

Preventive examinations for high-risk drugs with a computerized clinical decision support system

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Conclusion

We implemented a clinical decision support system (CDSS) alerting and ordering the monitoring examinations for high-risk drugs in an outpatient setting. The CDSS has potential to increase the monitoring examinations, but the acceptance rates of alerts for monitoring examinations were limited. Further studies are needed to explore the generalizability to other drugs.

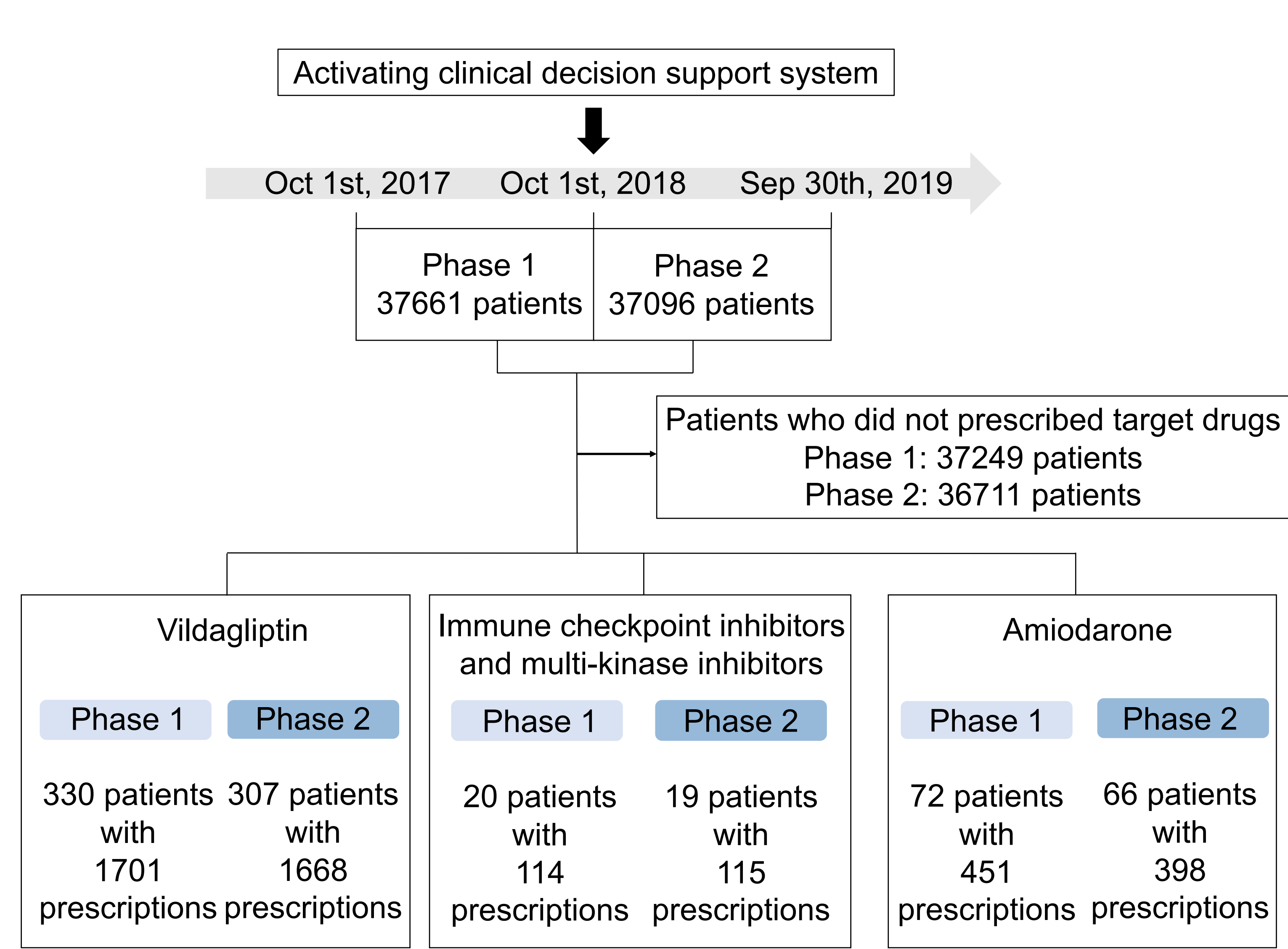
Introduction

Monitoring examinations are recommended in official drug package inserts to prevent severe adverse drug events (ADEs), but such recommendations are often missed.^{1,2)} To improve the ordering examinations, we investigated the effectiveness of a CDSS that alerting and ordering the monitoring examinations for high-risk drugs in an outpatient setting.

Methods

We conducted a prospective cohort study at a tertiary care teaching hospital. We developed the CDSS for recommending examinations for ADEs prevention based on official drug package inserts of the target drugs: vildagliptin, immune checkpoint inhibitors (ICIs), multi-kinase inhibitors (MKIs), and oral amiodarone. The CDSS automatically provided the alerts for recommending liver function tests for vildagliptin, thyroid function tests for ICIs and MKIs, and a slit-lamp examination of the eyes for oral amiodarone when patients were prescribed the drugs but not examined for a fixed period. The order of laboratory tests was automatically appeared if alert was accepted. The observation period was one year before activation (phase 1) and the following one year after activation of the CDSS (phase 2) (Figure 1). The alerts were hidden in the background and did not appear on the display in phase 1. In phase 2, alerts were displayed and physicians could see the alerts and decide whether to accept the guided examinations. The outcomes were the number of alerts and the actual orders of recommended examinations. In the prescription-level data, the proportions of prescriptions with alerts or examinations per all prescriptions of target drugs were compared between phase 1 and phase 2 in each cohort using chi-squared tests. We conducted interruptive time series analyses to evaluate the differences in temporal trend of proportion of alerted prescriptions per month between phases.

Figure 1. Study flowchart



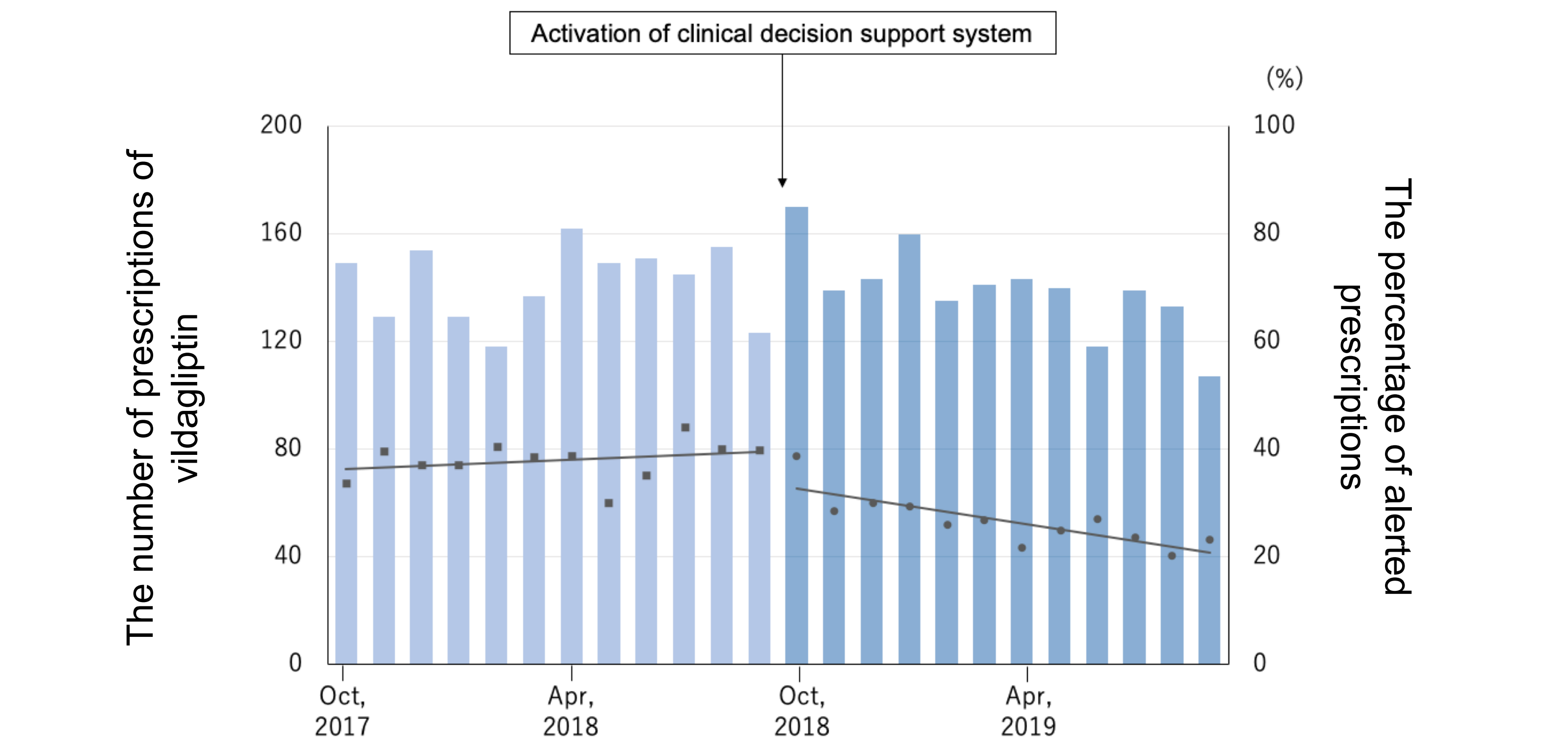
References

- 1) *J Gen Intern Med.* 2011;26(2):148-53
- 2) *J Gen Intern Med.* 2005;20(12):1120-26
- 3) *BMJ.* 2020;370:m3216
- 4) *BMJ Qual Saf.* 2017;26(3):217-25
- 5) *Sci Rep.* 2022;12(1):14967
- 6) *J Clin Pharm Ther.* 2020;45(6):1398-1404

Results

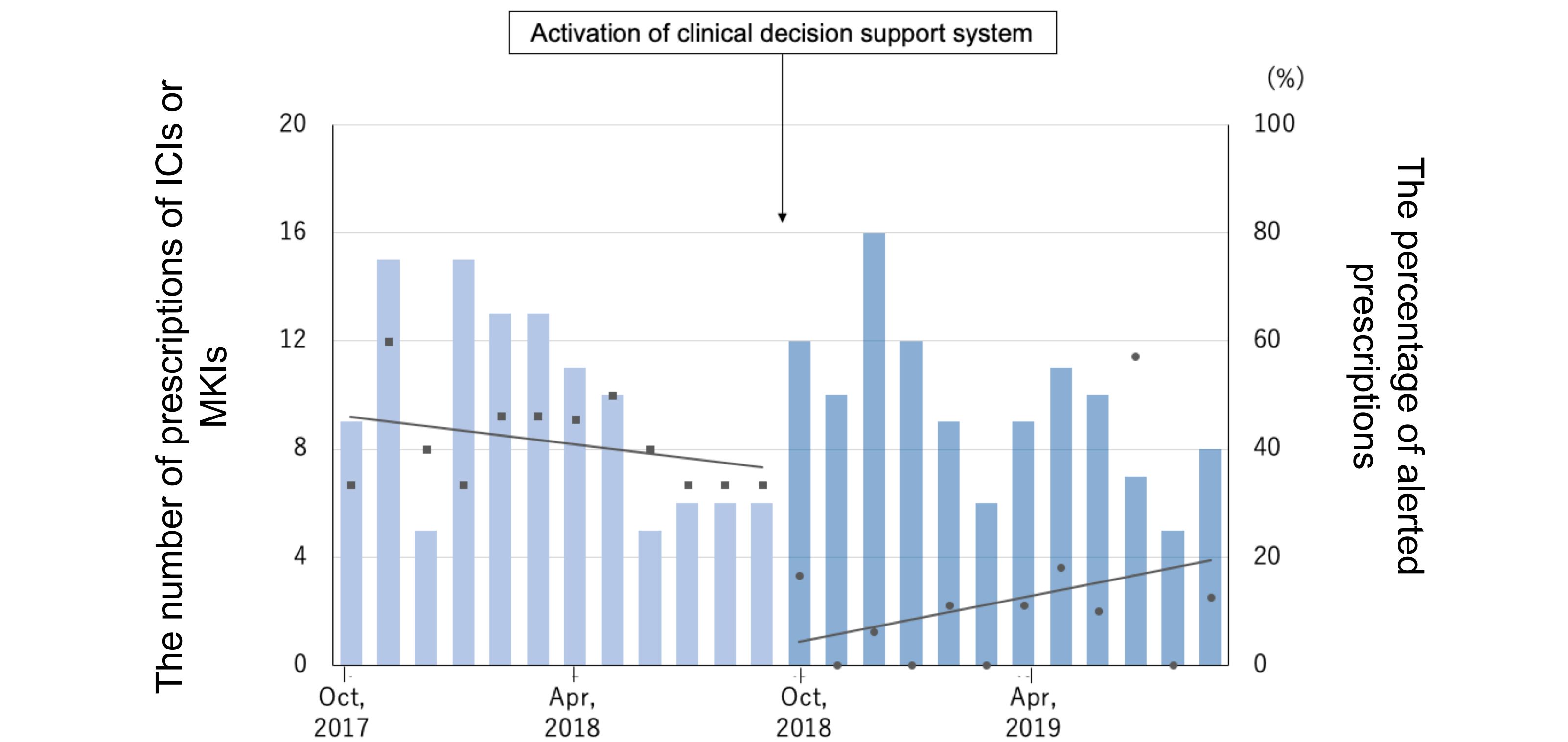
After activation of the CDSS, the proportion of prescriptions with necessitating the alerts were decreased and the proportion of monitoring examinations were increased numerically for all target drugs, but the acceptance rates of alerts were limited.

	Patients, n (%)		Prescriptions, n (%)			
Vildagliptin	Alert	Exam	Alert	P value	Exam	P value
Phase 1 (330 patients with 1701 prescriptions)	155 (47)	15 (4.5)	643 (38)		15 (0.9)	
Phase 2 (307 patients with 1668 prescriptions)	143 (47)	58 (19)	452 (27)	<0.0001	67 (4.0)	<0.0001



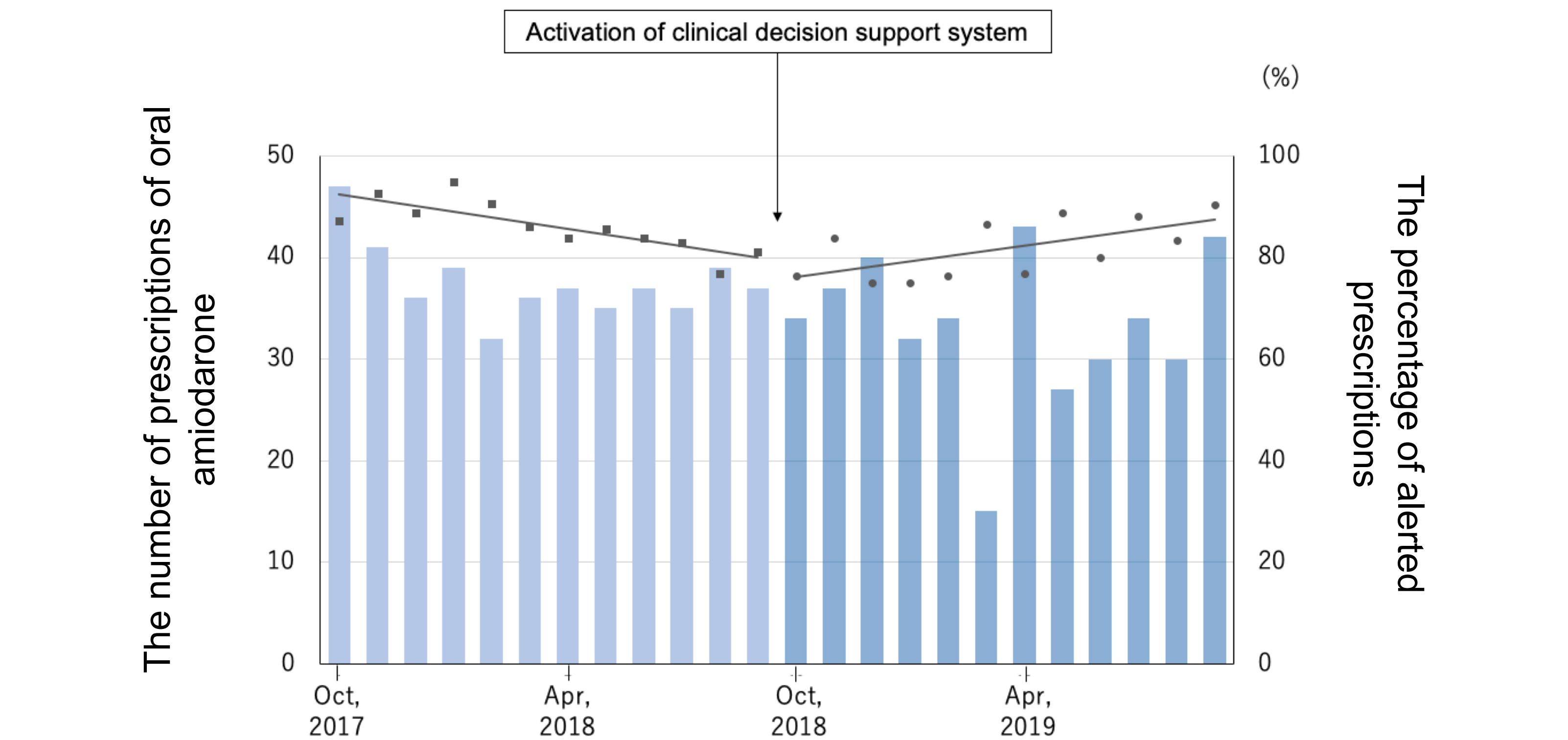
Straight lines indicate regression lines for alert percentages in each phase. The slopes of the regression lines were 0.28 and -1.08 for phase 1 and phase 2, respectively (P = 0.0026).

	Patients, n (%)		Prescriptions, n (%)			
ICIs and MKIs	Alert	Exam	Alert	P value	Exam	P value
Phase 1 (20 patients with 114 prescriptions)	11 (55)	3 (15)	49 (43)		3 (2.6)	
Phase 2 (19 patients with 115 prescriptions)	9 (47)	6 (32)	13 (11)	<0.0001	8 (7.0)	0.13



The slopes of the regression lines were -0.86 and 1.38 for phase 1 and phase 2, respectively (P = 0.15).

	Patients, n (%)		Prescriptions, n (%)			
Oral amiodarone	Alert	Exam	Alert	P value	Exam	P value
Phase 1 (72 patients with 451 prescriptions)	64 (89)	4 (5.6)	389 (86)		10 (2.2)	
Phase 2 (66 patients with 398 prescriptions)	62 (94)	8 (12)	324 (81)	0.055	12 (3.0)	0.47



The slopes of the regression lines were -1.13 and 1.03 for phase 1 and phase 2, respectively (P = 0.0002).

Discussion

- Interruptive alerts make it easier to follow recommendations, but can lead to alert fatigue.³⁾
- If physicians felt the alert was more minor than the target disease, the acceptance rate of alerts may have been lower.⁴⁾
- High-risk drugs that were frequently prescribed by many physicians irrelevant of the specialty could be effective target drugs.^{5,6)}