setting up committees for data validation.

With regard to the "decision making" and "follow-up/monitoring" stages, which deal with the preparation of the action plan and the respective follow-up of the plan's implementation, as well as the monitoring of possible socio-environmental and health impacts, the specialists recommend the creation of mechanisms for social participation and the development of joint action plans with public bodies, companies and affected communities in the construction and continuous monitoring of the action plan through indicators that can be related to the previous stages and evaluated in a systematic way and keeps going. The need for the presence of health professionals in the evaluation and planning team and the creation of mechanisms that can provide greater transparency about the responsibilities in the management and supervision of the plan was also mentioned. This last aspect was strongly analyzed in the case of the Belo Monte hydroelectric plant

where, due to the lack of definitions regarding the attribution of responsibilities between the public and private sectors, the affected population did not know who to turn to either for information or for the repair of their rights (GRISOTTI, 2016).

Finally, considering that, in Brazil, the implementation of hydroelectric plants has been taking place since the 1950s and, to date, more than two hundred have been built, Moran (2016) questions why there is still the repetition of errors in the process of construction and mitigation of impacts if there is already evidence on the negative and/or positive implications for the affected population. Although these errors are recurrent, in Brazil there is still no specific regulation for the assessment of health impacts in the environmental licensing process (SILVEIRA; FENNER, 2017). The assessment of environmental impacts is a legal requirement and normally carried out, especially in the period that precedes the implementation of an enterprise. However, in practice, the studies required in environmental licensing are mostly concerned with the direct impacts on the environment (BARBOSA; BARATA; HACON, 2012) and, in relation to health, tend to be neglected.

Although there is no specific legislation for HIA regarding the implementation of these projects, several studies point to the need for special attention to the health problems of the populations directly and indirectly affected (ROSA et al., 2018; GRISOTTI, 2016; SILVEIRA; ARAÚJO NETO, 2014; QUEIROZ; MOTTA-VEIGA, 2012; COUTO, 1999; among others). From this scenario, it is worth reflecting and questioning the stage that Brazil is when it comes to minimizing the negative impacts on the population affected in the processes of construction of hydroelectric plants. The experiences and lessons learned over the years and the projects already implemented could serve as a reference for minimizing harm to the population's health.

Final considerations

The participants of this study were consensual in proposing interdisciplinary and/or multidisciplinary teams in the Health Impact Assessment processes, which, in our view, reinforces, in turn, the use of the ecosystem approach. Although the inclusion of those involved in the construction process of hydroelectric plants, understood as public managers, entrepreneurs, researchers and the affected population, is a *sine qua non* condition for its better effectiveness and minimization of negative impacts, these co-participation processes must be followed by mechanisms that guarantee transparency in the preparation of the appraisal project, in the monitoring of the actions planned for the period during and after the project's implementation and, fundamentally, in the attribution of responsibilities. Considering the scientific evidence pointed out by researchers, the perceptions of managers and the populations affected in the projects already implemented, regarding the negative (or positive) impacts, can serve as subsidies for the elaboration of future projects and the qualification of new energy development strategies. In this regard, Leturcq (2016) reiterates the need to reflect on the analysis of problems already identified and widely studied, which constitute, as stated by Silveira and Fenner (2017), a technical and political support tool for decision makers.

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Avaliação de impacto à saúde no processo de implantação de usinas hidrelétricas: contribuições metodológicas

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Artigo Original

Resumo: A Avaliação de Impacto à Saúde (AIS) é definida pela Organização Mundial da Saúde como uma metodologia que engloba a identificação, predição e avaliação das esperadas mudanças nos riscos à saúde. Objetivo: analisar as contribuições de especialistas sobre as etapas da AIS. Foi realizada pesquisa com especialistas brasileiros sobre as etapas da AIS, no que tange às regiões de implantação de usinas hidrelétricas utilizando uma plataforma eletrônica. Participaram do estudo 18 especialistas de oito instituições de ensino superior de cinco estados brasileiros. Indicam que na AIS sejam observados os seguintes aspectos: necessidade de formação de equipes interdisciplinares e multiprofissionais; participação da população atingida em todas as etapas; atenção especial para a saúde mental; e considerar as evidências científicas. Esses aspectos contribuem para qualificar as etapas da AIS na implantação e monitoramento de novos empreendimentos hidrelétricos.

*Palavras-chave***:** saúde ambiental; riscos à saúde; população afetada; impactos socioambientais.

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Evaluación del impacto en la salud en el proceso de implantación de centrales hidroeléctricas: aportes metodológicos

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Resumen: La Organización Mundial de la Salud define la Evaluación del Impacto en la Salud (EIS) como una metodología que incluye la identificación, predicción y evaluación de los cambios esperados en los riesgos para la salud. Objetivo: analizar las contribuciones de expertos en las etapas de EIS. Se llevó a cabo una investigación con especialistas brasileños sobre las etapas de la EIS, con respecto a las regiones donde se encuentran las centrales hidroeléctricas utilizando una plataforma electrónica. Dieciocho especialistas de ocho instituciones de educación superior de cinco estados brasileños participaron en el estudio. Indican que los siguientes aspectos se deben observar en la EIS: necesidad de formar equipos interdisciplinarios y multiprofesionales; participación de la población afectada en todas las etapas; especial atención a la salud mental y, considerar las evidencias científicas. Estos aspectos contribuyen a calificar las etapas de EIS en la implementación y monitoreo de nuevos proyectos hidroeléctricos.

Palabras-clave: salud ambiental; riesgos a la salud; población afectada; impactos socioambientales.

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