

Received: 2018.05.22
Accepted: 2018.07.11
Published: 2018.11.13

Clinical Inertia in Type 2 Diabetes Patients in Primary Health Care Clinics in Central Bosnia

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Source of support: Departmental sources

Background: The goal of this research was to determine the frequency of clinical inertia of general practice physicians in the region of Central Bosnia in healthcare for type 2 diabetes patients, to analyze characteristics of patients and physicians, as well as glucose regulation during clinical inertia, and, on the basis of these indicators, give recommendations for reducing clinical inertia.





Material/Methods: This study included 29 doctors, family physicians, or general practitioners, who collected data in a total sample of 541 type 2 diabetes mellitus patients from July to November 2017. The research was conducted using 2 questionnaires. The glucose concentration in plasma and the percentage of glycosylated hemoglobin (HbA1c) were determined. Concentration of cholesterol, triglycerides, AST, and ALT were also measured. After the collection, new data were processed and the degree of clinical inertia was determined.

Result: Levels of HbA1c ranged from 4.3% to 13.0%, and 38.4% of all patients had HbA1c level higher than 7.5%, while 8.3% of them had HbA1c level 9.0% or higher. Clinical inertia in our research was 12.6% out of all patients and 48.2% were referred to a specialist by their doctor.

Conclusions: For better regulation of glycemia and reduction of clinical inertia with type 2 diabetes patients, more specialized training is needed for selected physicians. Strengthening of primary healthcare and encouraging doctors to perform procedures can contribute to better outcomes of treatment, lower clinical inertia, and better education of patients.

MeSH Keywords: **Diabetes Mellitus, Type 2 • Family Practice • General Practitioners**

Full-text PDF: <https://www.medscimonit.com/abstract/index/idArt/911286>

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Background

Clinical inertia is defined as lack of prompt action in spite of non-accomplished goals of a healthcare therapy. Clinical inertia occurs when a physician does not intensify treatment when necessary [1,2].

The term clinical inertia is most commonly used in treatment of common chronic diseases such as diabetes and arterial hypertension. However, this term also refers to the situations when healthcare providers continue doing what they usually do, despite evidence that change is necessary. For example, the patient is given oxygen when experiencing chest pain, although the pulse oximeter shows 97% oxygen saturation of blood in hospital conditions. In these situations, healthcare workers perform certain actions out of habit or because they were told "how to do it" by medical authorities [3].

Clinical inertia in practice has recently been receiving growing attention from scientists. In the Republic of Croatia, there has been only 1 national survey focused on inertia in family medicine healthcare of patients with type 2 diabetes, and it included all counties. The results showed that the frequency of clinical inert behavior is 57.7%, and there has been inert behavior with all their patients by 9% of doctors, while non-inert behavior has not been reported by any of the doctors [1].

A UK study of 80 000 examinees showed that several years are needed for intensification of medication treatment in type 2 diabetes patients, and the time range is longer when an insulin-dependent patient takes more different medications. Additional research in the UK has shown that many doctors delay changing a treatment, which can cause complications with diabetes and permanent consequences for the patient (e.g., cerebrovascular stroke, amputations, neuropathy, nephropathy, and retinopathy) [4–9].

The causes of clinical inertia have not yet been completely confirmed, but there is a general opinion that it is caused by patients as well as by healthcare professionals. There are many studies showing the unfavorable effect of clinical inertia on glycaemia control with type 2 diabetes patients [4,5,10]. These studies list the following reasons for the inert behavior: lack of time, busy working schedule, and deprivation of physicians (by the patient or by the healthcare system), poor communication between physicians and patients, and contradictions between individual guidelines for treatment of type 2 diabetes [11,12].

The extent of clinical inertia ranges from 8.4% to 70%, depending on research methodology and on the country where the study was performed [1,4,8,13,14]. In Bosnia and Herzegovina, there have not been any research on this topic, and, to the best of our knowledge, the present study is the

first to give an overview of the situation, scope, and possible causes of clinical inertia by physicians in caring for type 2 diabetes patients.

The goal of this research was to determine the frequency of clinical inertia by general practice/family physicians in the region of Central Bosnia in care of type 2 diabetes patients, to analyze characteristics of patients and physicians, and to assess effects of glucose regulation (fasting measurement of glucose levels in plasma and percentage of glycosylated hemoglobin) on clinical inertia, and on the basis of these indicators, to give recommendations for reduction of clinical inertia.

We assumed that clinical inertia was common among general practice/family physicians in care of type 2 diabetes patients, especially those with concentration of HbA1c >7.5% and those of older age (>65 years). We expected that clinical would be more common among general practice physicians without specialization.

Material and Methods

Design

This research was an overview carried out in general medicine ambulances in Canton Central Bosnia from August to December 2017.

Examinees

We enrolled 541 examinees of both sexes, all were older than 40 years, and all had type 2 diabetes. Patients with other types of diabetes were excluded, as well as patients with pancreatic disease and other endocrine causes of diabetes.

Causes

In the region of Central Bosnia there are 11 general/family medicine healthcare centers with 103 medical ambulances. In the first step, all 103 ambulances were grouped by the number of patients in healthcare in 3 strata according to the average number of medical folders (stratum 1–1800; stratum 2–2050; stratum 3–2270 medical folders). In the second step, patients who were going to be included in the research were chosen using a random number generator.

Sample size

Determination of the required sample size was performed in accordance with several assumptions. The average number of patients per doctor was about 2000, of which 1200 were over 40 years old. The average prevalence of type 2 diabetes

in Bosnia and Herzegovina is 9.9% per medical practice, and it was expected that 119 patients would be older than 40 years. The number of general practice physicians potentially available to participate in the research was 103, and response to participation in the research was expected to be about 30%, so we expected about 30 of them to participate.

According to average ambulance size in individual strata, the required sample sizes were calculated. In the smallest stratum, the general practice physicians sampled 23 patients, in the medium stratum it was 26, and in the largest stratum it was 28 patients, so that the final number of collected samples was 766.

The Ethics Committee of the Medical Faculty of the University of Split approved this research.

Measurements

The research was conducted by using 2 questionnaires previously used in work of Bralić Lang and associates [1], which we modified to suit the needs of the present study. In the research, the physicians filled out a questionnaire that covered socio-demographic characteristics, subjective characteristics, and objective characteristics of each physician. The first part of the questionnaire for the patients was filled out by the physician and included data on socio-demographic characteristics, information about comorbidity, medication, and developed complications, and the second part was filled in by the patients themselves and included questions about lifestyle, stress, smoking, physical activity, and diet. The stress level of patient was measured by a generic questionnaire for assessment of generally perceived psychological stress (the Perceived Stress Scale, PSS).

Postprandial fasting glucose concentration in plasma was determined (GIP) from 0.3 ml of full capillary blood using a Glucometer S glucose meter (Bauerfeind). We determined the percentage of glycosylated hemoglobin (HbA1c) from 2.6 ml of venous blood by using HPLC method on the Dimension Xpand plus integrated chemistry system (Siemens Healthcare Diagnostics, Inc.). If data on cholesterol concentration, triglycerides, AST, ALT, and creatinine had been entered into the medical file no more than 1 year before review by us, they were used for the present study. If any of these laboratory results were missing from the file, we collected new data in those missing categories. After data collection, the new data were processed and the degree of clinical inertia by physicians was determined. Inertia was classified as follows:

If HbA1c was <7.5% and the physician did not emphasize need for regular therapy using drugs, the behavior was marked as clinical inertia.

If HbA1c was 7.6–7.9% and the doctor did not increase the dose of drugs administered or if the doctor changed the previous treatment or referred the patient to hospital specialists, the behavior was marked as clinical inertia.

If HbA1c was 8–9% and the treatment was not changed, another drug was not added, insulin not introduced, nor the patient was not instructed to visit a hospital specialist, the behavior was marked as clinical inertia.

If HbA1c was >9% insulin was not given and the patient was not instructed to visit a hospital specialist, the behavior was marked as clinical inertia.

Statistical analysis

The level of statistical significance was set to 5% ($p < 0.05$), and all confidence intervals are given at 95% level. Normality of continuous variables distributions was tested using Kolmogorov-Smirnov analysis in samples larger than 30 (i.e., the sample of patients), and with Shapiro-Wilk test in samples smaller than 30 (i.e., the sample of doctors). If statistically significant departure from normality was identified, median and interquartile range were used as measures of central tendency and variability, respectively, otherwise mean and standard deviation were used. Associations between clinical inertia and patient level of HbA1c was tested using the χ^2 test, and Cramer's ϕ was used as the measure of effect size. Linearity of association between clinical inertia and level of HbA1c was tested using the linear-by-linear association statistic. Binary logistic regression analysis was used for univariate and multivariate prediction of clinical inertia. A multivariate predictive model was built with all variables that were in univariate analysis associated with clinical inertia at the level of statistical significance of $p < 0.25$ [15], and with patient age and sex as control variables.

All statistical methods were performed using SPSS for Windows, version 20.0 (SPSS, Inc., Chicago, IL, USA).

Results

Participants

Our study included 29 doctors, family physicians (FPs), or general practitioners (GPs), who each collected data on 12–28 patients, which resulted in a total sample of 541 type 2 diabetes mellitus patients.

Patient characteristics are shown in Table 1. Levels of HbA1c ranged from 4.3% to 13.0%; 208/541 (38.4%) of all patients had HbA1c level higher than 7.5%, while 45/541 (8.3%) of them had HbA1c level $\geq 9.0\%$ or higher.

Table 1. Patients' characteristics.

Sex, n (%)		
Male	234/541	(43.3)
Female	307/541	(56.7)
Age (years), median (IQR)	65	(60–70)
BMI (kg/m ²), median (IQR)	28.5	(25.9–32.0)
Waist circumference (cm), median (IQR)		
Male	95	(92–102)
Female	95	(88–103)
Creatinine (µmol/l), median (IQR)	80	(70–94)
Cholesterol (mmol/l), median (IQR)	5.5	(4.9–6.3)
HDL cholesterol (mmol/l), median (IQR)		
Male	1.3	(1.1–1.6)
Female	1.4	(1.2–1.8)
LDL cholesterol (mmol/l), median (IQR)	2.9	(2.2–3.8)
Triglycerides (mmol/l), median (IQR)	2.0	(1.5–2.7)
eGFR (ml/min./1.73 m ²), median (IQR)	75.0	(61.5–88.0)
Targeted level of blood pressure for T2DM (<140/80 mmHg) achieved, n (%)	39/539	(7.2)
Other chronic diseases present, n (%)	489/541	(90.4)
Chronic therapy other than OAD present, n (%)	460/541	(85.0)
Fasting glycemia (mmol/l), median (IQR)	7.8	(7.1–9.5)
Postprandial glycemia (mmol/l), median (IQR)	9.3	(8.1–11.5)
HbA1c (%), median (IQR)	7.2	(6.5–8.0)
Diabetes complications present, n (%)	191/539	(35.4)
Unhealthy diet, n (%)	232/536	(43.3)
Advised to increase physical activity, n (%)	296/529	(56.0)
Advised to stop alcohol-consuming, n (%)	90/502	(17.9)
Current smokers, n (%)	141/536	(26.3)
Stress		
Low level (0–13)	73/536	(13.6)
Moderate level (14–26)	446/536	(83.2)
High level (27–40)	17/536	(3.2)

IQR – Interquartile range.

Regarding lifestyle, 232/536 (43.3%) of patients had unhealthy diet, 141/536 (26.3%) were smokers, 296/529 (56.0%) of them had been advised by a doctor or some other healthcare worker to increase physical activity, and 90/502 (17.9%) of them had been advised by a doctor, healthcare worker, or family member to stop drinking alcohol.

Most (21/28 [75.0%]) of the doctors had a general practice, and one of them did not provide data on specialization (Table 2). Their ages ranged from 27 to 58 years, and their work experience ranged from 3 to 30 years. The number of patients

enlisted per doctor ranged from 1500 to 2500. Numbers of patients with type 2 diabetes diagnosis per physician ranged from 30 to 220, and the average daily number of patient visits per physician ranged from 20 to 50.

Clinical inertia

Out of all patients, 261/541 (48.2%) were referred to a specialist by their doctor, and this was treated as clinically non-inert behavior only if the level of HbA1c was higher than 7.5. If the level of HbA1c was 7.5 or lower and referral to a specialist

Table 2. Doctors' characteristics.

Sex, n (%)		
Male	11/29	(37.9)
Female	18/29	(62.1)
Age (years), median (IQR)	35.0	(29.5-43.3)
Specialization, n (%)		
Family physician	7/28	(25.0)
General practice	21/28	(75.0)
Work experience, median (IQR)	8.0	(4.5-14.0)
Distance from the specialist (km), mean (SD)	23.6	(15.83)
Patients in care, mean (SD)	2004.2	(232.69)
Patients with DM2, median (IQR)	190	(150-201)
Average daily number of visits, mean (SD)	37.8	(8.17)

IQR – Interquartile range.

Table 3. HbA1c level (%) and doctors' actions.

	HbA1c							
	≤7.5		7.6–7.9		8.0–8.9		≥9.0	
	n	(%)	n	(%)	n	(%)	n	(%)
Encouraging towards taking prescribed medication (n=485)	303	(62.5)	75	(15.5)	62	(12.8)	45	(9.3)
Increasing the drug dosage (n=141)	54	(38.3)	46	(32.6)	28	(19.9)	13	(9.2)
Changing previous therapy (n=34)	24	(70.6)	0	(0.0)	6	(17.6)	4	(11.8)
Adding a second or third drug (n=69)	46	(66.7)	0	(0.0)	12	(17.4)	11	(15.9)
Initiating an insulin (n=24)	0	(0.0)	4	(16.7)	4	(16.7)	16	(66.7)
Referring to clinical specialist (n=261)	138	(52.9)	42	(16.1)	53	(20.3)	28	(10.7)

was the only action the doctor performed, this was treated as clinically inert behavior. By using this definition, clinical inertia was found in 68/541 (12.6%) of all cases; 20/29 (69.0%) of doctors were clinically inert with at least one of their patients and mean clinical inertia per doctor was 11.5%.

Among actions doctors performed, encouraging patients towards taking prescribed medication was the most common, followed by referring to a specialist and increasing the drug dosage (Table 3).

Prediction of clinical inertia

After univariate analysis of patient and doctor characteristics, a multivariate predictive model was created. All variables that in univariate analysis were associated with clinical inertia at the level of statistical significance of $p < 0.25$ (Hosmer & Lemeshow,

2000) were entered in a multivariate predictive model. Although patient age did not satisfy these criteria, they were entered in the multivariate predictive model as control variables (Table 4).

In the multivariate predictive model, statistically significant predictors of clinical inertia were patient age, level of LDL cholesterol, blood pressure, level of HbA1c, and initiation of current therapy. When adjusted for all variables that were entered in the multivariate predictive model, patients aged 60–69 years had smaller odds for their doctor clinical inertia compared to younger patients, as well as patients with higher levels of LDL cholesterol. Patients whose blood pressure target level (<140/80 mmHg) was not achieved had risk for clinical inertia, as well as those whose current therapy was initiated by both a clinical specialist and an FP/GP. Risk for clinical inertia also increased with higher HbA1c.

Table 4. Univariate and multivariate associations of variables that entered into multivariate predictive model using forward selection procedure with clinical inertia.

	Clinical inertia				Univariate		Multivariate*	
	No		Yes		OR	95% CI	OR	95% CI
	n	(%)	n	(%)				
Patient's age (years)								
40–59 (n=121)	96	(79.3)	25	(20.7)	1		1	
60–69 (n=268)	243	(90.7)	25	(9.3)	0.40	[0.22, 0.72]	0.26	[0.09, 0.75]
70 or more (n=152)	134	(88.2)	18	(11.8)	0.52	[0.27, 0.998]	0.20	[0.06, 0.67]
BMI (kg/m ²)								
<25 (n=104)	90	(86.5)	14	(13.5)	1		1	
25–29.99 (n=223)	196	(87.9)	27	(12.1)	0.89	[0.44, 1.77]	2.74	[0.57, 13.09]
30 and more (n=214)	187	(87.4)	27	(12.6)	0.93	[0.46, 1.86]	4.96	[1.04, 23.68]
LDL cholesterol (mmol/L)								
Normal (<3.0) (n=288)	241	(83.7)	47	(16.3)	1		1	
Increased (≥3.0) (n=251)	230	(91.6)	21	(8.4)	0.47	[0.27, 0.81]	0.44	[0.14, 1.35]
Triglycerides (mmol/L)								
Normal (<1.7) (n=186)	181	(97.3)	5	(2.7)	1		1	
Increased (≥1.7) (n=353)	290	(82.2)	63	(17.8)	7.86	[3.11, 19.92]	3.31	[0.92, 11.86]
Targeted level of blood pressure for T2DM (<140/80 mmHg)								
Achieved (n=39)	38	(97.4)	1	(2.6)	1		1	
Not achieved (n=500)	433	(86.6)	67	(13.4)	5.88	[0.79, 43.54]	13.72	[1.19, 158.35]
Chronic therapy other than OAD								
No (n=81)	77	(95.1)	4	(4.9)	1		1	
Yes (n=460)	396	(86.1)	64	(13.9)	3.11	[1.10, 8.80]	3.31	[0.70, 15.78]
Fasting glycemia (mmol/L)								
≤7.0 (n=128)	108	(84.4)	20	(15.6)	1		1	
>7.0 (n=412)	364	(88.3)	48	(11.7)	0.71	[0.41, 1.25]	0.31	[0.08, 1.21]
Postprandial glycemia (mmol/L)								
≤7.5 (n=80)	72	(90.0)	8	(10.0)	1		1	
>7.5 (458)	398	(86.9)	60	(13.1)	1.36	[0.62, 2.96]	0.15	[0.03, 0.90]
HbA1c (%)								
≤7.9 (n=417)	386	(92.6)	31	(7.4)	1		1	
8.0–8.9 (n=79)	59	(74.7)	20	(25.3)	4.22	[2.26, 7.89]	14.94	[4.47, 49.98]
≥9.0 (n=45)	28	(62.2)	17	(37.8)	7.56	[3.74, 15.30]	21.17	[5.69, 78.71]
Diabetes complications (amputations, neuropathy and retinopathy)								
No (n=348)	327	(94.0)	21	(6.0)	1		1	
Yes (n=191)	144	(75.4)	47	(24.6)	5.08	[2.93, 8.81]	4.46	[1.50, 13.24]

Table 4 continued. Univariate and multivariate associations of variables that entered into multivariate predictive model using forward selection procedure with clinical inertia.

	Clinical inertia				Univariate		Multivariate*	
	No		Yes		OR	95% CI	OR	95% CI
	n	(%)	n	(%)				
Doctor's sex								
Male (n=217)	181	(83.4)	36	(16.6)	1		1	
Female (n=324)	292	(90.1)	32	(9.9)	0.55	[0.33, 0.92]	0.63	[0.25, 1.60]
The Guidelines can be implemented in practice								
Disagree (n=158)	121	(76.6)	37	(23.4)	1		1	
Agree (n=383)	352	(91.9)	31	(8.1)	0.29	[0.17, 0.48]	0.35	[0.14, 0.88]

OR – odds ratio; 95% CI – 95% confidence interval for odds ratio; * n=429 for multivariate prediction.

Discussion

Clinical inertia

The rate of clinical inertia in our research was 12.6%, while in similar research it was from 8.4% in Portugal [13] to 70% in the USA [14]. This large range depends on the research methodology and the country in which it was performed. To reduce this disproportion in different research, it is necessary to precisely define the methodology and differentiate temporary from real clinical inertia. In fact, we define clinical inertia as failure to intensify therapy until it does not deal with reasons for such behavior of the physician. For example, if the physician decides not to change therapy at a given time, this can be justified procedure. Sometimes physicians do not want to change the therapy, even if the of HbA1c findings are above permissible values, because they decided, in communication with the patient, that changing the patient's lifestyle would probably improve the HbA1c. However, this temporary attitude of physicians is often defined, as in our research, as clinical inertia.

In our research, if the physician advised the patient to see a specialist when HbA1c was higher, we did not consider it clinical inertia. Therefore, if the physician thinks, for any reason, that consultation with a specialist is necessary when HbA1c is higher, we cannot say that clinical inertia is present. In many studies of clinical inertia by family medicine physicians, seeing a specialist was not considered because it would clearly influence the level of clinical inertia found in those studies.

Reasons for occurrence of clinical inertia

It is important to know how to reduce clinical inertia, because it leads to many complications with diabetes [16,17]. This can be achieved only if we know the causes of clinical inertia.

A few authors agree that clinical inertia is influenced by factors related to the physicians (50%), patients (30%), and the healthcare system (20%) [10,18].

The doctor's main reason for non-intensifying therapy are "soft excuses", lack of time, and blaming the patients for not following given instructions [19]. A small number of physicians believe that the absence of more energetic treatment causes poorly regulated glycemia by patients. It is well known that judgements of physicians about wishes, motivation, and readiness of patients for change can be wrong and are very often connected to clinical inertia [20].

In our research, we determined that the increase of HbA1c value increases the risk of clinical inertia. Moreover, increased blood pressure, complications with diabetes, BMI >30 kg/m², and higher triglyceride values increase the risk of clinical inertia, and this has been studied previously [1,21,22].

People who take drugs other than OAD for other chronic diseases have higher risk of encountering physician clinical inertia. A meta-analysis by Aleonat covered 174 studies on clinical inertia and found that it is more common in patients with comorbidities, poly medication, and low social and economic status, and not related to the work of physicians [23].

We conclude that physicians pay more attention to the patients who are "healthier" and to those who are considered more disciplined (i.e., those who will follow instructions). We found that 71.4% of physicians in this research considered that the main reason for poorly controlled diabetes is not following the advice and instructions given by the physician, so they "give up" on such patients and pay more attentions to those with lower level of HbA1c.

The physicians with no specialization were clinically inert with 13.1% of examinees, while the physicians specialized in family medicine were clinical inert with 8.3% of examinees. This difference was not statistically significant, but it is congruent with other research showing less inertness by physicians who are specialists [24,25].

Clinical inertia is influenced by lack of knowledge and lack of education, but also by the personal attitudes of the physicians [26–28]. In our research, the physicians who considered that clinical guidelines for treatment of diabetes can be applied in practice were less inert.

What needs to be changed?

To achieve good control of glycemia it is necessary to set the target, to initiate the necessary therapy, and, when needed, to modify therapy in response to patient progress toward the set goal [19].

Better communication between physicians and patients is necessary to avoid accusations of failed treatment. The literature shows that physicians often (as in the present study) blame the patients for treatment failure, but research shows that the patients do not avoid intensification of therapy [29].

Patients with comorbidities, higher levels of HbA1c, polymedication, higher BMI, and higher arterial blood pressure require greater attention and more control in order to achieve glucose regulation with type 2 diabetes patients.

Defined goals of the treatment process, both for physicians and patients, can improve evaluation of the process and help determine the true prevalence of clinical inertia. It is very important to set goals in advance so there will not be any false accusations about set goals when the process is completed, and they are not reached. Sometimes, the only necessary change is in diet or lifestyle in order to achieve better regulation of type 2 diabetes [19].

It is necessary to precisely define the research methodology and to distinguish between temporary and real clinical inertia. The concept of clinical inertia is based on evidence-based medicine, but the measurement method, which is based on goal values,

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period, and decision on therapy intensification, are not enough to determine if the individual decision to changing the therapy is appropriate for the particular patient [30]. In order to calculate real clinical inertia, it is necessary to define “middle outcomes” that contain information about justified reasons for change or lack of change in current treatment [31]. Without this monitoring of clinical inertia, the only thing we can do is to follow the procedures of good clinical practice, and not address the real causes of clinical inertia [32].

Conclusions

Clinical inertia was found in 12.6% of all cases in our research. Higher HbA1c increases the risk of clinical inertia. Also, increase in blood pressure, complications with diabetes, BMI >30 kg/m² as well as higher triglyceride values, cause better chances for appearance of clinical inertia

For better regulation of glycemia and reduction of clinical inertia with the type 2 diabetes patients, advanced specialist training of chosen physicians is needed, along with strengthening of primary health care and encouraging physicians to perform needed procedures. Greater involvement of nurses is also needed; they can help improve outcomes of treatment, reduce clinical inertia, and better educate patients. Increased investments of money, time, and human resources are needed to reduce clinical inertia, and these are needed more than ever before.

Limitations

There are limitations to our study because it was overview research; therefore, we could not follow the examinees and we did not determine the reasons for (not) changing the therapy, so we could not determine if it was a case of temporary or continuous clinical inertia. We did not include drug availability data or social and economic status, which also could be predictors of clinical inertia.

Conflicts of interest

None.

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