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How Does Extrinsic Motivation Influence Intrinsic Motivation? A Study on the engagement mechanism of primary healthcare Workers based on the “Crowding-Out” and “Crowding-In” Effects

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How Does Extrinsic Motivation Influence Intrinsic Motivation? A Study on the engagement mechanism of primary healthcare Workers based on the “Crowding-Out” and “Crowding-In” Effects

Abstract: This study aims to explore the synergistic influence mechanism of extrinsic motivations and intrinsic motivations on the work engagement of primary healthcare workers (PHWs), with a focus on the mediating roles of relative deprivation and career calling. It further examines the moderating effect of extrinsic motivations on the relationship between intrinsic motivation and work engagement, to reveal whether the two types of motivations function complementarily or competitively under different conditions. A cross-sectional survey was conducted among 962 PHWs from 62 community health service center or township health centers across three cities in Zhejiang Province. Quantitative analyses revealed that both extrinsic and intrinsic motivations positively predicted work engagement. Among them, career advancement showed a stronger effect than material rewards, and job significance had a greater influence than job autonomy. Relative deprivation plays a fully mediating role in the process in which material rewards and career advancement affect work engagement. Career calling plays a fully mediating role in the process where job autonomy influences engagement, and a partially mediating role in the process where job significance influences engagement. Furthermore, material rewards negatively moderated the effect of job autonomy on work engagement (a “crowding-out effect”),

while career advancement positively moderated the effect of job significance on engagement (a “crowding-in effect”). The work engagement of primary healthcare workers is influenced by the complex interaction of extrinsic motivations and intrinsic motivations, among which the fairness perception and value recognition are the key psychological mechanisms. Extrinsic motivations can either “crowd out” or “crowd in” extrinsic motivations, depending on the type of incentives and the working context. In practice, management should adopt an integrated incentive system that emphasizes developmental recognition, provides foundational material support, and integrates attention to fairness perception and value guidance, so as to effectively enhance engagement across the grassroots health workforce.

Introduction

With the evolution of organizational psychology, positive psychology has gained increasing emphasis in management research[1]. As a central construct in positive psychology, “work engagement” was first defined by Kahn[2], referring to the energy and concentration an individual invests in work, along with a sense of meaning and fulfillment. As a highly valued and measurable indicator, work engagement has gradually replaced job satisfaction to measure organizational effectiveness, and has been proven to significantly enhance work efficiency, service quality, and patient satisfaction significantly[3]. However, there is still controversy over its own dimensional composition, and its influencing factors are complex and diverse. Its role in different contexts and subjects still needs further investigation[4,5,6].

The healthcare context represents one such critical setting. Within it, PHWs play a crucial role as “health gatekeepers”. Their engagement in work is of great significance for implementing hierarchical medical treatment, enhancing the service capacity and quality at the grassroots level, and improving residents’ health outcomes. Nevertheless, due to the complexity of primary healthcare work, PHWs face several limitations, such as inadequate resources, poor working conditions, lack of recognition, and limited opportunities for career development[7]. These challenges have been shown to undermine the work engagement, thereby reducing job performance and ultimately leading to burnout and high turnover rate[8,9]. Therefore, effectively enhancing the work engagement of PHWs has become an urgent and complex issue.

Previous studies have confirmed that appropriate incentives may provide a crucial solution to this issue[10,11]. Ryan and Deci introduced the concepts of intrinsic and extrinsic motivation from the perspective of self-determination theory[12]. They suggested that intrinsic motivation stems from personal values, beliefs and desires, such as a sense of accomplishment and fulfillment, while extrinsic motivation refers to external rewards like salary, bonus, or recognition. Deci also claimed that people are motivated by a combination of internal and external factors, and that intrinsic motivation is more likely to lead to long-term, sustained behavior change. On this basis, the extrinsic and intrinsic motivation for PHWs continue to be explored. A meta-analysis concluded that economic incentives and career development opportunities are equally important motivators, neither of which can be neglected[13]. Okereke found that patterns of financial incentives received by community health workers can influence

their satisfaction and productivity in rural Nigeria[14]. While De Mesa suggested that interventions such as performance-based extrinsic motivations are often inadequate in reducing workforce attrition, especially in rural and remote settings[15]. It can be seen that much of this research on incentives focus on extrinsic motivation, to some extent neglecting the role of intrinsic motivation, especially among high-quality groups.

Moreover, despite numerous studies, the underlying mechanisms of interaction between these two types of motivation remain unclear and even controversial. Porter[16] claimed that providing appropriate extrinsic rewards based on enhancing employees' perceived work value can improve their enthusiasm, suggesting extrinsic and intrinsic motivations are mutually reinforcing. Deci[17], however, holds different views, argued that work itself carries motivational value, and that external rewards may actually undermine employees' sense of autonomy and intrinsic value. Smith's study also found that extrinsic motivations may weaken intrinsic motivation, thereby reducing performance[18]. Thus, whether extrinsic motivations complement or compete with intrinsic motivation remains ambiguous.

The studies mentioned above have provided a reliable theoretical foundation, yet several limitations remain. First, regarding research subjects, studies focusing on the work engagement of PHWs are relatively rare and fragmented. Existing research has predominantly examined populations such as enterprise Employee, teachers, and civil servants[19,20,21], or has been limited to doctors in public hospitals[6,22], the unique particularities and complexities of primary healthcare services are not fully captured. Second, in terms of research depth, most studies remain at the the stage of establishing

a correlation along the "incentives-engagement-output" pathway[4,14,23].

They lack an in-depth analysis of the mediating mechanism through which incentives influence work engagement, which limits the translation of findings into specific, actionable management practices. Third, from a research perspective, there is a lack of empirical studies on PHWs that examine how various intrinsic and extrinsic incentive factors jointly shape work engagement.

To bridge these gaps, our study focuses on PHWs, aiming to explore the influence of extrinsic and intrinsic motivators on their work engagement and to construct a corresponding theoretical model. Furthermore, this study introduces the mediating effect of incentive factors in work engagement, as well as the moderating effect between extrinsic and intrinsic motivators. The purpose of this study is not only to propose more reasonable incentive measures to improve PHWs' engagement, but also provide more targeted management strategies for policy makers and administrators in the government and healthcare sectors.

Theoretical basis

Extrinsic motivations and PHWs' engagement

Extrinsic motivation is driven primarily by the external rewards or consequences associated with a behavior, rather than the behavior itself. Studies indicate that when employees perceive organizational support measures, such as material rewards or career advancement[7], they tend to exhibit increased feedback behavior, allocate more resources to their work, and enhance their engagement as a reciprocal response. For

instance, Koh demonstrated that perceived career advancement prospects significantly influence work engagement in healthcare settings, sometimes even more than material rewards[24]. Given that numerous empirical research have established a connection between extrinsic motivations and PHWs' engagement, we proposed the following hypotheses.

Hypothesis1: Material rewards are positively related to PHWs' engagement

Hypothesis2: Career advancement is positively related to PHWs' engagement

The mediating role of relative deprivation between extrinsic motivations and PHWs' engagement

The effectiveness of extrinsic motivators is influenced by individuals' perceptions of fairness. When individuals perceive rewards as fair, extrinsic motivators amplify their positive impact on behavior and enhance work enthusiasm[25]. Conversely, perceptions of unfairness can breed dissatisfaction and resentment, which weaken the motivational effect of extrinsic rewards, dampen enthusiasm, and ultimately reduce engagement. This mechanism helps explain how extrinsic incentives affect the PHWs' engagement[26]. Supporting this view, Gero[27] proposed that independent of absolute income, increased relative income deprivation is associated with a higher risk of psychosocial stress stemming from upward social comparisons. Similarly, Al-Qathmi[28] found that perceived discrepancies in reward allocation are a prominent factor affecting turnover intention in medical laboratory technologists. This evidence suggests that relative deprivation plays an mediating role between extrinsic motivators and PHWs' engagement. We therefore adopt relative deprivation as an indicator of fairness

perception and propose the following hypotheses:

Hypothesis 3: Relative deprivation is a mediator in the relationship between material rewards and PHWs' engagement.

Hypothesis 4: Relative deprivation is a mediator in the relationship between career advancement and PHWs' engagement.

Intrinsic motivations and PHWs' engagement

Compared to extrinsic motivation, intrinsic motivation arises from the work itself, such as the sense of autonomy and accomplishment[10]. Previous studies have proved that employee engagement can be predicted by intrinsic motivation. For instance, Vera[29] found that job autonomy and social support enhance intrinsic drive and engagement among nurses. Similarly, studies confirmed that when employees perceive their tasks as importance and value, their need for achievement fosters greater emotional and energetic investment in work[30]. Therefore, we conceptualize intrinsic motivation through two dimensions: job autonomy and job significance, and propose the following hypotheses:

Hypothesis5: Job autonomy is positively related to PHWs' engagement.

Hypothesis6: Job significance is positively related to PHWs' engagement.

The mediating role of career calling between intrinsic motivations and PHWs' engagement

According to expectation theory, the greater the value placed on a goal, the stronger the motivation, which in turn enhances an individual's enthusiasm for work[31]. Studies further indicate that a sense of career calling helps individuals align their personal

values and goals with their professional roles. By having a clear and meaningful mission, people are more likely to experience a sense of purpose and motivation, which can in turn foster greater work engagement and improve performance[32,33]. Reuben[34] also suggested that narrowing the gap between career calling and daily work responsibilities can motivate physicians and create satisfaction. Accordingly, we proposed the following hypotheses:

Hypothesis7: Career calling is a mediator in the relationship between job autonomy and PHWs' engagement.

Hypothesis8: Career calling is a mediator in the relationship between job significance and PHWs' engagement.

The moderating effects of extrinsic/ intrinsic motivations on PHWs' engagement

Previous studies have demonstrated that either a "complementary effect"[16] or a "competitive effect"[17] may exist between extrinsic and intrinsic motivations. However, existing research findings remain inconsistent and even contradictory. Based on Self-Determination Theory and related integrative motivation models, external motivational factors may exert a moderating effect on individual work engagement through their interaction with internal motivational factors. Hereby, We proposed the following assumptions:

Hypothesis9a: Material rewards is a negative moderator in the relationship between job autonomy and PHWs' engagement.

Hypothesis9b: Material rewards is a negative moderator in the relationship between job significance and PHWs' engagement.

Hypothesis10a: Career development is a negative moderator in the relationship between job autonomy and PHWs' engagement.

Hypothesis10b: Career development is a negative moderator in the relationship between job significance and PHWs' engagement.

Based on the hypotheses above, we constructed the theoretical framework, as presented in Fig. 1.

Materials and methods

Participants and Procedure

In this study, we conducted a survey of health workers in primary medical institutions of different areas in Zhejiang province. A stratified sampling approach was first adopted based on regional economic development and the level of the local healthcare industry. Three cities, Hangzhou, Ningbo and Huzhou, were selected as the sample sites. In each city, 15 to 20 community health service center or township health centers were randomly chosen , resulting in a total of 62 institutions across the three cities as study sites. Next, health workers including doctors, nurses, public health physicians and medical technicians in each institution met our inclusion criteria were selected using random sampling. The inclusion criteria were as follows: (1) being formally employed by the target primary healthcare institution; (2) having more than 6 months of work experience; and (3) consenting to participate in the study. PHWs who were off-duty during the survey period due to maternity leave, sick leave, study, vacation or other reasons were excluded.

The sample size was initially estimated at 450 based on Kendell's method. To account for potential incomplete or invalid responses, it was increased by 20%, setting the target at 540 participants. Accordingly, 1156 questionnaires were distributed, of which 1083 questionnaires were returned.

Prior to formal data collection, a pilot survey was conducted in Hangzhou, the provincial capital city of Zhejiang. Based on the issues identified and collected during the survey, we revised the questionnaire and refined the survey protocol. After obtaining informed consent from each participant, the purpose, objectives, and other relevant details of the study were explained. Investigators used paper-based or electronic questionnaires to conduct face-to-face surveys, double-checked the data, with any discrepancies resolved through discussion with a third researcher, and recorded the entire interview process. Manual screening was then applied to exclude questionnaires with missing responses or other quality issues, resulting in 962 valid samples for final analysis.

Measures

General information

The general survey form comprised of 10 items, including: gender, age, marital status, title, post, level of education, type of employment, hospital level, monthly income and years of experience.

Extrinsic motivations

The extrinsic motivations scale developed by Al-Qathmi[28] was used to assess the

extrinsic motivations of PHWs in their work. Based on the job content and characteristics of PHWs, the scale was adapted into two sub-dimensions including extrinsic (4 items) and development rewards(6 items). The items were rated on a 5-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). Higher scores indicated a higher level of extrinsic motivation.

Intrinsic motivations

To assess the intrinsic motivation perceived by PHWs in their work, we developed an intrinsic motivations scale, and the initial items were drawn from the studies of Schnell[35], which include 5 items on job autonomy and 5 items on job meaning, respectively. All items were also scored on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), and higher scores indicated higher level of perceived intrinsic motivation.

Relative deprivation

The measure of relative deprivation was adapted from the scale originally developed by Callan[36] and Osborne[37] for professionals in high-prestige occupations. Previous studies[26] have demonstrated good reliability and validity of this scale among Chinese physicians. To improve its applicability to PHWs, the scale was further modified based on qualitative interview data and panel discussions.

Career calling

Career calling was evaluated with the 12-item “Calling and Vocation Questionnaire (CVQ)” developed by Dik[38] through a seven-year longitudinal follow-up empirical study. To better align with the professional characteristics and work objectives of PHWs,

several items were adapted accordingly, resulting in a final scale consisting of 12 items rated on a 5-point Likert scale.

Engagement

To measure work engagement, this study adopted the Utrecht Work Engagement Scale (UWES) revised by Schaufeli[39], which consists of 9 items. After repeated testing, the scale demonstrated acceptable internal consistency. To accommodate the Chinese context and to facilitate large-scale surveys, the expressions of several items was appropriately adapted. Ultimately, all 9 items were rated using a 7-point Likert scale, and higher scores indicated higher work engagement.

Statistical analyses

Statistical analyses were conducted using SPSS 26.0. Descriptive statistics, including independent t-tests and one-way ANOVA, were employed to evaluate and compare engagement scores across PHWs with different demographic characteristics. The reliability and validity of the questionnaire were examined through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Pearson correlation was used to assess the relationships among potential variables in the model and to preliminarily examine the research hypotheses. Furthermore, hierarchical linear regression was applied to construct and test the model, thereby further verifying the hypotheses. Statistical significance was set at $p < 0.05$.

Ethical considerations

The study was approved by the Institutional Review Board of Hangzhou Normal University. Prior to the data collection, all participants were informed that their data

would be anonymized and only be used for research purposes. Additionally, written informed consent was obtained from each participant.

RESULTS

Demographic characteristics

Significant differences in work engagement scores among PHWs were observed across several demographic and occupational variables. Specifically, differences were found by gender (t=2.06, p=0.04), post (F=5.432, p<0.01), professional title (F=3.333, p=0.019), work experience (F=2.439, p=0.046), and average monthly income (F=3.869, p<0.01). Male PHWs reported higher engagement scores (M=4.88, SD = 1.00) compared to female PHWs (M=4.73, SD=1.09). In terms of occupational roles, general practitioners demonstrated higher engagement than both nurses (M=4.60, SD =1.05) and medical technicians (M=4.58, SD=1.12). Additionally, PHWs with senior professional titles scored higher (M=5.06, SD =1.12) than those whose titles were to be assessed (M=4.72, SD=1.29). Those with 20 or more years of work experience also showed greater engagement (M=4.92, SD=1.12) than those with five years or less (M=4.66, SD=1.07). Regarding monthly income, PHWs earning 3,001–6,000 yuan had lower engagement scores (M=4.69, SD=1.09) than those earning 6,000–9,000 yuan (M=4.90, SD=1.06) and those earning more than 9,000 yuan (M=5.06, SD =1.20), respectively.

Correlation statistics

Correlation analysis revealed significant associations among all variables. Material rewards (r=0.460, p<0.01), career advancement (r=0.480, p<0.01) , job autonomy (r=0.505, p<0.01), job significance (r=0.596, p<0.01), and career calling (r=0.721, p<0.01) showed significant positive correlations with PHWs' engagement. In contrast, relative deprivation showed a significant negative correlation with PHWs' engagement (r=-0.166, p<0.01). The means, standard deviations, and Pearson correlation coefficients for all variables are presented in Table 1.The assumptions between each antecedent variable and the outcome variable were all supported by the data in the preliminary examination.

Table 1 Mean, standard deviation, and correlation coefficient of each variable.

variables	Mean	SD	1	2	3	4	5	6	7
1.Material rewards	3.25	.98	1						
2.Career advancement	3.40	.91	.687**	1					
3.Job autonomy	3.56	.86	.691**	.655*	1				
4.Job significance	3.93	.83	.548**	.552**	.612**	1			
5.Career calling	3.54	.76	.443**	.491**	.552**	.635**	1		
6.Relative deprivation	3.50	1.18	-.520**	-.463**	-.359**	-.262**	-.003	1	
7.Engagement	4.78	1.07	.460**	.480**	.505**	.596**	.721**	-.166**	1

(Notes: *P<0.05, **P<0.01, the same as below.)

The SEM model of factors influencing PHWs' engagement

SEM was employed to test the hypothesized relationships among variables influencing PHWs' engagement. Since the sample size is larger than 200, the Bollen-Stine bootstrap method was used to correct the model. As shown in Fig. 2, the obtained model demonstrated a good fit to the data according to the following fit indices (χ^2=1834.581, χ^2/df=1.72, RMSEA=0.03, AGFI=0.96, CFI=0.99, GFI=0.97, NFI=0.97, IFI=0.99, and TLI=0.98), which suggest that the proposed model adequately represents the observed relationships in the data.

Mediating effect test

The Bootstrap estimation method was applied in this study to examine mediating effects, with the 95% confidence interval for each mediation effect calculated. As shown in Table 2, it was confirmed that relative deprivation fully mediated the effects of both material rewards and career advancement on engagement, supporting H3 and H4. Material rewards and career advancement influenced engagement through relative deprivation, with total effects of 0.041(Z=3.727, 95%CI=0.022, 0.065) and 0.022(Z=2.444, 95% C=0.008,0.043), respectively, which also supports H1 and H2. Moreover, career calling fully mediated the relationship between job autonomy and engagement, and partially mediated the relationship between job significance and engagement, confirming H7 and H8. The total effect of job autonomy on engagement through career calling was 0.136(Z=3.778, 95%Z=CI=0.071,0.212), with a not significant direct effect. For job significance, the indirect effect via career calling was 0.440 (Z=11.000, 95% CI=0.37, 0.524), the direct effect was 0.220(Z=4.074, 95%CI=0.116,0.321), and the total effect was 0.659(Z=12.434, 95%CI=0.556, 0.765), thereby supporting H5 and H6.

TABLE 2 The bootstrap 95% CI for the mediating effect test and deviation correction

Paths	**Effect**	**Point estimation**	**Product of coef.**		**Bias-Corrected 95% CI**	
			Std. Estimate	**Z**	**Lower**	**Upper**
Material rewards→	Indirect effect	0.041	0.011	3.727	0.022	0.065
Relative deprivation→	Direct effect	/	/	/	/	/
Engagement	Total effect	0.041	0.011	3.727	0.022	0.065
Career	Indirect effect	0.022	0.009	2.444	0.008	0.043
advancement→	Direct effect	/	/	/	/	/
Relative deprivation→	Total effect	0.022	0.009	2.444	0.008	0.043

TABLE 2 The bootstrap 95% CI for the mediating effect test and deviation correction

Paths	Effect	Point estimation	Product of coef. Std. Estimate	Z	Bias-Corrected 95% CI Lower	Upper
Engagement						
Job autonomy→	Indirect effect	0.136	0.036	3.778	0.071	0.212
Career calling→	Direct effect	/	/	/	/	/
Engagement	Total effect	0.136	0.036	3.778	0.071	0.212
Job significance→	Indirect effect	0.440	0.040	11.000	0.37	0.524
Career calling→	Direct effect	0.220	0.054	4.074	0.116	0.321
Engagement	Total effect	0.659	0.053	12.434	0.556	0.765

Moderating effect test

To test the moderating effect of extrinsic motivations on the relationships between (1)job autonomy and work engagement, and (2)job significance and work engagement, hierarchical regression analysis was performed by sequentially entering independent variables, moderating variables and their interaction terms. The maximum variance inflation factor(VIF) values were 4.801, 4.812, and 4.848, respectively, all of which are below the requirement of 5, indicating that there is no serious multiple co-linear relationships and the regression results of the model are acceptable.

As shown in Model4 of Table3, the interaction between material rewards and job autonomy is significantly negative($\beta=-0.094$, $p< 0.01$), indicating that material rewards play a negative moderating role in the process of job autonomy affecting engagement, thus, H9a was supported. In contrast, the interaction term between material rewards and work significance is not significant($\beta=0.029$, $p>0.05$), indicating that material rewards have no significant moderating effect between work significance and engagement, thus, H9b was not supported.

TABLE 3 Moderating Effect of Material Rewards

	Model 1	Model 2	Model 3	Model 4
Gender	-0.023	0.040	.048	.043
General practitioner	-0.126**	-0.081**	-.082**	-.081**
To be assessed	0.013	0.061	.064	.069
Work experience (years)	0.023	.086**	.087**	.088**
Average monthly income (¥)	0.060	-.024	-.040	-.041
job autonomy		0.256**	.190**	0.168**
job significance		0.446**	.423**	.460**
Material rewards			.120**	.123**
Material rewards × job autonomy				-.094**
Material rewards × job significance				.029
job autonomy × job significance				.081*
R^2	.026	.409	.416	.422
$\triangle R^2$	.026	.383	.007	.006
F	5.024**	309.207**	11.136**	3.404*

As shown in Model4 of Table4, the interaction between career development and job autonomy is not significant (β=0.048, p>0.05), indicating that career development has no significant moderating effect between job autonomy and engagement, thus, H10a was not supported. In contrast, the interaction between career development and job meaning was significantly positive(β =0.098, p<0.01), indicating that career development positively moderates the effect of job meaning on engagement, thus, H10b was supported.

TABLE 4 Moderating Effect of Developmental Rewards

	Model 1	Model 2	Model 3	Model 4
Gender	-0.023	0.040	.046	.056*
General practitioner	-0.126**	-0.081**	-.079**	-.085**
To be assessed	0.013	0.061	.062	.068*
Work experience (years)	0.023	.086**	.099**	.097**
Average monthly income (¥)	0.060	-.024	-.029	-.027
job autonomy		0.256**	.175**	.174**
job significance		0.446**	.405**	.428**
Career advancement			.168**	.165**
Career advancement × job autonomy				.048

TABLE 4 Moderating Effect of Developmental Rewards

	Model 1	Model 2	Model 3	Model 4
Career advancement × job significance				.098**
job autonomy × job significance				-.039
R^2	.026	.409	0.424	0.434
$\triangle R^2$	.026	.383	.015	.011
F	5.024**	309.207**	24.586**	5.997*

Additionally, the interaction between job autonomy and job significance was significant(β=0.081, p<0.05) in Table3, but not significant(β=−0.039, p>0.05) in Table4, which suggests that the interaction between autonomy and significance depends on the type of extrinsic incentives present.

To further explore the moderating effect of material rewards, we conducted a simple slope analysis. The simple effects of material rewards on the relationship between job autonomy and engagement are plotted in Fig. 3. The results indicate that regardless of the level of material rewards, the PHWs' engagement has shown an upward trend with the improvement of their work autonomy. It is worth noting that when material rewards are relatively low, the positive impact of job autonomy on work engagement is more significant.

Similarly, to further examine the moderating role of career advancement, a simple slope analysis was conducted, and the simple effect of career advancement on the relationship between job significance and engagement was plotted as Fig. 4. Regardless of the level of career advancement, PHWs' engagement increased with higher job significance. Moreover, under conditions of high career advancement, job significance has a stronger positive impact on PHWs' engagement.

Discussion

Consistent with prior research[10,14] this study confirms that extrinsic motivators—material rewards and career advancement—significantly enhance PHWs' engagement. More importantly, the results reveal that career advancement shows a stronger influence than material rewards.This suggests that for PHWs, growth opportunities and professional recognition are more potent drivers of sustained engagement than financial incentives alone.

In addition, this study reveals the critical mediating role of relative deprivation between extrinsic motivation and engagement. Mediation analysis indicates that relative deprivation fully mediates the effects of both material rewards and career advancement on PHWs' engagement. This implies that PHWs first engage in fairness comparisons when evaluating extrinsic incentives. However, when they perceived as unfair, such incentives may induce a sense of relative deprivation, which can trigger a negative impact on their well-being and their health[40], thereby weakening the positive effect of extrinsic motivators on enthusiasm[26].This findings emphasizes that how extrinsic incentives are managed is as important as whether they are provided.

The results affirm that both job autonomy and job significance can promote the engagement among PHWs. This finding is similar to the previous studies[41]. Furthermore, this study reveals that career calling plays a key mediating role in the impact way of internal motivation on PHWs' engagement. Aligning with prior research conducted among teachers[42], employees with a sense of career calling are more willing to invest themselves in their work. For PHWs, perceiving autonomy and significance

in their roles is likely to activate the deeper value goals associated with a calling, such as compassion, altruism, and benevolence, thus increasing their engagement. This finding enriches our understanding of intrinsic motivation, the key to enhancing work engagement is not merely the experience of autonomy or meaning itself, but whether these experiences can awaken a deeper, identity-based value recognition between the individual and the profession.

More notably, career calling partially mediated the relationship between job significance and engagement. This suggests that while perceiving work as meaningful directly enhances engagement, a significant portion of this effect is achieved through the activation of a career calling. Practically, when PHWs view their tasks as socially valuable, this perception not only directly motivates them but also strengthens their sense of being“called”to the profession[32,43], which in turn further amplifies their engagement. These findings imply that job significance emerges as the stronger predictor, enhancing the perceived significance by clearly communicating its social value, its connection to patient outcomes, and its recognition of its role is a more efficient pathway for improving PHWs’ engagement than simply increasing autonomy.

A key contribution of this study is its empirical demonstration of how extrinsic motivations moderate intrinsic motivations, which reveals the “Crowding-out and Crowding-in effects” effects to a certain extent. The results demonstrate that material rewards weaken the positive effect of job autonomy on PHWs' engagement, representing a “crowding-out effects”. This discovery reveals the psychological mechanism through which material rewards affect engagement and supports the

cognitive evaluation theory, which indicates that unreasonable material rewards may have a certain degree of control. Individuals may shift their behavioral attribution from internal ("I want to do it") to external ("I must do it"), thereby reducing intrinsic motivation and diminishing both proactive and creative work behaviors[12].

Conversely, material rewards did not significantly moderate the relationship between job significance and engagement. This suggests that the experience of meaningful work may be more resilient to the potential undermining effects of extrinsic motivations. Perceived significance, rooted in social value and personal fulfillment, appears to operate through a different motivational pathway, which is less susceptible to being "crowded out" by external rewards.

Simple slope analysis further reveals that job autonomy most strongly promotes engagement when material rewards are relatively low. This implies that in low-pay or resource-constrained grassroots settings, material incentives are most likely to undermine the intrinsic motivation derived from autonomy. These findings suggest that, in practice, material incentives should be used cautiously in roles that rely on job autonomy. Managers in primary healthcare institutions can strengthen the sense of work meaningfulness and engagement through non-material forms of recognition, such as providing developmental opportunities and offering timely affirmation.

This study also reveals a distinct pattern regarding the moderating effect of career advancement. While such rewards did not significantly moderate the relationship between job autonomy and engagement, they strengthen the motivation effect of job significance on PHWs' engagement, generating a "crowding-in effects"， which can be

understood through the lens of informational versus controlling rewards in motivation theory, when external rewards are perceived as informational feedback[12] such as organizational recognition, they can enhance intrinsic motivation. Career advancement signals the value of the work itself and conveys organizational appreciation to individuals[23], helping PHWs recognize the significance of their tasks. Thus, it serves an informational rather than a controlling role, preserving individuals' sense of autonomous motivation, thereby enhancing the positive impact of job significance on engagement.

This dual effect resolves part of the long-standing debate over "complementarity and competition", that is, the influence of extrinsic motivations on intrinsic motivations depends on the type of extrinsic motivations and the specific internal needs interacting with them. Material rewards may conflict with the need for autonomy, while career advancement can amplify the sense of meaning derived from work. These findings help managers recognize that to sustain employee motivation, establishing clear and accessible career development pathways and regularly providing developmental feedback may be more effective and sustainable compared to relying solely on short-term incentives such as salary and bonuses. We can further explore under what circumstances different extrinsic rewards can serve as supplements or alternatives to intrinsic motivators. and explore how to combine developmental support with modest material recognition, in order to optimize engagement across diverse healthcare settings.

Limitations

We acknowledge several limitations. First, the cross-sectional data can not infer the causal relationship between variables, future research could adopt longitudinal designs to trace the dynamic changes in motivation and engagement. Second, the sample was limited to Zhejiang Province, the findings may not generalize to other regions, especially those with different economic conditions or healthcare resources. Third, the data were derived from self-reports, future research could collect data from colleague evaluations, such as peer evaluations, patient feedback, or objective performance indicators. Finally, this study did not examine potential moderating effects of contextual factors like leadership support or team climate, subsequent research could incorporate a wider range of situational variables to improve the model.

Conclusion

This study established a moderated mediation model to systematically examine the factors and mechanisms influencing work engagement among PHWs. The empirical results demonstrate that both extrinsic and intrinsic motivations positively predict work engagement, with fairness perception(a sense of relative deprivation) and value identification(a sense of career calling) serving as key psychological pathways. More importantly, the findings indicate that extrinsic incentives do not affect intrinsic motivation in a single direction; instead, their influence is contextual, resulting in a "double-edged" effect. Material rewards weaken the positive relationship between job autonomy and engagement (a "crowding-out" effect), whereas career advancement strengthen the relationship between job significance and engagement (a "crowding-in"

effect). These findings not only provide a new theoretical perspective for understanding the complexity of incentive mechanisms, but also suggest that managers in primary healthcare institutions should adopt an integrated incentive system, the one that ensures basic material support while prioritizing clear career pathways, emphasizing the communication and feedback of work meaning, and fostering a fair organizational climate. Such an approach can more effectively and sustainably enhance engagement and stability among PHWs.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request. The datasets and the survey questionnaire are provided in the supplementary file.

Author Contributions

P H: Data collection and analysis, writing the original draft. Wt W: Writing - Review & Editing; Supervision. Xq F: Writing - Review & Editing Supervision. S W:Writing - Review & Editing; Supervision. All authors agreed with the final version of the manuscript.

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Competing interests

The authors declare no competing interests.

Ethical approval

This study has been ethically reviewed and approved by the Teaching and Research Ethics Committee of Hangzhou Normal University (No. [2026]022). All procedures in this study were in accordance with the institutional research guidelines and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all participants involved in the study, conducted by the first author from June 2023 to March 2024. Consent covered participation, data use, and publication. Participants were assured of confidentiality and anonymity. They were also provided with the researcher's email address for any further inquiries. The consent process and all procedures adhered to ethical guidelines to ensure participant rights and data integrity.

Fig. 1 Theoretical model diagram

Fig. 2 Final structural equation model

Fig. 3 The moderating role of material rewards in the relationship between job autonomy and engagement

Fig. 4 The moderating role of career advancement in the relationship between job significance and engagement

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Figures

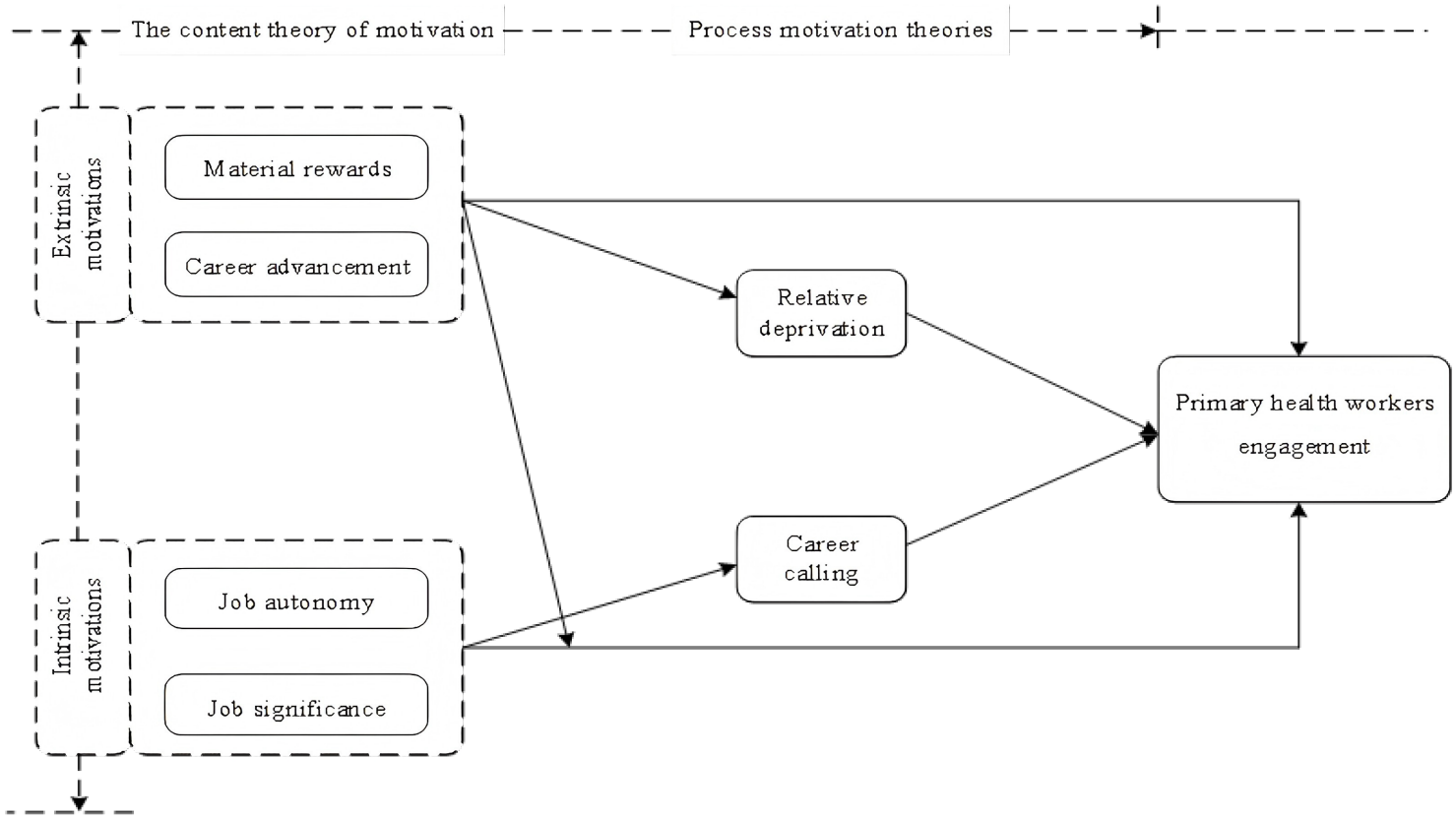
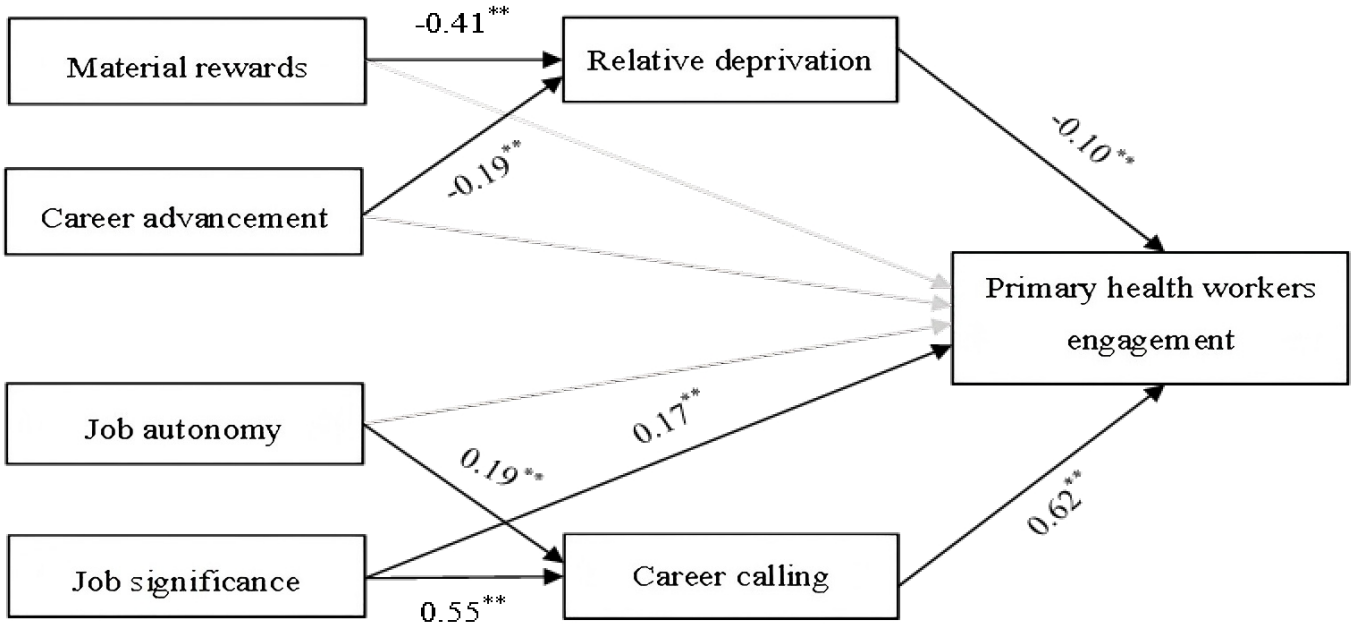


Figure 1

Theoretical model diagram



*p<0.05,**p<0.01

Model fit: *Chi2*=1834.581, Chi2/df=1.72, *RMSEA*=0.03, *AGFI*=0.96, *CFI*=0.99, *GFI*=0.97, *NFI*=0.97, *IFI*=0.99, *TLI*=0.98.
Coefficients: Job significance was positively associated with primary health workers Engagement (standardized $\beta = 0.17, p < .001$)

Figure 2

Final structural equation model

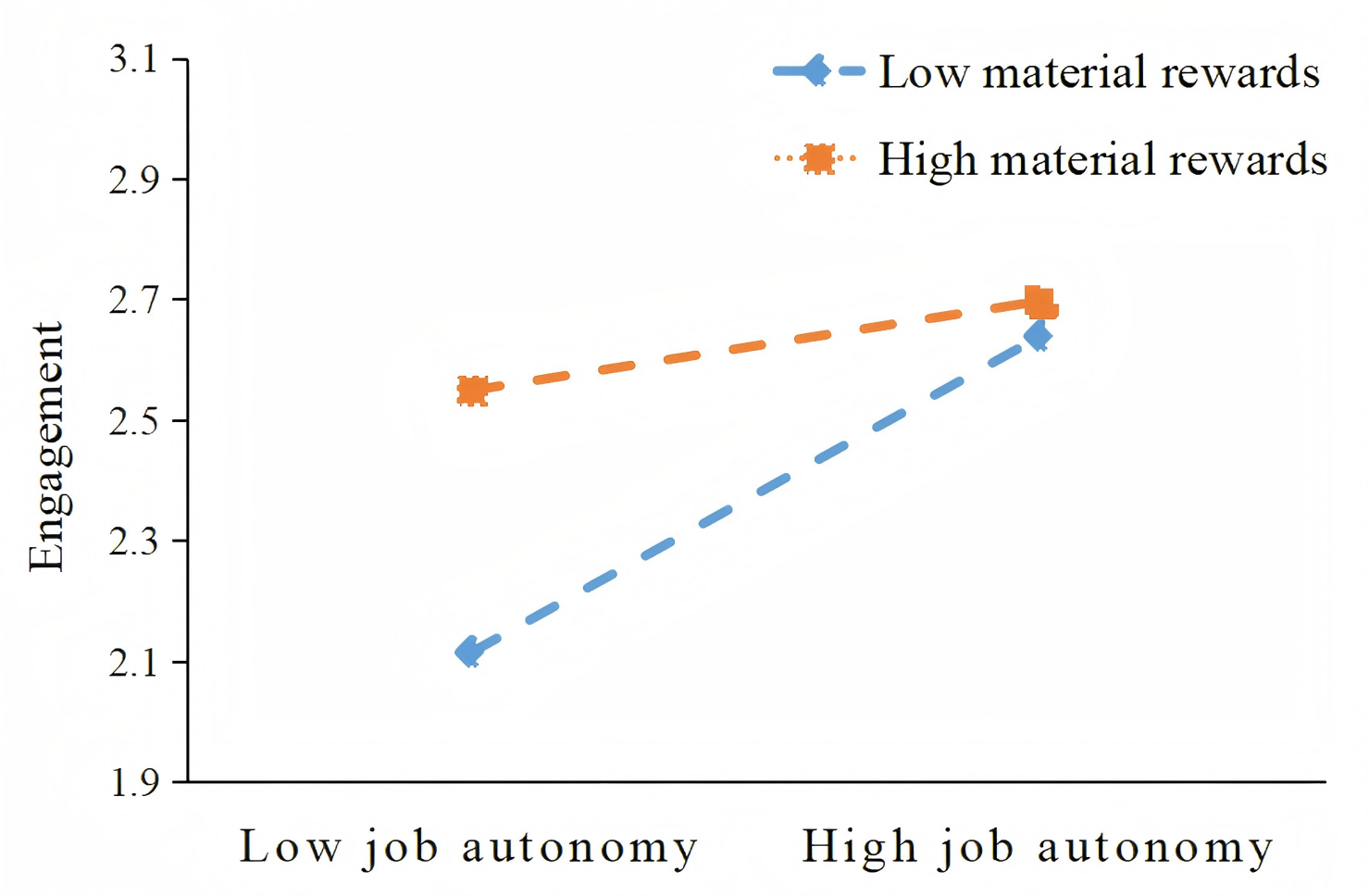


Figure 3

The moderating role of material rewards in the relationship between job autonomy and engagement

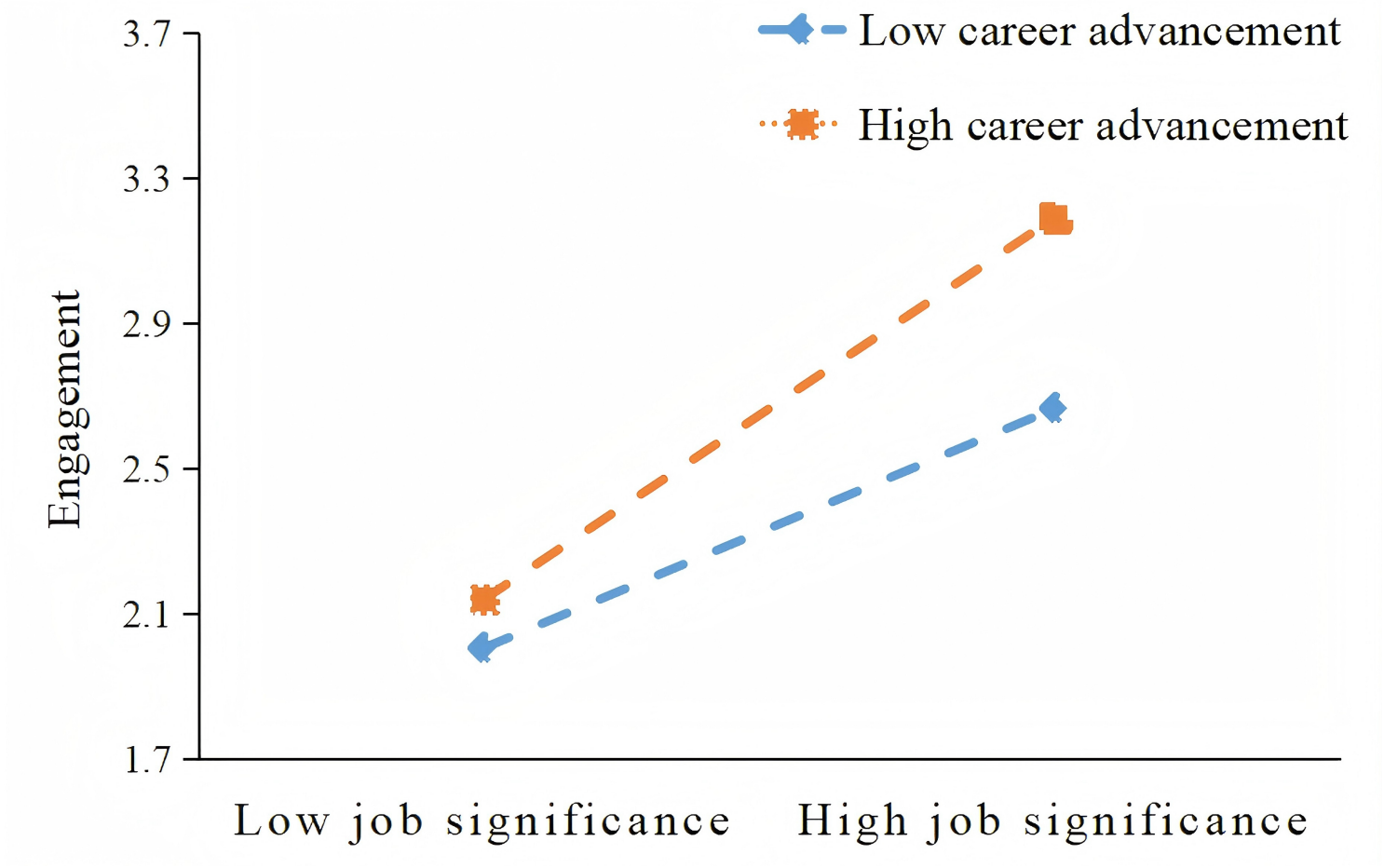


Figure 4

The moderating role of career advancement in the relationship between job significance and engagement

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