

A Multi-Dimensional Study of Organisational Boundaries and Silos in the Healthcare Sector

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Abstract

The aim of this study is to understand how healthcare practitioners experience organisational boundaries and silos in day-to-day operations. Based on a multi-dimensional scale of organisational boundaries, the study provides new insights on how organisational demarcation lines enable and constrain daily work tasks in the healthcare sector. The results indicate that tendencies toward organisational silos relate to systems and hierarchies (management-staff) rather than professions and departments. Moreover, the study identifies resource scarcity as an important undercurrent in the understanding of the respondents' perceptions of boundaries and silos. The study contributes to existing research by documenting the coordination and collaboration challenges linked to the multitude of demarcation lines in complex health organisations. The study is based on a quantitative and qualitative analysis of survey responses from 895 healthcare practitioners in Denmark.

Key words: Boundaries, Boundary Work, Silos, Innovation, Healthcare.

Introduction: Exploring Boundary and Silo Structures

There is a rich and varied literature on organisational boundaries, which is defined here broadly as '(...) delimitations that separate one entity from another'.¹ While organisational boundaries may serve positive objectives such as facilitating greater efficiency, collaboration, and coordination, they can also become obstacles to achieving these goals. The latter type of boundaries is colloquially referred to as 'silos', which can be understood as organisational delimitations that obstruct collaboration and coordination between individuals, groups, departments, and organisations.²³

The aim of this study is to deepen our understanding of how practitioners perceive boundaries and silos in complex healthcare organisations. The study develops and test of a new, multi-dimensional

scale of organisational boundaries, which provides an overview of productive and destructive demarcation lines. To the knowledge of the authors, no attempts have yet been made to develop a scale to measure the broader architecture of boundaries in the healthcare sector. While a broad range of organisational boundaries have been addressed in the academic literature, there has been little dialogue between the different streams of research, and broader studies on the manifestations of multiple boundaries remain scarce.⁴⁵ This tendency is even more pronounced in the study of organisational silos, where few attempts have been made to examine the multiple dimensions of silos conceptually and empirically.

The study is based on an online survey with responses from 895 practitioners working within the healthcare sector. Healthcare is a highly relevant for discussions of organisational boundaries as the sector has often been accused of silo-thinking (e.g. between departments and professions) which have negative impacts for the organisations (inefficiency), citizens (poor health outcomes), payers (higher costs), and society more generally.⁶⁷⁸ Exploring boundaries and silos in the healthcare sector can help identifying the areas where managers and employees perceive coordination and collaboration barriers in day-to-day work practices. As noted by Rodríguez and colleagues: *'The problem of managing across boundaries is nowhere more urgent or more complex than in the health care field.'*⁹

Organisational Boundaries and Silos

Implicitly or explicitly, all organizations establish boundaries between what is considered inside (individuals, teams, groups, functions, headquarter, subsidiaries, business units, joint ventures, etc.) and outside the organization (stakeholders, branch, industry, field, institutions, logics, etc.). Some boundaries are relatively well-defined, such as departments within an organisation, whereas others are more fluid and relate to tasks, technologies, authorities, professions, disciplines, networks, communities, identity, and culture.^{10 11}

References to silos typically comes with negative connotations as an umbrella term for impermeable organisational boundaries which obstruct the orchestration of activities. For instance, references to silos are often made to describe poor coordination between departments that are *'isolated*

from each other and have few means of communicating'.¹² Silos can also give rise tensions between practitioners in the organisation.^{13 14} For instance, frustration can arise among employees in organisations in which relevant knowledge is not shared, where groups sub-optimize rather than work together, and where coordination is unnecessarily complicated. Moreover, silos that secure privileges for certain actors, such as higher budgets or decision-making powers, are likely to be perceived as unfair by others in the organisation. Last, silos can be an obstacle to innovation and change which require coordination and collaboration across departments, disciplines, and knowledge domains.^{15 16 17} As noted by Mørk and colleagues: *'Many breakthroughs in knowledge fail to be translated into medical practices because they cut across established boundaries and power relations...'*¹⁸.

Organisational silos have frequently been the subject of discussion in the context of the healthcare sector. As an example, hospitals are often organized around functional silos, even though individual hospital departments depend on each other and patients often move through several different departments during their stay.^{19 20} The current functional setup of healthcare is inefficient and disadvantageous, especially for patients with polychromic diseases who often have to navigate within a system of ill-coordinated departments and organisations (general practitioners, municipalities, hospitals, etc.).²¹

Healthcare organizations are also made up of numerous professions (doctors, nurses, managers, etc.) who may not agree on the relevance and importance of activities.²² According to Kerosuo, the division of labour is a dominant theme in discussions of boundaries in healthcare contexts.²³ Professional boundaries between different organisation members can be reinforced by regulations, with some professions having special responsibilities, rights and privileges, for example regarding access to patient data and rights to perform certain activities such as blood-testing and issuing prescriptions.

Organisational silos can also be reinforced by technologies, budgets, measurements, and accounting systems, which make it more or less attractive to coordinate and collaborate across boundaries. Likewise, the allocation of budgets to specific teams, departments, and hospitals, each of them responsible for only a subpart of healthcare delivery, increases the risk of silo-thinking.²⁴ Silo-

based budgeting may dissuade healthcare units from collaborating with each other and divert focus away from health outcomes for citizens towards budget maximisation within each silo.²⁵

Method and Dataset

To explore organizational boundaries and silos in healthcare organisations, an online survey was designed by the researchers in dialogue with an external data provider. The online survey was sent to 2,311 Danish citizens registered as working with healthcare in the data-provider's panel database of internet users who have agreed to take part in market research surveys and opinion polls. The respondents were informed that the survey focused on their workplace experiences with special emphasis on coordination, collaboration, and job satisfaction. To test the accuracy of the job categorisations, an initial test question about workplace was included at the beginning to filter out any citizens registered incorrectly in the panel database. A total of 909 employees holding different positions within the Danish healthcare completed the survey. A closer analysis of the results led to the exclusion of 14 respondents who had registered themselves as unemployed, retired, etc. The study is thus based on responses from a total of 895 citizens, equal to a final response rate of 38.7 percent. The large majority of respondents were women (83.8 percent). 80.2 percent of the respondents were working in the public healthcare sector (municipalities, regions, or state), while 17.9 percent were working in the private sector.

Measurement of Variables

One of the challenges studying boundaries is that they often cannot be seen.²⁶ Even though a number of scholars have developed broad classifications of boundaries within and between organisations, no consensus exists on the practical measurement of organizational boundaries and silos, either individually or collectively.^{27 28} With special focus on the healthcare context, a new scale of organizational boundaries was developed based on the available literature, which emphasise distinctions between e.g. units/departments,²⁹ professions,³⁰ temporality,³¹ hierarchies,³² systems,³³ and finance.³⁴ More specifically, the respondents were asked 10 questions linked to specific boundaries that

could either play a positive or a negative role in the organization, with only the latter boundaries perceived as silos.

<i>No:</i>	<i>Boundary theme:</i>	<i>Boundary Question (Strongly disagree-Strongly agree):</i>
1	Department	Collaboration and coordination of tasks within and between departments work satisfactorily.
2	Technology	Databases, IT-systems, and other technologies facilitate collaboration and coordination across the workplace.
3	Profession	Collaboration and coordination among professions (doctors, nurses, administrators, etc.) works satisfactorily.
4	Hierarchy	Management contributes to a good workplace environment for employees on the floor.
5	Temporality	The emphasis on daily tasks/operations is not at the expense of the long-term development of the workplace.
6	Finance	The budgets in the workplace do not lead to unfair prioritization of special areas and/or groups.
7	Regulation	Rules and regulations create a good framework for a meaningful organization of work tasks.
8	Identity	All employees across departments and professions agree on the prioritisations of the workplace.
9	Prevention/treatment	The workplace has a satisfactory balance between prevention and treatment in relation to citizens/patients/clients/customers.
10	External partners	Collaboration and coordination of work tasks between the workplace and external partners is satisfactorily.

Table 1: Scale for measuring organisational boundaries and silos

After satisfactory results of Kaiser-Meyer-Olkin Measure of Sampling Adequacy calculated as

$$KMO = \frac{\sum_{j \neq k} \sum r_{jk}^2}{\sum_{j \neq k} \sum r_{jk}^2 + \sum_{j \neq k} \sum p_{jk}^2}$$

where r_{jk} is the correlation between the variables j and k , and p_{jk} is the partial correlation between the variables j and k , and Bartlett's Test of Sphericity calculated as

$$\chi^2 = \frac{(N - k) \ln(S_p^2) - \sum_{i=1}^k (n_i - 1) \ln(S_i^2)}{1 + \frac{1}{3(k-1)} \left(\sum_{i=1}^k \left(\frac{1}{n_i - 1} \right) - \frac{1}{N - k} \right)}$$

where k is the number of samples with sizes n_i , $N = \sum_{n=1}^k n_i$, $S_p^2 = \frac{1}{N - k} \sum_{n=1}^k (n_i - 1) S_i^2$ is the pooled estimate for the variance, where S_i^2 are sample variances, a principal component analysis with Varimax rotation was conducted to investigate how many factors would arise from the ten boundary themes. After checking pair-wise correlations, Cronbach's alpha was calculated for the resulting factor(s) to assess internal consistency.

In addition, the impact of sector (public (i.e. state, regional, and municipal) versus private) and organisation size on the identified factor(s) was analysed using a linear regression model(s). Public vs. Private healthcare provision has previously been a discussion in the health management and organisation literature.³⁵ In this study, we suggest that private healthcare providers can be expected to be more efficient, e.g. because they are more specialised and have direct financial incentives to minimise waste.³⁶ All things being equal, it will strengthen the internal coordination and reduce silo tendencies. As for organisation size, larger organisations can be expected to move towards departmentalisation and specialisation, which increase the administrative complexity and make it more challenging to coordinate the flow of work across organisational units.³⁷ Organisation size can therefore be expected to be positively correlated with the risk of silos. Besides sector and size, the linear regression models also included three demographic variables: - age, educational level, type of employment. Results of the regression models are commented on the 0.05 significance level.

The survey also included a qualitative question intended to shed more light on how healthcare employees perceive silos in their organisation. The qualitative question served an explorative purpose and was intended to provide more insights about the fixed boundary categories and potentially serve as inspiration for expanding the current scale with new organisational delimitations. More specifically, the respondents were asked to give an example of a topic that had sparked internal discussions within the organisation. The exact formulation of the question was: *'Collaboration can sometimes give rise to discussions at the workplace. Please provide one concrete example of an internal discussion and indicate the solution (if any)'*. The formulation of the question was intentionally broad to inspire responses that were not guided toward specific boundaries. All the examples from the respondents were provided in local language and the quotations used in this manuscript have thus been translated. 417 respondents (46.6%) provided answers which varied significantly in length and detail.

The quotes were subject to three stages of qualitative analysis. First, the text was subject to thematic coding in SPSS. The answer of a respondent could be coded in more thematic categories if several issues were addressed in the same text. The analysis went through several iterations before most quotes were organised in a limited number of themes. Second, the analysis included the identification of quotes which were assessed to address organisational boundaries. Not all quotes could be related to organisational boundaries, e.g. because they did not provide enough detail (e.g. broad references to communication problems) or did relate to any identifiable boundary. For instance, some respondents referred to personal disagreements with colleagues (bullying, harassment etc.). It was not possible to link these interpersonal tensions to any underlying organisational boundaries. Third, all quotes were coded according to the fixed boundary categories (see Table 1). The objective was to examine the relationship between the categories from the open coding procedure to the categories in the survey. The findings from the qualitative analysis are summarised in Table 6.

Findings from the Analysis

Figure 1 shows the overall scores (i.e. averages) of the boundary questions from the online survey. As seen from the results, healthcare personnel primarily consider the surrounding system infrastructure as

impediments for coordination and collaboration. In particular, rules and regulations are considered as obstacles for the meaningful organisation of the work in healthcare. On the contrary, the day-to-day human interaction between professions does not seem to give rise to the same level of silo thinking.



Figure 1: Boundaries in the healthcare sector, ordered from the least dominant to the most dominant.

Because of missing answers, the principal component analysis was based on 629 respondents. Given that the sampling is adequate (Kaiser-Meyer-Olkin Measure is 0.936) and the observed correlation matrix is significantly different than the identity matrix (Bartlett's Test of Sphericity χ^2 is 2940.66, p-value < 0.001), we conducted a principal component analysis with Varimax rotation of the ten boundary themes and the results are presented in Table 2.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.400	54.003	54.003	5.400	54.003	54.003
2	.790	7.903	61.906			
3	.694	6.937	68.843			
4	.601	6.007	74.850			
5	.505	5.050	79.900			
6	.472	4.723	84.623			
7	.444	4.444	89.067			
8	.418	4.185	93.252			
9	.349	3.492	96.744			
10	.326	3.256	100.000			

Table 2: Total Variance Explained

The principal component analysis resulted in only in one factor. All pair-wise correlations were positive, which made it possible to calculate Cronbach's alpha. Cronbach's alpha is 0.903 which indicate that the ten boundary themes can be used as one scale/construct in quantitative studies. As it can be seen in the component matrix (Table 3), correlations between the generated factor and the individual themes range from 0.637 to 0.800. It was not possible to improve Cronbach's alpha by omitting any of the ten items. Omitting any item would lead Cronbach's alpha to drop from 0.903 to 0.889-0.900.

	Component 1
Collaboration and coordination of tasks within and between departments work satisfactorily.	.769
Databases, IT-systems, and other technology facilitate collaboration and coordination across the workplace.	.637
Collaboration and coordination among professions (doctors, nurses, administration etc.) works satisfactorily.	.727
Management contributes to a good workplace environment for employees on the floor.	.744
The emphasis on the daily tasks/operations is not at the expense of the long-term development of the workplace.	.749
The budgets at the workplace do not lead to unfair prioritization of special areas and/or groups.	.704
Rules and regulation create a good framework for a meaningful organization of the work tasks.	.676
All employees across departments and professions agree on the prioritisations of the workplace.	.767
The workplace has a satisfactorily balance between prevention and treatment in relation to citizens/patient/clients/customers.	.800

Table 3: Component Matrix

Two regression models were tested. The first regression model uses the factor from the principal component analysis of the ten boundary themes as a dependent variable. The second regression model uses an unweighted average of the ten boundary themes as a dependent variable to inform readers who prefer ipsative scales; additionally, it illustrates how stable are standardized regression coefficients depending on how the dependent variables is calculated. The results from the regression models are presented in Table 4 and Table 5.

Model		Standardized	T	Sig.
		Coefficients		
		Beta		
1	(Constant)		1.937	.053
	Gender	-.017	-.430	.667
	Age	.039	.980	.328
	Educational level	-.083	-2.053	.041
	Private sector	.161	3.768	.000
	Organizational size	-.228	-5.299	.000

Table 4: Regression Model for the Boundary Factor

Model		Standardized	T	Sig.
		Coefficients		
		Beta		
1	(Constant)		18.285	.000
	Gender	-.013	-.379	.705
	Age	.051	1.468	.143
	Educational level	-.059	-1.678	.094
	Private sector	.181	4.849	.000
	Organizational size	-.200	-5.316	.000

Table 5: Regression Model for the Boundary Average

The findings indicate that respondents working in larger organisations are more likely to report silo tendencies. A likely explanation is that larger organisations are more likely to be divided into specialised units and that the costs of coordination and control increases with size.³⁸ Respondents working in the public sector are also more likely to experience silos compared to employees working in the private sector. While the differences between public and private healthcare organisations have been subject to much debate, one possible explanation is that employees in the public sector are subject to more public regulation and political interference. Moreover, private organisations may offer more specialised services to a narrow group of stakeholders whereas public sector organisations need to meet the demands of more stakeholders and tackle complex conditions that cut across functional and professional boundaries.³⁹ The interaction between organisation size and the sector (public/private) was tested in separate models but it was not significant (p-values were 0.665 (the factor as a dependent variable) and 0.445 (the average as a dependent variable) respectively). Therefore, regression coefficients are not reported here. Surprisingly, the results also indicate that respondents with lower education seem to be less troubled with silos in healthcare organisations. However, it is inconclusive whether the education level has any bearing on perception of organisational boundaries when accounting also for the sector and the organization size.

Insights from the Qualitative Analysis

The responses to the qualitative analysis provide further insights about the organisational boundaries and silos perceived by healthcare workers (Table 6). *Hierarchical boundaries* between management and staff were identified by respondents as a key area of discussion. Discussions linked to boundaries and silos typically manifested themselves in quotes that indicated managers were detached from what went on in the organization. Common references were made to managers not knowing “what happened on the floor” and perhaps also having little interest in day-to-day activities. Respondents also made references to *professional boundaries* between staff at the same hierarchical level that could sometimes hinder collaboration and coordination. The professional silos were reported to establish hierarchies among staff members, with some professions seen as peripheral compared to others. The flow of activities between *departments* and other organizational entities also gave rise to challenges.

Respondents reported difficulties in coordinating tasks across departmental and organizational silos that manifested themselves in limited knowledge-sharing and sub-optimisation. Last, *organisational controls, systems and standards* that regulate the relationship between organisation members and activity flows (e.g. national cancer pathway standards) were reported to accentuate silos between organisational entities. As an example, a respondent reported that poor data systems made the coordination of tasks between units difficult: *'Unfortunately, we do not use the same databases for our work across departments, which gives rise to misunderstandings. We do not know others' work tasks and how they are carried out.'*

	Themes:	Quotes linked to boundaries:		Primary link to fixed boundary themes:
	Frequency (No. of quotes)	Frequency (No. of quotes)	Percentage of total number of quotes (%)	
Management of staff	93	44	47%	Hierarchy
Resource scarcity (lack of time, personnel, financial resources etc.)	69	15	22%	Department
Coordination of tasks among staff members	60	30	50%	Hierarchy
Issues linked to clients/patients (e.g. what treatment is needed, what service level).	49	37	76%	Department
Employee issues (negativity, bullying etc.)	44	15	34%	Interpersonal
Issues linked to professions	43	29	67%	Profession
Inadequate information and communication	39	22	56%	Hierarchy
Technology issues (e.g. poor IT systems)	26	8	31%	Technology
Administration and documentation	24	9	38%	Regulation
Coordination across departments/units	17	13	76%	Department

Collaboration and coordination with external partners	15	12	80%	Department
Other responses, uncategorised	13	1	8%	-
No discussions and problems perceived	34	0	0	-
Refuse to answer question	3	0	0	-
Total	529	235	44%	-

Table 6: Summary of results from the qualitative coding.

Resource scarcity may accentuate the perceptions of silos in healthcare organisations. Lack of resources, for instance personnel and financial resources, was often mentioned by the respondents and likely influenced the other categories in the Table 6. While not constituting a silo in itself, resource scarcity creates tensions and reinforces silo tendencies relating to management, employees, and flow of activities. As noted by one respondent: *'Too many work tasks for too few employees. Employees get stressed because they are under too much pressure and do not have a management who steps in.'* Lack of resources also has negative consequences for the quality of healthcare services delivered to patients. According to a respondent, *'Healthcare errors happen on a daily basis as a consequence of budget cuts.'*

Looking across the findings, hierarchical boundaries consistently seem to an area of concern in healthcare organisations. Organisations thus need to prioritise the vertical relationships between management and staff if they want to overcome silo tendencies. The findings also indicate that system boundaries (rules, regulation, technology) were perceived as key barriers for coordination and collaboration yet appeared to play a less prominent role in the daily discussions at the workplace. A possible explanation is that the question with fixed alternatives measured the boundary characteristics of multiple healthcare areas without ranking their relative importance, whereas the open question specifically directed attention to the topics that respondents feel the most in their daily work. For instance, some boundaries in the healthcare sector may be considered as a given and thus escape attention in the daily discussions at the workplace.

Discussion

The findings from the analysis shed light on the dominant demarcation lines facilitating and obstructing the orchestration of organisational activities in the healthcare sector. This study is a response to calls for broadening understanding of the multiple boundaries and silos that influence organisational life.^{40 41} Organisational boundaries do not only relate to a single dimension of the organisation (e.g. departments or professions). Organisational hierarchies, professional cultures, financial systems etc. all create demarcation lines between issues, activities, and actors.

The evidence from the study indicates that silos are most likely to found in healthcare systems and hierarchies. The results somehow diverge from the existing body of literature on boundaries and silos in the healthcare sector, which have often emphasised the demarcation lines between different professional groups (e.g. doctors and nurses).^{42 43} However, it should be stressed that organisational boundaries are interrelated and hierarchies, systems, procedures, and routines may therefore be dominated by specific professional groups. As an example, physicians have a monopoly over certain tasks, while other professions are placed lower in the hierarchy and thus dependent on physicians' decisions in order to perform their jobs.⁴⁴ As noted by Bucher and colleagues: *'In the field of health care, physicians are situated at the apex of the status hierarchy due to their extensive training and exclusive rights.'*⁴⁵

The findings indicate that size and sector are structural conditions, which play a role in explaining differences in perceived silo tendencies. With regards to organization size, the findings may reflect the management challenges arising when large, complex organisations have to orchestrate work across vertical and horizontal boundaries. Here, healthcare managers need to increase the focus on building bridges across organisational boundaries and establish check and balances which increase transparency of work and share responsibilities across organizational silos.⁴⁶ When it comes to the sector differences, respondents from private healthcare providers report less silos compared to public sector organizations. While the relationship may be caused by multiple factors, the findings make it relevant to discuss if the dominant structures of public sector organizations always support coordination and collaboration across vertical and horizontal boundaries. For instance, a study of hip surgery in Denmark indicated that private providers had more incentives to optimize non-clinical activities (e.g., waiting

times, etc.) whereas there was no major difference in clinical quality.⁴⁷ Transferred to silo discussions, public sector managers may consider means to reward initiatives which improve the flow of work within and between organisational units.

The proposed framework provides scholars and practitioners with an overview of the multiple boundaries permeating healthcare organisations. However, the framework is not beyond reproach and can be further advanced to develop a more fine-grained analysis of the boundaries within and between organisations. An area of improvement concerns the relationship between the organisation and the external stakeholders (regulators, financiers, suppliers, etc.), as the majority of items in the current framework are linked to internal boundaries. However, rules and regulation are found in the survey to be a key barrier for the organisation of work tasks (see Figure 1). Here, it could be relevant to divide this item into more sub-categories in order to identify the underlying sources or rules and regulations. Moreover, the findings from the qualitative analysis indicate that a number of boundary issues emerge in the relationship between the healthcare professionals and the citizens (see Table 6). Moreover, the framework does not cover boundaries linked to broader societal phenomena, such as national identities or gender issues.⁴⁸ Last, while most items in the framework are generic, the question concerning prevention/treatment are specifically tied to the healthcare context. Therefore, the framework requires further adaptations before it can be adapted to other sectors.

The findings from the qualitative data analysis also indicate that resource scarcity (time, budget and staff, etc.) plays a role in the understanding of organisational boundaries and silos. The findings are in line with previous research which links resource scarcity to the experience of job performance and tensions.⁴⁹ In situations with limited resources, there will be a temptation to optimize within rather than between organisational units. The results may supplement existing research linking organisational tensions to resource scarcity.^{50 51} The emergence of silos may partly be a sign of 'anorexia', which creates an imbalance between different units in the organisation.⁵² Future studies should look closer at the relationship between the availability, distribution and use of resources and any observable synchronisation challenges.

Conclusion

The aim of this study was to examine the multiple organisational demarcation lines in the healthcare sector. The study developed a new scale of organisational boundaries which were tested among a sample of Danish healthcare practitioners. The findings indicate that boundaries linked to systems and hierarchies (management-staff) are more likely to be perceived as silos in the healthcare sector. On the contrary, respondents are less concerned about professional boundaries as a barrier for coordination and collaboration. The study also indicates that resource scarcity is a key underlying dimension in explaining organisational boundaries and silos. Overall, the study contributes to the literature by developing of a multidimensional scale for measuring organisational boundaries and silos and providing evidence about their prevalence in the healthcare sector.

This article has limitations. The study is explorative in nature and does not claim that the new scale covers the entirety of organisational boundaries. For instance, this study is based on an online survey, which is a useful method for providing an overview of how organisational phenomena are perceived by practitioners at a single point in time. More longitudinal studies are needed to shed light on how boundaries and silos perceived and acted upon over time. The survey method may also be less useful for examining boundaries linked to deeper held values, culture and logics in the organisation. Here, in-depth case studies will be more suitable for studying the relationship between the organisational boundaries and broader categories of power, disciplines, knowledge, skills, and culture. Last, more research is needed to explore the best ways for managers to break down dysfunctional silos and thereby improve the performance of healthcare organisations.⁵³

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