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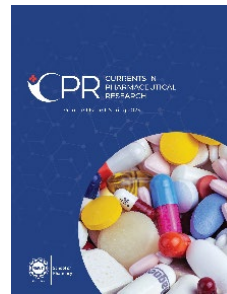
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Title: Impact of Community Pharmacy-based Primary Care Clinic on the Management of Chronic Diseases in Saudi Arabia

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Impact of Community Pharmacy-based Primary Care Clinic on the Management of Chronic Diseases in Saudi Arabia

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ABSTRACT

In Saudi Arabia, community pharmacies offer individualized, patient-centered care through primary care clinics. To accomplish the healthcare goals set in the country's Vision 2030, this method plays a key role in managing chronic diseases and improving medication management. Hence, this study aims to assess the effectiveness of primary care clinics within community pharmacies in Saudi Arabia, with a focus on their role in delivering personalized, patient-centered care. A chart review approach was utilized in this study conducted at Aldwaa Pharmacy Clinic in Riyadh, Saudi Arabia. The primary objective was to assess the variations in hemoglobin A1C (HbA1c) (%) from baseline. In the same way, the evaluation of blood pressure (BP), body mass index (BMI), fasting glucose (FG), neuropathy, retinopathy, and cardiovascular disease (CVD) symptoms was included as the secondary objective. Measurements were taken at the start and during the two follow-up periods, with patient satisfaction measured after the final visit. It was determined that pharmacist-led interventions significantly dropped HbA1c levels from a median of 7.3% at baseline to 6.9% in both Period 1 and Period 2 follow-ups ($p < 0.001$). BMI also exhibited significant improvement, dropping from a median of 32.5 kg/m² at baseline to 30.7 kg/m² by the Period 2 follow-up ($p = 0.035$). Furthermore, patient satisfaction remained notably high, with over 93% reporting being very satisfied with the services. While other secondary outcomes showed improvement, the changes were not statistically significant. The study concluded that community pharmacy-based primary care clinic positively impacts patient health outcomes and patient satisfaction. So, integrating these services into the broader healthcare system is essential to achieve national healthcare goals.

Keywords: chronic disease management, community pharmacy, diabetic

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patients, pharmaceutical care, primary care clinic

1. INTRODUCTION

Pharmaceutical care in community pharmacy (CP) is a patient-centered approach that aims to maximize the results of medication therapy. It involves a wide range of activities and responsibilities that extend beyond the traditional role of distributing medications [1]. On a global scale, Community pharmacies play a pivotal role in delivering extensive healthcare services, as well as optimizing and ensuring the safe and effective use of medicines. Pharma practitioners within the community come in contact with patients on a daily basis, furnishing medical consultation, pharmaceutical edification, and general facilitation to foster the precise use of their prescriptions. They actively assist patients by virtue of such devotion while overseeing their health [2]. To execute comprehensive drug management is one of the vital roles of community pharmacists. They administer medication reconciliation to limit any medicinal dosage errors by going over the patient's prescription. They also consult with the patients regarding their medicinal consistency and in adopting appropriate measures, including guiding the patients on the significance of adhering to their medication, identifying potential contingencies, and addressing approaches to enhance compliance. Simultaneously, calibrating for the fatal reactions of medicinal drugs is a fundamental component of healthcare services offered by community pharmacies [3].

A multitude of studies affirm that pharmaceutical services delivered by community pharmacies significantly contribute to the improvement of patients' health. Evidence from an extensive meta-analysis of 52 studies shows that, compared to standard care groups, patients receiving pharmacist-led interventions experienced a significant reduction in systolic blood pressure (SBP), diastolic blood pressure (DBP), and HbA1c levels [4]. Akin to the Rx EACH study, a large-scale randomized investigation affirmed the role of community pharmacist-driven programs in mitigating the risk of cardiovascular diseases (CVDs). Patients in the intervention group experienced 21% greater reduction in CVD risk, along with a significant improvement in LDL cholesterol levels, SBP, HbA1c levels, and smoking cessation rates [5]. These studies accentuate the integral role community pharmacists play in containing chronic conditions and reducing the risk factors of CVDs.

Complimentarily, research brings to light the positive impact of community pharmacist-driven interventions to the fore. A study carried out in western Nepal showed that CP-based educational interventions significantly improved patients' knowledge, practices, and management of hypertension, with a notable drop in SBP and DBP [6]. In a like manner, a pharmacist-led diabetes care program in the United States, organized at a community health center, established notable fall in HbA1c levels, along with improvements in SBP, LDL cholesterol, and the quality of life measures [7]. This investigation disclosed that the pharmacist's involvement in patient care, be it in a resource-limited setting, leads to meaningful clinical and behavioral improvements across various chronic conditions. An illustration of this development are the primary care clinics introduced within some pharmacies in the Kingdom of Saudi Arabia (KSA), offering a range of services targeted at improving patient health. These clinics continue to mirror the growing role of community pharmacies in enhancing healthcare delivery in the country [8]. This aligns with Saudi Arabia's Vision 2030 for healthcare development under the supervision of the Ministry of Health. A study conducted in the Asir region assessed the clinical services provided by community pharmacists, revealing their varied levels of engagement in public health initiatives. The highest involvement was reported in areas such as weight management (61.7%), sexual health (60.6%), and healthy eating (57.5%). On the other hand, reduced people participation was observed in vaccination and immunization services (21.8%) and dyslipidemia screening (30.6%) [9]. Despite these advancements, there remains a lack of comprehensive data to confirm the efficacy of these services in KSA [10].

This study is conducted at a time when there is rising emphasis on improving the quality of healthcare services in the KSA. The significance of this research lies in its focus on evaluating the effectiveness of the primary care clinic within community pharmacies in Saudi Arabia, with a particular emphasis on their role in providing personalized, patient-centred treatment. Moreover, it aims to evaluate their impact on medication management, chronic disease control, and overall healthcare access. Further, this study intends to contribute valuable insights that can guide future healthcare practices and policies, ultimately improving public health.

2. METHODOLOGY

2.1. Study Setting

This study was conducted at Aldwaa Pharmacy Clinic in Riyadh, KSA.

2.2. Study Design

It is a retrospective study conducted using a retrospective chart review methodology.

2.3. Study Subjects

2.3.1. Inclusion Criteria. All patients with pre-diabetic or diabetic HbA1c levels utilizing the clinic's services were included.

2.3.2. Exclusion Criteria. Patients who did not attend follow-up visits (at least two visits) after their baseline visit or those with incomplete outcome data were excluded.

2.4. Sample Size

A total of 89 patients were included in the study, comprising all individuals who visited the clinic during the study period and met the eligibility criteria.

2.5. Study Procedure

2.5.1. Pharmaceutical Care Intervention. Primary care clinics offer personalized pharmaceutical care services designed for individual patients. Services commence when patients book appointments through the app or visit the pharmacy in person, with follow-up visits typically occurring every three months. During these visits, the pharmacist collects patient information and provides various care services, including patient education, counseling, medication reconciliation, and lifestyle modifications. Health assessments encompass blood sugar testing (HbA1c and fasting glucose), uric acid levels, blood pressure readings, total cholesterol level, glomerular filtration rate, eye exams, retinopathy and neuropathy evaluations, diabetic foot exams, anxiety and depression assessment, annual vaccination, and weight management. Following the sessions, patients receive a satisfaction survey via SMS to evaluate both the services and the pharmacist.

2.6. Outcomes Measures

Any change in hemoglobin A1C (HbA1c) (%) from baseline marked the

primary outcome for this study. Secondary outcomes included the assessment of blood pressure (BP), body mass index (BMI), fasting glucose (FG), neuropathy, retinopathy, and cardiovascular disease (CVD) symptoms including angina, heart failure, claudication, and decreased exercise tolerance. The outcomes were evaluated at baseline and during two follow-up intervals, referred to as Period 1 and Period 2. Patient satisfaction was assessed at the end of the Period 2 visit, with an average of 3-month interval between each period.

2.7. Data Management

Data were collected from patients' files through a retrospective chart review using a data collection sheet. The study period extended from January 1, 2021 to May 30, 2024. Data were numerically coded and entered into the software. Missing data were addressed using variable imputation.

2.8. Statistical Analysis

All analyses were conducted using IBM SPSS 29 software to analyze the effectiveness of community pharmacist-based clinical services. This was achieved by examining the health-related variables and outcomes among pre-diabetic and diabetic patients to identify the recurrent trends and significant changes over time. The investigation mainly focused on HBA1c levels and changes in BMI, FG, and BP were taken as key indicators of metabolic and cardiovascular health. Additionally, other variables such as neuropathy, retinopathy, CVD symptoms, and satisfaction among the participants were also explored.

Descriptive statistics, including means, medians, minimums, and maximums, were used to summarize the study variables. As data was not normally distributed, the Friedman test was conducted to assess differences across points in time for repeated measures. Pairwise comparisons were performed using the Wilcoxon Signed Ranks test to identify the specific points in time with significant differences. A blinded statistical assessor was used to conduct the analysis of the outcomes.

2.9. Ethical Considerations

Privacy and confidentiality were maintained, with no identifying information about healthcare professionals or patients disclosed. Identifiers were securely stored separately from the data files, with access restricted to the investigators approved by the Institutional Review Board (IRB). Ethical

approvals were obtained from the Ethical Review Board at Princess Nourah bint Abdulrahman University.

3. RESULTS

3.1. Baseline Characteristics

In this study, a total of 89 participants were retrospectively included. The majority of the participants were male (86.2%) and the median age was 44 years. The vast majority (93.3%) were diabetic, while the remaining were classified as pre-diabetic. Regarding comorbidities, 32.6% had none, while the majority (34.8%) had two. Dyslipidemia was observed in 35.9% of the participants and 17.9% were classified as obese. Further, coronary artery disease was present in 3.4% of participants, whereas hypothyroidism, mitral regurgitation, benign prostatic hyperplasia, thrombocytopenia, and chronic allergic rhinitis were each found in fewer than 2% of cases. In terms of family history, 61.8% reported a positive family history of medical conditions, while the remaining indicated no such history (Table 1).

Table 1. Baseline Characteristics

Comorbidity	<i>N</i>	%
Diabetes		
Pre-diabetic	6	6.7
Diabetic	83	93.3
DLP	32	35.9
Obese	16	17.9
Coronary artery disease	3	3.4
Thrombocytopenia	1	1.1
BPH	1	1.1
Disc	1	1.1
Chronic allergic rhinitis	1	1.1
Mitral regurgitation	1	1.1
Hypothyroidism	1	1.1
Gastritis	1	1.1
H-pylori	1	1.1
Number of comorbidities		
0	29	32.6
1	23	25.8
2	31	34.8

Comorbidity	<i>N</i>	%
3	6	6.7
Family History		
Diabetes (DM)	51	57.3
Hypertension (HTN)	3	3.4
Dyslipidaemia (DLP)	1	1.1

3.2. Primary Outcome (Glycated Haemoglobin Blood)

The analysis of HBA1c levels over three time periods (Baseline, Period 1, and Period 2) showed that the median HBA1c decreased from 7.3 at Baseline to 6.9 in both Period 1 and Period 2 (see Table 2 and Figure 1 below). Friedman test indicated a significant difference across the three time periods ($p = 0.001$). Pairwise comparisons using the Wilcoxon Signed Ranks test showed significant reductions in HBA1c from Baseline to Period 1 ($p = 0.001$) and from Baseline to Period 2 ($p < 0.001$). However, any change in HBA1c from Period 1 to Period 2 was not statistically significant ($p = 0.158$).

Table 2. HBA1c Levels

	Baseline	Period 1	Period 2	chi-square (<i>p</i>)
Friedman Test				
Mean	7.99	7.29	7.09	14.047(0.001)
Median	7.3	6.9	6.9	
Minimum	4.8	4.8	4.8	
Maximum	14	11.8	11.5	
Wilcoxon Signed Ranks Test				
Z(p-value)	3.257(0.001)	1.411(0.158)	8.149(<0.001)	

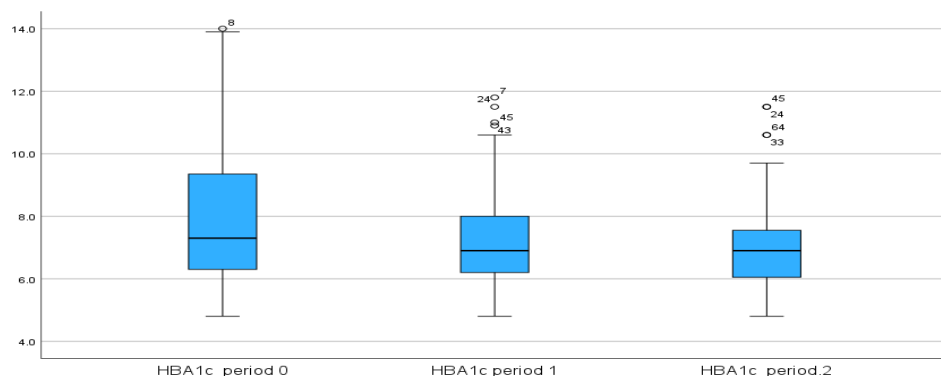


Figure 1. HBA1c Levels

3.3. Correlation of Follow-Up Duration Between Period 1 and Period 2

The results of Spearman correlation analysis depicted in Table 3 highlight a strong and statistically significant relationship between HbA1c levels and follow-up visits at Baseline, Period 1, and Period 2 ($p < .001$), particularly between Period 1 and Period 2 ($r = 0.767$). This indicates consistent trends in glycemic control across various points in time. In contrast, the cross-correlation between visit periods and HbA1c values was relatively weak and mostly not significant statistically, suggesting that visit timing alone had a limited direct association with changes in HbA1c levels.

Table 3. Correlation Matrix between Visit Periods and HbA1C

		HbA1c Period 1	HbA1c Period 2
Visit Period 1	Correlation	0.186	0.232
	<i>p</i> -value	0.085	0.03
Visit Period 2	Correlation	-0.007	0.033
	<i>p</i> -value	0.947	0.761
HbA1c Baseline	Correlation	0.528	0.578
	<i>p</i> -value	<.001	<.001
HbA1c Period 1	Correlation	1	0.767
	<i>p</i> -value		<.001
HbA1c Period 2	Correlation	0.767	1
	<i>p</i> -value	<.001	

3.5. Secondary Outcomes

3.5.1. Body Mass Index (BMI). Of the 25 participants with available data on BMI in all three periods, median BMI decreased from 32.5 kg/m² at Baseline to 31.6 kg/m² in Period 1 and further to 30.7 kg/m² in Period 2. The Friedman test indicated a significant difference in BMI across the three periods ($p = 0.008$). Although there was no significant difference in BMI between baseline and Period 1 ($p = 0.177$). However, significant differences were observed between Period 1 and Period 2 ($p = 0.018$) and between Period 0 and Period 2 ($p = 0.035$), suggesting an improvement in BMI over time (Table 4).

Table 4. BMI (in kg/m²) Values

	Baseline	Period 1	Period 2	Chi-square (<i>p</i>)
Friedman Test				
Mean	32.04	31.21	31.06	10.08 (0.008)
Median	32.50	31.60	30.70	
Minimum	23	23	22	
Maximum	39	56	39	
Wilcoxon Signed Ranks Test				
Z (<i>p</i> -value)	-1.351 (.177)	-2.365(.018)	-2.105(.035)	

3.5.2. Fasting Glucose (FG). Fasting glucose (FG) levels were only observed by a few participants over the three periods. Table 5 shows that the median FG decreased from 123.5 mg/dl at Baseline to 112 mg/dl in Period 1. Then, it decreased to 107.5 mg/dl in Period 2, with no statistically significant change in FG over the three points in time ($p = 0.499$).

Table 5. FG Values of Friedman Test

	Baseline	Period 1	Period 2	Chi-square (<i>p</i>)
Mean	130	112.83	131.5	1.60 (0.499)
Median	123.5	112	107.5	
Minimum	90	80	89	
Maximum	212	158	266	

3.5.3. Blood Pressure (BP). Systolic blood pressure (SBP) and diastolic blood pressure (DBP) for 48 and 45 participants were analyzed, respectively. The results are shown below in Table 6. The median SBP and DBP across the three periods was quite similar. Friedman test did not show any statistically significant changes ($p = 0.894$ and $p = 0.177$, respectively) (Table 6).

Table 6. BP Values of Friedman Test

	Baseline	Period 1	Period 2	Chi-square (<i>p</i>)
SBP (<i>n</i> =48) Over Three Periods				
Mean	126.44	125.60	127.21	0.225 (0.894)
Median	123.5	122.5	128	
Minimum	100	100	75	
Maximum	160	174	175	
DBP (<i>n</i> =45) Over Three Periods				
Mean	79.24	79.06	82.36	3.463 (0.177)
Median	80	78	80	

	Baseline	Period 1	Period 2	Chi-square (<i>p</i>)
Minimum	54	54	47	
Maximum	110	130	154	

3.6. Neuropathy, Retinopathy, and CVD Symptoms

The number of participants with neuropathy showed a slight fluctuation over time, decreasing from 8 at Baseline to 5 in Period 1 and then rising to 7 in Period 2. Regarding retinopathy, the number of participants without retinopathy gradually increased over time. Meanwhile, the number of participants without CVD symptoms remained consistently high throughout the study. Cochran's Q test indicated no significant changes in neuropathy status, retinopathy status, or CVD symptoms across the three periods (Table 7).

Table 7. Neuropathy Status, Retinopathy Status, and CVD Symptoms

	Yes	No	Cochrans Q (<i>p</i> -value)
Neuropath			
Baseline	8	81	0.933 (0.627)
Period 1	5	84	
Period 2	7	82	
Retinopathy			
Baseline	7	82/	1.50 (0.472)
Period 1	4	85	
Period 2	4	85	
Cardiovascular symptoms			
Baseline	2	87	2 (0.368)
Period 1	0	89	
Period 2	2	87	

3.7. Patient Satisfaction

Patient satisfaction was tracked by post-visit (Period 2 visit) SMS surveys. The analyzed satisfaction levels revealed the perceived service quality at the Aldwaa Pharmacy Clinic. The distribution of satisfaction scores regarding various service aspects indicated overall satisfaction among the respondents to be very high.

3.7.1. Satisfaction Trends Across Service Aspects. Among the 89 participants, the majority of the responses reported "very satisfied" for all service categories: service quality (93.96%), pharmacist satisfaction

(94.58%), pharmacist information (92.49%), clinic privacy (93.41%), and clinic hygiene (93.67%). A smaller proportion of participants reported being "satisfied" with percentages ranging from 3.56% for pharmacist satisfaction to 5.17% for pharmacist information. The percentage of respondents who were "not satisfied" or "not satisfied at all" was minimal, indicating the overall high levels of satisfaction with the services provided, further emphasizing the positive impact of pharmacist involvement in patient care, especially in managing chronic diseases.

Table 8. Percentage Distribution of Satisfaction Levels across Service Aspects

Category	Service Quality (%)	Pharmacist Satisfaction (%)	Pharmacist Information (%)	Clinic Privacy (%)	Clinic Hygiene (%)
Very Satisfied	93.96%	94.58%	92.49%	93.41%	93.67%
Satisfied	3.94%	3.56%	5.17%	4.54%	4.35%
Not Satisfied	0.25%	0.14%	0.40%	0.32%	0.18%
Not Satisfied at All	1.84%	1.71%	1.93%	1.73%	1.79%

4. DISCUSSION

This study aimed to investigate the effectiveness of the pharmaceutical care services provided at a community pharmacy-based primary care clinic in Riyadh, KSA. The primary outcome was the change assessed in HbA1c among patients with diabetes mellitus and pre-diabetes. Secondary outcomes included the assessments of BMI, FG, BP, neuropathy, retinopathy, CVD symptoms, and patient satisfaction.

The main findings of this study showed a significant reduction in HbA1c levels and BMI over time, whereas FG, BP, neuropathy, retinopathy, and CVD symptoms showed no significant changes. Notably, more than 90% of patients reported being "very satisfied" with different aspects of care.

Although the current study was conducted in KSA, its findings are comparable to those of previous studies in different countries and health systems. The study shows that the provision of community pharmacy-based pharmaceutical care has the potential to reduce HbA1c from 7.3 to 6.9 ($p < 0.001$) with follow-up [11]. This is consistent with the results obtained by prior studies, such as the study by Yuan et al. [4], which found that pharmacist-led interventions had a significant beneficial effect on glycemic

control, reducing HbA1c (weighted mean difference (WMD), 95% CI: -0.565, -0.905 to -0.224). Similarly, Scott et al. [7] reported positive outcomes of a pharmacist-managed diabetes program, showing a significant reduction in HbA1c levels (95% CI: 0.08–1.78, $p < 0.05$), supporting the key role of community pharmacy-based services in chronic disease management.

Moreover, a significant reduction in BMI was observed, with BMI decreasing from a median of 32.5 to 30.7 kg/m² ($p = 0.035$). A similar reduction was reported in the study by Alfayoumi et al. [12], where BMI significantly decreased from 30.8 to 27 kg/m² ($p < 0.001$) among patients enrolled in a pharmacist-led diabetes education and monitoring program.

4.1. Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. Firstly, the retrospective design (which relied on existing documentation through a chart review methodology) inherently introduces several challenges, such as incomplete or inconsistent data and an inability to control for confounding variables. Secondly, the absence of a comparison group makes it difficult to attribute the observed changes solely to intervention. Finally, the study was conducted at a single pharmacy chain (Aldwaa Pharmacy Clinic) in Riyadh with a small sample size of 89 participants, which restricts the generalizability of the findings to other regions or healthcare settings within Saudi Arabia. However, a multicentre service was not feasible because of the fact that primary care clinic is a new type of clinic introduced in Saudi Arabia. These limitations highlight the areas for improvement which should be focused in future research to strengthen the validity and applicability of the results.

4.2. Implications for Community Pharmacy Practice in Saudi Arabia

Data from this study could help benchmark clinical practice. It is hoped that this primary care clinic would be incorporated into the mainstream of Saudi community pharmacy practice. Integrating primary care clinics into routine practice would be of significant interest to the organisations attempting to implement advanced services to enhance healthcare delivery.

The results enhance the emerging role of community pharmacy in chronic disease management. Considering the remarkable reduction in HbA1c levels and BMI, it is essential to incorporate pharmaceutical care services in community pharmacies to enhance the outcomes of diabetes

management. High patient satisfaction indicates that community pharmacy-based clinics are well-accepted and enhance patient involvement in their own healthcare.

The establishment of more community pharmacy-based primary care clinics across Saudi Arabia may provide relatively easy access to address medical needs, to manage chronic diseases more effectively, and to prevent or slow down the disease progress. Policymakers must consider their integration within the national healthcare framework to help facilitate the realization of Saudi Vision 2030 for improved healthcare quality and accessibility [13-15]. Additionally, further studies with larger sample sizes and longer follow-ups are needed to assess long-term outcomes.

4.3. Conclusion

The study concluded that pharmaceutical care services provided at a community pharmacy-based primary care clinic improved glycemic control for diabetic patients. Along with lowering BMI, community pharmacy-based services helped to reduce FG, BP, neuropathy, retinopathy, and CVD symptoms, while also enhancing patient satisfaction with the services and their interactions with the pharmacist, although the latter require more attention and strategic planning for improvement. These results complement Saudi Arabias Vision 2030 goals for healthcare development by highlighting the vital role community pharmacy-based clinics play in improving healthcare delivery, aiding in the treatment of chronic diseases, and improving health outcomes. However, further research with larger sample sizes and long-term follow-up is needed to validate these outcomes and explore their broader applications.

Author Contribution

Basmah Albabbtain: conceptualization, methodology, investigation, formal analysis, writing-original draft, writing-review & editing. **Lama Altuwijri:** conceptualization, methodology, investigation, data curation, formal analysis, writing-original draft, writing-review & editing. **Hadeel Almutairi:** conceptualization, methodology, investigation, data curation, formal analysis, writing-original draft, writing-review & editing. **Mohammed Alkhars:** data curation, writing-review & editing

Conflict of Interest The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as causing a potential conflict of interest.

Data Availability

The raw data supporting the conclusions of this study will be made available by the authors without undue reservation.

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Generative AI Disclosure Statement

The authors did not use any type of generative artificial intelligence software for this research.

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