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ORIGINAL RESEARCH

Temporal Relationship Between Treatment Burden and Self-Care and Its Impact on Systolic Blood Pressure and Hypertension Control

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Background: Effective blood pressure (BP) control necessitates sustained adherence to self-care regimes; however, adherence can be undermined by excessive treatment burden. The longitudinal dynamics between treatment burden and self-care behaviours remain less understood, with particularly limited understanding of how the temporal relationship may influence BP control.

Objective: This study sought to examine the temporal relationship between treatment burden and self-care while investigating their collective longitudinal impact on both systolic BP levels and hypertension control.

Methods: We investigated a community-based longitudinal cohort of 1718 hypertensive patients (mean age 54.6 ± 11.9 years; 28.5% with coexisting diabetes). Treatment burden and self-care were measured at two time points (T1 and T2), separated by an approximate 11-month period, with BP measured in the subsequent 14 months (T3). We employed cross-lagged panel modelling and mediation analysis to examine the temporal relationship between treatment burden and self-care (from T1 to T2) and their collective influence on systolic BP and hypertension control (T3).

Results: After adjusting for covariates, we observed a significant cross-lagged path coefficient between treatment burden (T1) and self-care (T2) in the total sample (path coefficient = −0.089, $P<0.001$). The association remained consistent across subgroups–including individuals aged less than 60 years (path coefficient = −0.083), aged 60 years and above (path coefficient = −0.113), diabetic patients (path coefficient = −0.103), and non-diabetic patients (path coefficient = −0.085), with all $P<0.001$. The mediation analyses demonstrated that self-care (T2) accounted for 10.7% ($P<0.001$) and 11.1% ($P<0.001$) of the total effect of treatment burden (T1) on systolic BP and hypertension control (T3), respectively.

Conclusion: Our study findings establish a temporal sequence wherein elevated treatment burden precedes suboptimal self-care capacity, which in turn adversely affects subsequent BP control. The nature of such association opens the door for further primary care research on developing more sustainable hypertension management strategies.

Keywords: treatment burden, self-care, systolic blood pressure, hypertension control, cross-lagged panel model, mediation analysis

Introduction

Elevated blood pressure (BP), particularly high systolic BP, is the most significant risk factor for premature death worldwide.[1] Data from Chinese national surveys among adults aged 35–75 years indicate low hypertension control rates, with fewer than one in twelve adults with hypertension achieving target BP levels.[2] The clinical complexity of hypertension is compounded by its frequent coexistence with comorbidities,[3] resulting in the wide inclusion of hypertension in multimorbidity indices.[4] These intersecting health burdens have been shown to reduce quality of life

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and functional capacity while exacerbating poor hypertension control and mortality risk.[5,6] The management of hypertension and its accompanying comorbidities in patients with duplicative and fragmented care often engenders treatment burden. This has been defined as the cumulative "work" of patienthood, encompassing attending medical appointments, undergoing diagnostic procedures, receiving therapeutic regimens, self-monitoring, and making lifestyle modifications, alongside their psychosocial impact on functioning and well-being.[7–9] These aspects of burden are often exacerbated by intensified treatment.[9]

Effective hypertension management necessitates sustained, multifaceted self-care, incorporating dietary changes, smoking cessation, moderation of alcohol consumption, physical activity, self-monitoring, and medication.[10–12] While robust evidence substantiates the effectiveness of self-care in achieving BP control,[13,14] the asymptomatic nature of hypertension may tend to undermine patients' adherence to symptom-driven treatment strategies.[15,16] The reciprocal relationship between treatment burden and self-care has been posited, with empirical studies demonstrating that escalating treatment burdens often correlate with poorer compliance across pharmacological, exercise, and dietary domains.[17–20] Meanwhile, intensified self-care regimens may be conversely linked to a rise in perceived treatment burden.[21] Nevertheless, evidence from population studies regarding the temporal relationship between treatment burden and self-care is largely scanty, with limited understanding of the extent to which such relationship may influence BP control.

The present study aimed to explore the temporal relationship between treatment burden and self-care through cross-lagged panel analysis, while further examining their longitudinal impact on systolic BP levels and hypertension control through mediation analysis.

Materials and Methods

Study Design and Participants

We conducted a prospective observational cohort study within a network of 33 community health centres (CHCs) managed by a tertiary-level hospital in Shenzhen, southern China. These CHCs function as primary care extensions of tertiary hospitals, delivering standardised, free-of-charge national basic public health (BPH) services in the community.[22,23] All hypertensive patients enrolled in the BPH programme from 2017 onwards were considered eligible for follow-up assessments. We employed a three-wave longitudinal design, ie, an initial enrolment assessment of treatment burden and self-care (T1), an interim follow-up evaluation of these measures after approximately 11 months (T2), and the final follow-up measurement of BP (T3; an approximate 14-month post-T2 observation) to capture any delayed clinical effects.

Measurement of Treatment Burden

Treatment burden was measured using the 15-item Treatment Burden Questionnaire (TBQ), an instrument originally developed in French.[24] The tool was subsequently translated into English and validated among patients with long-term conditions.[25] A Mandarin Chinese version of the TBQ instrument (TBQ_AU1.0_cmn-CN_RC) was developed by our team, commissioned by the Mapi Research Trust, following a standard forward and backward translation procedure. Our work adhered to the item structure of the English version without substantive modifications, additions, or omissions.[26] Linguistic validation was conducted by a review panel consisting of two senior general practice (GP) physicians and ten primary care patients with multimorbidity. Cultural differences in language usage were carefully examined, with minor adaptations made to optimise cultural relevance to the Chinese healthcare context while maintaining translation equivalence. Component matrix yielded from the factor analysis accounted for 71.3% of the total variance. Psychometric evaluation revealed excellent internal consistency, as evidenced by a Cronbach's α coefficient of 0.884, complemented by strong test–retest reliability with intraclass correlation coefficients (ICC) ranging from 0.725 to 0.846 across all individual items.[26] These validation results substantiate the use of TBQ as a reliable and valid tool for measuring treatment burden in Chinese patients. Consistent with the original scoring interpretation of TBQ, a higher score reflects greater perceived treatment burden.

Measurement of Self-Care

The assessment of hypertension self-care encompassed 5 behavioural domains derived from the literature.[27,28] These domains included smoking, alcohol drinking, physical activity, daily diet, and medication adherence, each operationalised as a dichotomous variable (0=nonadherent vs 1=adherent) with equal weighting, in accordance with previously validated methodologies,[28,29] to reflect overall adherence. Current smoking was defined as smoking ≥1 cigarette daily for at least 6 months (0=smoking; 1=nonsmoking), while regular drinking was defined as alcohol drinking for an equivalent of >25 g/day (men) or >15 g/day (women) of alcohol consumption, or habitual drinking on ≥4 days per week (0=drinking; 1=nondrinking). Physical activity adherence required ≥30 minutes of moderate-intensity aerobic exercise (eg, brisk walking or cycling) on 5 or more days weekly on average (0=physical inactivity; 1=physical activity). A healthy diet was defined through self-reported adherence to principles of moderate flavouring and avoidance of excessive salty, sweety, or oily foods, alongside maintenance of balanced meat and vegetable consumption (0=unhealthy diet; 1=healthy diet). Medication adherence evaluation incorporated components of self-reported medication taking on time and following prescribed dosages, with participants reporting adherence to both components across seven consecutive days classified as adherent (1) [vs nonadherent (0)]. Patients who had missing or incomplete profiles on medication adherence during the study period were excluded to ensure the homogeneity of the study cohort in terms of self-care adherence measurements. A composite self-care score was derived through summation across all 5 domains (range: 0–5), with higher scores indicating better self-care adherence.

Assessment of Blood Pressure and Hypertension Control

The presence of hypertension and coexisting diabetes at enrolment was ascertained by the attending GP physician according to the clinical guidelines. Standardised BP measurement procedures were conducted using routinely validated automated sphygmomanometers with participants in a seated position. Measurements were obtained from the arm with higher BP values, with the mean of two readings taken at 1–2 minute intervals recorded. Patients who demonstrated a systolic BP ≥140 mmHg through repeated clinical measurements at the final follow-up assessment (T3) were classified as having suboptimal hypertension control.[30]

Statistical Analysis

Generalised linear models using the analysis of covariance (ANCOVA) approach were used to assess sex-based differences in study variables among participants with and without coexisting diabetes. Reciprocal relationships between treatment burden and self-care across time were evaluated using cross-lagged panel models, in which spuriousness was tested by comparing cross-lagged correlations based on assumptions of synchronicity and stationarity.[31] The paradigm of the cross-lagged correlations was depicted in Figure 1. The path coefficient β_1 represents the cross-lagged effects from

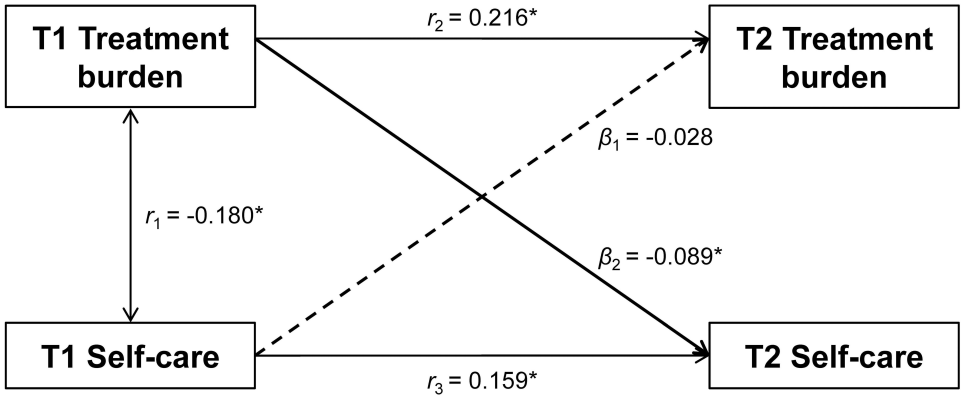

Figure 1 Cross-lagged panel model of treatment burden and self-care among study participants.
Notes: β_1, β_2 = cross-lagged path coefficients; r_1 = synchronous correlations; r_2, r_3 = auto-correlations. Models adjusted for age, sex, and presence of diabetes comorbidity. *P<0.001.

self-care at enrolment (T1) on treatment burden at interim follow-up (T2), while path β_2 coefficient indicates the cross-lagged effects from treatment burden at T1 on self-care at T2. Pearson correlation coefficients were computed for standardised (*z* score transformed) treatment burden and self-care measures at T1 and T2, with covariate adjustment, yielding six pairwise associations. The cross-lagged path coefficients (β_1 and β_2) were estimated from the correlation matrix using maximum likelihood method. The model was fully saturated with two explicitly measured variables, allowing model fit evaluation to be omitted given its just-identified nature. Relationships between treatment burden and self-care examined using cross-lagged panel models (CLPM) were stratified by age (<60 vs ≥60 years) and presence of diabetes comorbidity (diabetics vs nondiabetics), with covariate adjustment. The between-group differences in path coefficients were assessed using Fisher's *z* test.

Following the establishment of the temporal relationship between treatment burden at T1 and self-care at T2, a causal mediation model was constructed to examine whether self-care at T2 may mediate the association of treatment burden at T1 with systolic BP and hypertension control at T3. We specified treatment burden at T1 as the predictor variable (X), self-care at T2 as the mediator (M), and BP outcomes as dependent variables (Y). The mediation analysis was conducted via a four-stage sequential approach: (1) demonstrating the total effect of X on Y (β_{Total}), ie, X→Y association; (2) establishing the effect of X on M (β_{MX}), ie, X→M association; (3) determining the effect of M on Y ($\beta_{YM.X}$), ie, M→Y association while controlling for X; and (4) quantifying the mediation proportion by dividing the indirect effect ($\beta_{Indirect}$) by the total effect, ie, $[(\beta_{MX} \times \beta_{YM.X})/\beta_{Total}] \times 100\%$. CLPM analyses were performed using Mplus 8.3, while the mediation analyses were conducted using Stata 15.1 with adjustment for age, sex, and presence of coexisting diabetes. Statistical significance level was set at $P<0.05$.

In the sensitivity analysis, we applied a leave-one-out cross-validation approach in both CLPM and mediation models, in which self-care was restructured by systematically excluding each of the five original domains in turn, thereby creating modified composite scores comprising the sum of the remaining four domains (maximum score: 4 points). To illustrate, when leaving out the nonsmoking domain, the recalculated self-care score incorporated nondrinking, physical activity, healthy diet, and medication adherence. CLPM and mediation models were adjusted for age, sex, and the presence of coexisting diabetes, which maintained consistency with the primary analysis.

Results

The longitudinal cohort comprised 1718 hypertensive patients (54.4% male; mean age 54.6 ± 11.9 years), of whom 490 had coexisting diabetes. Table 1 summarises the mean levels of variables at T1, T2, and T3, stratified by sex and presence of diabetes comorbidity. After adjusting for age, women participants had significantly higher self-care scores at both T1 and T2 compared to men ($P<0.001$). Table 2 presents pair-wise Pearson's correlations between T1 and T2 values

Table 1 Treatment Burden, Self-Care, Systolic Blood Pressure, and Hypertension Control Among Study Participants by Age and Presence of Diabetes Comorbidity

Variables	Diabetics (n=490)		*P*	Nondiabetics (n=1228)		*P*
	Men	Women		Men	Women	
n	246	244		689	539	
T1						
Treatment burden	14.2 (13.4)	15.0 (13.2)	0.525[a]	14.8 (13.4)	15.8 (13.6)	0.161[a]
Self-care	2.9 (1.1)	3.3 (1.0)	<0.001[a]	2.7 (1.1)	3.2 (0.9)	<0.001[a]
T2						
Treatment burden	15.9 (12.9)	15.8 (11.9)	0.964[a]	15.2 (12.7)	15.1 (12.7)	0.528[a]
Self-care	3.3 (1.0)	3.6 (1.0)	0.044[a]	3.2 (1.1)	3.6 (0.9)	<0.001[a]
T3						
SBP, mmHg	135.3 (13.9)	136.0 (14.5)	0.855[a]	135.8 (13.7)	137.0 (14.6)	0.254[a]
HTN control, n (%)	134 (54.5)	139 (57.0)	0.550[b]	396 (57.5)	295 (54.7)	0.412[b]

Notes: Variables are presented as mean (standard deviation) or n (%) where appropriate. [a]Between-group differences were tested in Generalised linear models using analysis of covariance (ANCOVA) adjusted for age. [b]Between-group differences were tested using chi-square test.

Abbreviations: SBP, systolic blood pressure; HTN, hypertension.

Table 2 Pearson's Correlation Coefficients of Relationship Between Treatment Burden and Self-Care Among Study Participants

Groups	Variables	Treatment Burden at T1	Self-Care at T1	Treatment Burden at T2
All participants[a]	T1 Self-care	−0.19***	…	…
	T2 Treatment burden	0.16***	−0.04	…
	T2 Self-care	−0.14***	0.19***	−0.08**
<60 years / ≥60 years[b]	T1 Self-care	−0.12***/−0.35***	…	…
	T2 Treatment burden	0.11***/0.30***	−0.02/−0.09*	…
	T2 Self-care	−0.11***/−0.20***	0.17***/0.25***	0.00/−0.24***
Diabetics / nondiabetics[c]	T1 Self-care	−0.22***/−0.18***	…	…
	T2 Treatment burden	0.26***/0.13***	−0.10*/−0.02	…
	T2 Self-care	−0.15**/−0.13***	0.20***/0.19***	−0.17***/−0.04

Notes: [a]Adjusted for age, sex, and presence of diabetes comorbidity. [b]Adjusted for sex and presence of diabetes comorbidity. [c]Adjusted for age and sex. *P<0.05; **P<0.01; ***P<0.001.

for self-care and treatment burden in the total sample and across age groups and subjects with and without coexisting diabetes, with adjustment for covariates where appropriate. Most of the correlation coefficients were significant (P<0.05), except between T1 self-care and T2 treatment burden in the total sample, under 60s, and those without coexisting diabetes. We also observed no significant correlations between T2 treatment burden and T2 self-care in those aged less than 60 years and those with the absence of coexisting diabetes.

The CLPM analysis showed that path coefficients for treatment burden at T1 on subsequent self-care at T2 in the total sample (β_2 = −0.089, P<0.001), when adjusted for age, sex, and diabetes comorbidity, were significant and in the expected directions, suggesting that greater treatment burden was associated with poorer self-care adherence (Figure 1). This pattern persisted across age-stratified (β_2 = −0.083 for under 60s and β_2 = −0.113 for older participants; both P<0.001; Figure 2) and comorbidity-stratified (β_2 = −0.103 for patients with coexisting diabetes and β_2 = −0.085 for nondiabetic patients; both P<0.001; Figure 3) analyses. Notably, the path coefficients did not significantly differ by age (under 60s vs older participants: P=0.558) and presence of diabetes comorbidity (diabetics vs nondiabetics: P=0.733).

Mediation analyses, controlling for age, sex, and diabetes comorbidity, revealed that self-care at T2 partially mediated (10.7%) the longitudinal association between treatment burden at T1 and systolic BP at T3 ($\beta_{Indirect}$ = 0.024, P<0.001; β_{Total} = 0.226, P<0.001; Figure 4). This mediation operates through a negative association between treatment burden at T1 and self-care at T2 (β_{MX} = −0.010, P<0.001), coupled with a stronger inverse relationship between self-care at T2 and systolic BP at T3 ($\beta_{YM.X}$ = −2.294, P<0.001). Similarly, self-care partially mediated (11.1%) the pathway between treatment burden at T1 and hypertension control at T3 ($\beta_{Indirect}$ = −0.001, P<0.001; β_{Total} = −0.009, P<0.001; Figure 5),

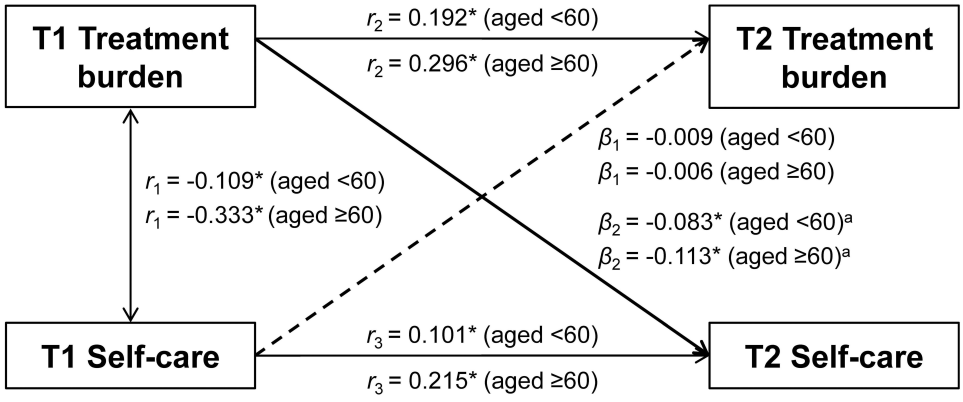

Figure 2 Cross-lagged panel model of treatment burden and self-care stratified by age.
Notes: β_1, β_2 = cross-lagged path coefficients; r_1 = synchronous correlations; r_2, r_3 = auto-correlations. Models adjusted for sex and presence of diabetes comorbidity. *P<0.001. [a]Between-group difference in path coefficients (under 60 years: −0.083 vs ≥60 years: −0.113; P=0.558).

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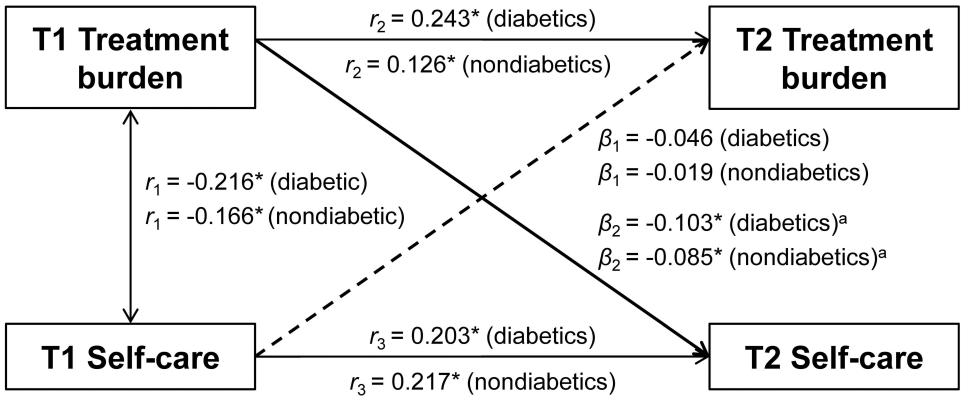

Figure 3 Cross-lagged panel model of treatment burden and self-care by presence of diabetes.
Notes: β_1, β_2 = cross-lagged path coefficients; r_1 = synchronous correlations; r_2, r_3 = auto-correlations. Models adjusted for age and sex. *P<0.001. [a]Between-group difference in path coefficients (diabetics: −0.103 vs nondiabetics: −0.085; P=0.733).

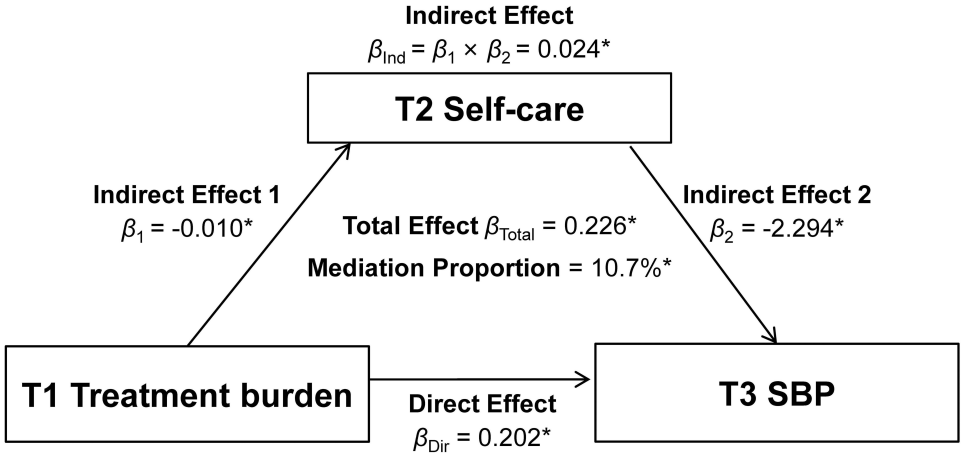

Figure 4 Mediating effect of self-care on the relationship between treatment burden and systolic blood pressure.
Note: *P<0.001.

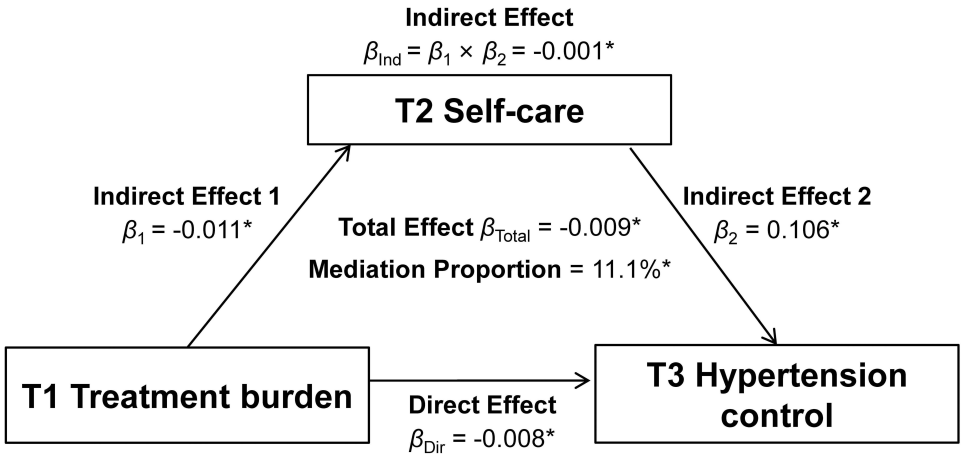

Figure 5 Mediating effect of self-care on the relationship between treatment burden and hypertension control.
Note: *P<0.001.

operating through a negative association between treatment burden at T1 and self-care at T2 ($\beta_{MX} = -0.011$, $P<0.001$), coupled with a stronger relationship between self-care at T2 and hypertension control at T3 ($\beta_{YM.X} = 0.106$, $P<0.001$).

In the leave-one-out sensitivity analysis revealed stable path coefficients from treatment burden at T1 to self-care at T2 across all subgroups, indicating robust temporal relationships unaffected by self-care domain exclusion (Supplementary Table 1). Mediation analysis showed consistently modest effect magnitudes and significance levels, with self-care at T2 accounting for 7.0–8.9% of the total effect of treatment burden at T1 on systolic BP levels and hypertension control at T3 across subgroups, suggesting that no single behavioural domain exerts disproportionate influence within the self-care construct (Supplementary Tables 2 and 3).

Discussion

This longitudinal study elucidated the temporal associations between treatment burden and self-care in a sample of Chinese hypertensive patients using cross-lagged path analysis—a robust statistical approach for determining causal relationships. Results demonstrated that increased treatment burden significantly predicted reduced self-care levels. This pattern was consistent across age (<60/≥60 years) and diabetes comorbidity (diabetic/nondiabetic) subgroups. These patterns influenced systolic BP levels and hypertension control in the subsequent 14 months, with self-care accounting for 10.7% and 11.1% of the total effect of increased treatment burden on elevated systolic BP levels and reduced hypertension control (both $P<0.001$), respectively.

Treatment burden has been identified as a risk factor compromising self-care capacity among patients with chronic conditions. Evidence from American primary care settings suggests that both cumulative and task-specific treatment burdens predict poorer adherence to therapeutic regimens.[20] While such correlational findings are informative, they remain inadequate for establishing causal relationships. Our CLPM analysis advances these findings by establishing temporal precedence–higher treatment burden predicts later self-care decline.[20,32] It may be possible that when treatment benefits were not immediately apparent, patients may experience increasingly onerous burden, thereby diminishing one's emotional engagement and undermining their long-term motivation to maintain health-monitoring routine. Notably, though between-group differences were non-significant, the association between treatment burden and self-care was marginally stronger in older adults and those with coexisting diabetes. In elderly populations, this likely reflects the compounding effects of age-related functional decline,[33] polypharmacy,[34] and multimorbidity-induced therapeutic complexity.[35] In those with concurrent diabetes, competing disease management priorities appear to exacerbate the challenges of maintaining hypertension self-care. These observations underscore the need for mixed-methods investigations to further understand the mechanisms driving these relationships in the process evaluation.[36]

The mediation pathway identified in our study substantiates the Cumulative Complexity Model, demonstrating how intensified treatment burden worsens the workload-capacity imbalances, triggering breakdowns in self-care capacity and driving patient complexity.[37] Our secondary hypothesis suggests that excessive treatment burdens may exceed patients' cognitive resources, impairing both self-care implementation and task prioritisation, ultimately compromising BP control. While self-care partially mediated these associations (9.3–11.1%), these modest effects warrant cautious clinical interpretation. The direct pathway established in our study revealed that each 1-unit decrease in treatment burden yielded a 0.20 mmHg systolic BP reduction ($\beta_{Direct} = 0.202$, $P<0.001$), implying that treatment burden alleviation that achieves a clinically meaningful BP reduction threshold (eg, a 10 mmHg reduction in systolic BP, corresponding to 20% fewer major cardiovascular events and 13% lower all-cause mortality[38]) is likely to provide widely applicable health benefits. These findings collectively position treatment burden reduction as a viable intervention strategy for optimising BP management.

Empirical evidence confirms that enhanced self-care practices directly lower systolic BP.[39–41] This relationship is corroborated by our study findings and aligns with the Individual and Family Self-Management Theory,[42] which emphasises that effective BP control depends on patients' self-management capabilities and sustained engagement with treatment regimens that derive from positive reinforcement mechanisms and emotional responses.[43] Modifiable behavioural patterns have been estimated to account for up to 40% of premature deaths.[44] However, the pivotal role of self-care and health-promoting behaviours in hypertension management remains undervalued in daily practice. Significant barriers persist across multiple levels, encompassing individual psychological constraints (eg, low self-efficacy and outcome expectancy), familial interactions, boarder social determinants, and systemic healthcare challenges

that collectively constrain self-care capacity.[12,45] This situation is exacerbated when clinical interventions are intensified without proper consideration of treatment burden, leading to unsustainable adherence as patients may inevitably prioritise among competing demands,[37] particularly in a multimorbidity context.[46]

Implications for Theory and Practice

Our study provides empirical evidence supporting the Cumulative Complexity Model (CCM),[37] substantiating its theoretical framework through the identified "treatment burden → self-care → health outcomes" pathway. Our findings demonstrate that treatment burden detrimentally affects health outcomes both directly and indirectly through its deleterious impact on self-care capacity, thereby necessitating an expansion of the CCM to incorporate these parallel mechanistic routes. Therapeutic intensification, while clinically intended to improve outcomes, may inadvertently exacerbate treatment burden through increased workload demands, connecting the burdensome experience with erosion of patient capacity, which may subsequently worsen health outcomes.[37] The feedback loop may impose mounting pressures on healthcare systems through escalating service utilisation and resource expenditure.

The established mediation pathway (treatment burden → self-care → health outcomes) reveals treatment burden as a progressive determinant of self-care capacity erosion, thereby elevating BP through disruptions in self-management activities. These findings may call for a reorientation of strategies towards prioritising treatment burden mitigation, eg, through regimen simplification and use of organisational strategies, on top of the existing efforts to enhance an individual's self-care competencies and adherence in medication management and lifestyle changes. Examples of implementation may include restructure of clinical services, patient-centred prescribing practices, and individualised treatment intensity calibration to better support chronic disease management. Incorporating burden-sensitive care assessment tools, eg, the TBQ,[25] into routine clinical metrics may enable identification of workload reduction opportunities while evaluating how care aligned with patient priorities ultimately influences health outcomes.[47]

Strengths and Weaknesses

Our study has several strengths. To the best of our knowledge, this investigation represents the first population-level quantitative analysis to establish the temporal relationship between treatment burden and self-care while evaluating their combined impact on systolic BP and hypertension control. The research benefits from a relatively large primary care cohort of hypertensive patients and assessment of multiple aspects of self-care. The use of a valid and internationally recognised instrument ensured rigorous measurement of treatment burden. Result consistency across patient subgroups strengthened the robustness of study findings. This study has some limitations that warrant consideration. First, the reliance on self-reported measures of treatment burden and self-care behaviours may be susceptible to recall and socio desirability bias. Second, by excluding patients who discontinued medication from the analysis, the study may have biased the sample toward more engaged individuals. Third, our findings from a Chinese cohort may have limited generalisability to geographically diverse populations given cross-national variations in healthcare system structures and sociocultural contexts. Crucially, the characteristically strong family support in the Chinese society–encompassing filial piety, shared care-giving, intergenerational relationship, and emotional engagement–may disproportionately mitigate treatment burden relative to the Western populations wherein such support networks are often less institutionalised. Last but not least, the mediating effect of self-care on the treatment burden-BP linkage was modest, enunciating the need for further qualitative studies to uncover additional factors across the full adult life course.

Conclusions

In conclusion, our study demonstrated that elevated treatment burden preceded poor self-care behaviours in a longitudinal primary care cohort of Chinese hypertensive patients using cross-lagged path analysis. Self-care was identified as a significant mediator in the temporal pathway linking treatment burden to both systolic BP levels and hypertension control. These findings provide novel insights into the temporal relationships between treatment burden, self-care, and hypertension outcomes, which may be an important clue to optimise hypertension management strategies.

Data Sharing Statement

The datasets used and analysed during the current study are available from the last corresponding author (HHXW) upon reasonable request.

Ethics Statement

Ethics approval was granted from the School of Public Health Biomedical Research Ethics Review Committee at Sun Yat-Sen University in accordance with the Declaration of Helsinki 2013.

Informed Consent Statement

All patients provided written consent. Data were anonymised in the dataset to protect patient privacy.

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Disclosure

The authors declare that there are no conflicts of interest in this work.

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