Health Policy and Planning, 2025, 40(8), 854–866
https://doi.org/10.1093/heapol/czaf035
Advance access publication date: 11 July 2025
Original Article

The effect of performance-based financing interventions on health worker motivation and job satisfaction: experimental evidence from six national pilots

Sneha Lamba[1,*], Jed Friedman[2], Eeshani Kandpal[3]

[1]Department of Humanities and Social Sciences, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, India
[2]Development Research Group, The World Bank, 1818 H St NW, Washington, DC 20433, USA
[3]Center for Global Development, 2055 L Street NW, Washington, DC 20433, USA
*Corresponding author. E-mail: lambasneha@iitd.ac.in

Accepted on 29 May 2025

Abstract

A long-standing concern suggests that performance-based financing (PBF) may undermine the intrinsic motivation of health workers by heightening extrinsic motivation concerns via the novel introduction of financial incentives. However, the theoretical effect of PBF on worker motivation and job satisfaction is ambiguous as these programs may also improve working conditions, staff engagement, and other factors that determine health worker morale. We use data from six evaluations of national pilots to empirically assess the effect of PBF on worker motivation and job satisfaction. In these six pilots (in Cameroon, Kyrgyz Republic, Nigeria, Tajikistan, Zambia, and Zimbabwe), geographical units (or health facilities) were either randomized or quasi-experimentally assigned to receive PBF or the alternatives of direct facility financing (DFF), enhanced supervision (ES), or business-as-usual comparison arms. Baseline and endline health worker surveys were carried out in the context of these national pilots. The primary outcomes investigated here are health worker motivation and job satisfaction. Secondary outcomes include subconstructs of health worker motivation and job satisfaction extracted using exploratory factor analysis. For two countries out of six—Nigeria and Kyrgyz Republic—we find increases in overall worker motivation and null effects in the other four when contrasting PBF with the business-as-usual comparison. For five countries out of six (all but Cameroon), we find increases in job satisfaction. Further, PBF did not have any systematic motivating or demotivating effects when compared with the health system intervention alternatives of DFF and ES (each in a subset of countries), except in Nigeria where satisfaction in the PBF arm was lower when compared with DFF. All told, these results contain practically no evidence of an adverse effect of PBF on overall health worker motivation or job satisfaction and indeed suggest a beneficial impact in some country settings.

Keywords: health workers; motivation; job satisfaction; crowding-out; performance-based incentives

Key messages

- Scholars have argued that performance-based financing (PBF) decreases worker motivation by crowding out intrinsic motivation. While this concern has been widely discussed, there is little rigorous causal empirical evidence to support it.
- We present causal evidence from six evaluations of national pilots to show that PBF has little discernible effect, and in some settings, positive effects, on worker motivation and satisfaction, when compared with business-as-usual comparison.
- The presumed effects of PBF on worker motivation are not a reason to rule out this approach as a supply side strengthening strategy.

Introduction

Performance-based financing (PBF) is a widely used tool deployed by policymakers to improve the health service delivery around the world (Gautier *et al.* 2019, Duran *et al.* 2020). PBF interventions are generally described as financial incentives for health service providers and/or facility management staff conditional on the quantity and quality of services provided (Fritsche *et al.* 2014). The underlying logic of PBF schemes is based on standard economic theory, which suggests that contracts tying payments to performance can be used to elicit greater effort in settings with standard principal-agent problems such as private information or the inability to observe worker effort (Prendergast 1999, Lazear 2000, Duflo *et al.* 2012). However, some theoretical concerns suggest that PBF schemes may be counter-productive because they can lead to reductions in health worker motivation. Scholars argue that while paying for performance may improve extrinsic motivation driven by financial rewards, there may be an equal or more powerful 'intrinsic motivation crowding-out', which results in an ambiguous effect on overall health worker motivation. Intrinsic motivation driven by factors such as autonomy, recognition, altruism, and purpose are likely to be especially strong among health providers who perform cognitively complex tasks in suboptimal settings (Himmelstein *et al.* 2014, Lohmann *et al.* 2016). This is

Table 1. Summary of all DID results comparing PBF, DFF, ES, and pure control.

	PBF vs control	PBF vs DFF	PBF vs ES	DFF vs control	ES vs control
Motivation					
Cameroon	NR	NR	NR	NR	NR
Kyrgyz Republic	0.52 ($P = 0.05$)		NR		NR
Nigeria	*0.54* ($P < 0.001$)	NR		*0.63* ($P < 0.001$)	
Tajikistan	NR				
Zambia	NR	NR		NR	
Zimbabwe	NR				
Satisfaction					
Cameroon	NR	NR	0.38 ($P = 0.06$)	NR	NR
Kyrgyz Republic	0.50 ($P = 0.04$)		NR		NR
Nigeria	*0.74* ($P < 0.001$)	−0.18 ($P = 0.07$)		*0.92* ($P < 0.001$)	
Tajikistan	*0.93* ($P < 0.001$)				
Zambia	0.56 ($P = 0.07$)	NR		NR	
Zimbabwe	0.37 ($P = 0.02$)				

NR, null result.

especially true in the context of PBF interventions introduced to health systems in low resource settings. Indeed, literature on this subject finds that PBF affects health worker performance through channels such as 'triggering a sense of accomplishment', 'altering social dynamics', 'providing a direction to work towards', and 'reinforcing a feeling of professionalism' among others (Kalk *et al.* 2010, Bertone and Meessen 2013, Lohmann *et al.* 2016). Therefore, PBF may affect sources of motivation beyond those driven purely by monetary rewards.

Although the phenomenon of 'intrinsic motivation crowding-out' has been confirmed by studies in behavioral economics and social psychology, these are largely confined to those involving the introduction of payments to hitherto non-incentivized tasks such as blood donation and are largely located in high-income contexts (Deci and Ryan 1985, Gneezy and Rustichini 2000b, Ariely *et al.* 2009, Lohmann, Muula, *et al.*, 2018). To date, given the paucity of studies, there is little and inconclusive evidence on the effect of a change in how payments are made on worker motivation and satisfaction in the context of health systems in low resource settings (Binyaruka *et al.* 2020). A systematic review of 35 peer reviewed articles by Renmans et al. in 2016 points towards contradictory findings from evaluations and calls for more research on the influence of context and design of PBF schemes. This is because PBF intervention packages often consist of many elements in addition to financial incentives, which makes it difficult to disentangle the effects of pure incentives from other effects (Ireland *et al.* 2011, Lohmann, Wilhelm *et al.* 2018). Another systematic review of the theories underpinning PBF schemes finds a wide array of adopted theories, with intrinsic motivation crowding out theory used in multiple studies to warn against the adverse effects of PBF (Paul *et al.* 2021). More recent studies from Afghanistan, Democratic Republic of Congo, and Malawi find contrasting effects of PBF on health worker motivation (Engineer *et al.* 2016, Lohmann, Muula, *et al.*, 2018, Lohmann, Wilhelm *et al.* 2018, Maini *et al.* 2019). In Democratic Republic of Congo, Maini *et al.* find lower health worker motivation in facilities where PBF had been withdrawn by donors compared with workers who had never received PBF. In Malawi, Lohmann, Muula *et al.* and Lohmann, Wilhelm *et al.* do not find evidence of intrinsic motivation crowding out and find that PBF increased motivation of health workers to improve their performance via multiple channels beyond the financial rewards provided to individuals. In Afghanistan, Engineer *et al.* do not find any evidence that PBF improved health worker motivation.

Renmans *et al.* (2016) argue that viewing PBF exclusively as a payment-related incentive is inadequate and that the different aspects and implications of the broad PBF package should be explained to unpack the effects on worker motivation. Further, the exact motivation mechanisms through which PBF affects health worker performance are poorly understood. Binyaruka *et al.* (2020) emphasize the need to assess how PBF works across settings as well as within settings by studying heterogeneous effects of PBF on different cadres of health workers and health facilities.

In this paper, we contribute to this literature by presenting experimental or quasi-experimental evidence from six countries, where both PBF and plausible health system intervention alternatives—specifically, direct facility financing (DFF), and enhanced supervision (ES)—were piloted. These interventions include two cluster randomized control trials in Kyrgyz Republic and Zambia, one randomized control trial in Cameroon, and three quasi-experiments in Nigeria, Tajikistan, and Zimbabwe.[1] We present results for the impact of PBF incentives on health worker motivation and job satisfaction (hereafter M&S) through a comparison of PBF to business-as-usual (pure control) using a difference-in-differences (DID) approach in all six countries. We further study intrinsic motivation crowding out as a channel by comparing PBF with two alternative policies of DFF and ES, that is (i) PBF compared with DFF in three countries (and DFF compared with business-as-usual) and (ii) PBF compared with ES in two countries (and ES compared with business-as-usual). We provide more details about these national pilots in the Supplementary Table 20 to this study.

This study is among the first to present rigorous counterfactual evidence from multiple countries on a topic that been debated in literature but has generally lacked externally and internally valid empirical evidence. We summarize our main results in Table 1. First, comparing the effect of PBF against business-as-usual on health worker motivation across all the countries, we show that PBF has had no systematic demotivating effect and apparently improved motivation for health

[1] For these three country studies, the main identifying assumption is the parallel trends assumption employed in a difference-in-difference specification. To assist comparability, especially with regards to balance of baseline covariates, treated units are typically grouped with comparisons based on observable baseline values. This is a standard approach in difference-in-difference analysis—see for example Roth *et al.* (2023). In no case were districts matched or grouped on the basis of baseline primary outcomes of interest. More importantly, treatment assignment is not correlated with the pretreatment outcomes of interest, which can generate the regression-to-mean bias as studied in Daw and Hatfield (2018).

workers in Nigeria and Kyrgyz Republic. We do not find any negative effects of PBF compared with business-as-usual on health worker job satisfaction and instead find positive effects in five of six countries (all but Cameroon). Second, in addition to presenting results comparing PBF to business-as-usual, we compare the effect of PBF packages on health worker M&S against two other popular health financing approaches, i.e. DFF, in the countries of Cameroon, Nigeria, and Zambia, and ES in the countries of Cameroon and Kyrgyz Republic and, again, find little evidence of differential program impact on health worker M&S. Finally, we study the effect of PBF on subconstructs of motivation and job satisfaction which furthers our understanding of the underlying mechanisms through which PBF affects health workers. Certain subconstructs are close in meaning the concept of 'intrinsic motivation', and we test whether the phenomenon of 'intrinsic motivation crowding out' could explain our results of either no significant or significantly positive results (i.e. a reduction in subconstructs closest to 'intrinsic motivation' masked by an increase in other subconstructs). We find little support for such a hypothesis in the data.

Materials and methods

Data sources

We used data from baseline and endline health worker surveys in the six countries, collected as part of evaluations of PBF effectiveness, to study the effect of PBF on health worker M&S. All six studies were part of an umbrella health financing project, called the Health Results Innovations Trust Fund, administered at the World Bank. Crucially these financed pilots included support for independent evaluation, which led to efforts to harmonize data collection and evaluative efforts across each study. The project and harmonization process are described in detail in De Walque *et al.* (2022) and individual country details on study design and implementation can be found in Ahmed *et al.* (2023), De Walque *et al.* (2021), Friedman *et al.* (2016), Khanna *et al.* (2021), Shepard *et al.* (2020), and Zeng *et al.* (2018). Any health facility sampled for evaluation included health worker surveys with at least one health care provider at the facility, but the same health provider was not necessarily—indeed not typically—interviewed at baseline and endline. Therefore, while the data structure typically contains a panel of health facilities, our unit of analysis is the individual health worker. Our primary aim is to examine the effect of PBF on health worker M&S through a comparison of these measures across workers at comparison and treatment (PBF) health facilities before and after the introduction of PBF. We also examine if there is any evidence of 'intrinsic motivation crowding out' in the context of PBF given the salience that this phenomenon has attained in the field. We investigate this through unpacking the overall measures of M&S into subconstructs of the same using exploratory factor analysis (EFA) across the six countries.

Measurement of motivation and satisfaction

Motivation and Satisfaction (M&S) were measured using Likert-scales in health worker interviews. For the motivation scale, respondents were asked to what extent they agreed with statements such as 'Staff willingly share their expertise with other members' and could respond with (i) Most of the Time (=5), (ii) More than Half of the Time (=4), (iii) Less than Half of the Time (=3), (iv) Only Rarely (=2) or (v) Never (=1). Similarly, respondents were asked to what extent they were satisfied with different aspects of their life in a health facility to assess job satisfaction. To demonstrate, an example of a statement in the satisfaction scale is 'Working relationships with other facility staff' to which respondents could respond with: (i) Extremely Dissatisfied (=1), (ii) Dissatisfied (=2), (iii) Indifferent (=3), (iv) Satisfied (=4) or (v) Extremely Satisfied (=5). Statements in Likert Scales that were framed negatively were recoded so that they are ordered in the same way as positively framed statements. Many of the scale items overlap across the six countries in our study and were adopted from validated scales used in other settings such as the Minnesota Satisfaction Questionnaire (Weiss *et al.* 1967), the Job Satisfaction Survey (Spector 1985), and the Kenyan Health Worker Motivation Scale (Mbindyo *et al.* 2009). These scales were collated and adapted to local contexts and languages and therefore differ at the individual item level as well as in terms of the total number of items in each scale for each country (See Supplementary Tables 23–26 for details). The number of item-level health worker questions related to motivation ranges from 22 to 38. Therefore, we carry out and report country level analyses in this paper, and do not report any pooled results .[2,3]

The analysis takes a multidimensional or compositional approach to motivation to unpack the sources of motivation. EFA has been widely used to study health workers in developing countries because there is no unanimous framework or default theory on the dimensionality of motivation (Borghi *et al.* 2018). Like the approach taken for motivation— there is no theoretical framework underpinning satisfaction among health workers—the analysis breaks down the satisfaction results to understand the effect of PBF on satisfaction subconstructs, such as satisfaction with working conditions or relation with peers.

We computed EFA driven scale scores for extracted subconstructs, using oblique rotation which allows factors to be correlated. Parallel analysis conducted separately for each of the six countries was used to decide on the dimensionality or

[2] Another reason we do not report pooled results across countries, besides the variation in adopted scales, is that response patterns in the Likert scales may also systematically vary across the study countries. More generally, there have been various attempts to address the concern of Likert type scale-use heterogeneity through the use of anchoring vignettes or calibration questions (for example Lietz 2010, Sturgis and Smith 2010, Angelini *et al.* 2014, Ravallion *et al.* 2016, Benjamin *et al.* 2023). It is interesting to note that the resulting "corrected" or "anchored" scales do not typically change the underlying results. Further, as the inference is always conducted at the national level (and not pooled), for Likert scale heterogeneity to bias inference the heterogeneity in response would need to be correlated with exposure to treatment, which is unlikely as treatment is randomized or quasi-randomized. Finally, the direct control for worker characteristics will absorb any response heterogeneity to the extent such heterogeneity is correlated with the included characteristics and regional fixed effects will further control for response heterogeneity across regions.

[3] An additional concern with self-reported constructs such as worker motivation and satisfaction is the possible presence of social desirability bias if the respondents believed the survey enumerators were linked to program implementers or official representatives of the health system. It is not clear if health workers were aware that these data collection exercises were linked to an evaluation of the PBF or other program, as most information sought pertains to general considerations. In the studied contexts, we believe that the likelihood of social desirability response bias is low. Of the six contexts studied here, only the Nigerian data sheds direct light on this question. That study, however, finds little pre-condition for social desirability bias: only about forty percent of all health workers participating in the Nigerian PBF trial had even heard of the trial (Khanna *et al.* 2021; Bauhoff and Kandpal 2024). Further the participation of the facility in a particular program was determined by the health system governors at the national or provincial level and continued participation was not contingent upon the survey responses of individual health workers. While we believe that the possibility of health worker responses affected by social desirability bias is low for these stated reasons, it is difficult to definitively rule out such survey effects.

the number of factors to be retained for M&S. Parallel analysis creates a randomly generated dataset with the same number of observations and variables as the original dataset. We retain the number of factors where eigenvalues of the original data are larger than eigenvalues of randomly generated data. The commonly used cut-off of 0.4 for substantive loadings was used to decide which items should be retained (Chandler *et al*. 2009). EFA driven scale scores were computed keeping only items that had loadings higher than 0.4 for each subconstruct. We dropped items on the scale that were answered by only a subset of health workers such as 'Available schooling for your children' (asked conditional on presence of children) from both the parallel analysis and the EFA. The subconstructs of M&S extracted through EFA, the scale items corresponding to each subconstruct, and associated Cronbach's alpha for each of the six countries are detailed in Supplementary Tables 21 and 22. Cronbach's alpha was greater than the recommended value of 0.7 for the construct of overall motivation for all countries except Tajikistan (and Cronbach's alpha was greater than the recommended value of 0.7 for the construct of overall job satisfaction for all countries except Zambia).

We normalize the overall scores and subconstruct level scores for M&S by subtracting the mean and standard deviation at baseline for each country. Supplementary Figures 1 and 2 present distribution of scores before and after normalization for each country and each measure of M&S.

Estimation strategy

Treatment arms

The study used a DID approach to estimate the effect of PBF (and its alternatives) on health worker M&S. The DID approach compares the changes from baseline to endline in one project arm to the same change in the other arm. The number of treatment arms differed from four treatment arms of PBF, DFF, ES, and business-as-usual in Cameroon to two treatment arms of PBF and business-as-usual in Tajikistan and Zimbabwe. In all the six countries, PBF consisted of the elements of linking payments to performance at the facility and health worker levels, independent monitoring of results, systematic supervision of health facilities, and managerial autonomy to facilities. DFF included the same elements of financing, monitoring, supervision, and autonomy, but payments to facilities were not linked to their performance. ES only introduced elements of supervision, monitoring, and supportive feedback without the elements of financing and managerial autonomy at the facility level. Supplementary Table 20 describes the treatment arms and either the randomization or quasi-experimental design in the six countries. We present results for the cluster randomized control trials or randomized control trials in Cameroon, Kyrgyz Republic, and Zambia and three cluster grouped quasi-experiments in Nigeria, Tajikistan, and Zimbabwe separately in this paper.[4]

We include intervention strata fixed effects for all countries—this is usually at the level of state or province, although in the case of Nigeria exposure to PBF was stratified at the regional level. We also cluster standard errors at the geographical level of treatment in each country (this is usually at the district level for every country except Nigeria where standard errors were clustered at the ward level). The control variables included depend on the availability of these variables in each of the six countries as noted in the Supplementary Table 13 (and Supplementary Tables 27 and 28). Supplementary Tables 14–19 provide summary statistics for all the control variables at the health worker level included in the analysis for each country. We also show results from estimating the same specification with a narrowed set of control variables that are available for all six countries (these are limited to the sex of the health worker, their education levels, and their cadre level).

We adopt the canonical two-period specification:

$$Y_{ijrt} = \gamma_0 + \gamma_1 * PBF_{jr} + \gamma_2 * Period_t + \gamma_3 (PBF * Period)_{jrt} + X_{ijtr} + R_r + \varepsilon_{ijrt}$$

where Y_{ijrt} is the motivation or satisfaction for health worker i under facility j at time t for region r; γ_0 is a constant; PBF_{jr} is a binary variable taking the value of 1 for facilities that received the PBF treatment and 0 otherwise; $Period_t$ is a binary variable where it is 1 for the post-intervention period and 0 otherwise; γ_1 and γ_2 are the coefficients for the treatment and period binary variables, respectively; the interaction term is γ_3 which indicates the difference-in-difference treatment effect; X includes controls at the health-worker level, and R are intervention strata fixed effects. We estimate the above equation to compare (i) PBF facilities vs pure control or business-as-usual facilities, (ii) PBF facilities vs DFF facilities, (iii) PBF facilities vs ES facilities, (iv) DFF vs business-as-usual facilities, and (v) ES vs business-as-usual facilities by varying the treatment and comparison group across the stated combinations.[5]

Results

PBF compared with business-as-usual

Overall motivation and job satisfaction

Figure 1 presents the DID coefficient for the treatment effect of PBF coefficient for regressions including controls on health worker motivation (Figure 1a, Left) and satisfaction (Figure 1b, Right). Figure 1a shows that PBF did not have any systematic demotivating effects across all six study contexts. In Kyrgyz Republic and Nigeria, we find that health workers in PBF facilities experience approximately 0.52 and 0.60 standard deviation increase in motivation between baseline and endline compared with health workers in control facilities—the increase is significant at 95% for Kyrgyz Republic and at 99% for Nigeria. The coefficient for the DID estimator is positive but insignificant for Cameroon and Zimbabwe (and negative and insignificant for Tajikistan and Zambia).

Supplementary Table 1 presents the detailed results, with the average normalized scores as outcome variables for all six countries at baseline (Column I) and endline (Column II) for health

[4] For the three countries that leverage randomized variation in program exposure, we also conduct single difference estimations using endline data for robustness purposes with an ANCOVA specification at the facility level. These results, given in Supplementary Table 11, are consistent with the main findings of the paper. This analysis finds no impact on health worker motivation, and positive impact on worker satisfaction, in all the three countries

[5] As each study can be considered an independent trial, we do not account for multiple hypothesis testing corrections across country studies. Within country, we typically explore impacts on two outcomes—motivation and satisfaction. While we do not explicitly correct for multiple hypothesis testing in the analysis there may very well be observational dependence within a country between the satisfaction and motivation measures. Fortunately, if we were to apply Bonferroni corrections—the most conservative of multiple hypothesis test corrections—the results at the standard significance levels are mostly unchanged, with only one country's finding of a positive increase in satisfaction moving to a null effect (Kyrgyz Republic).

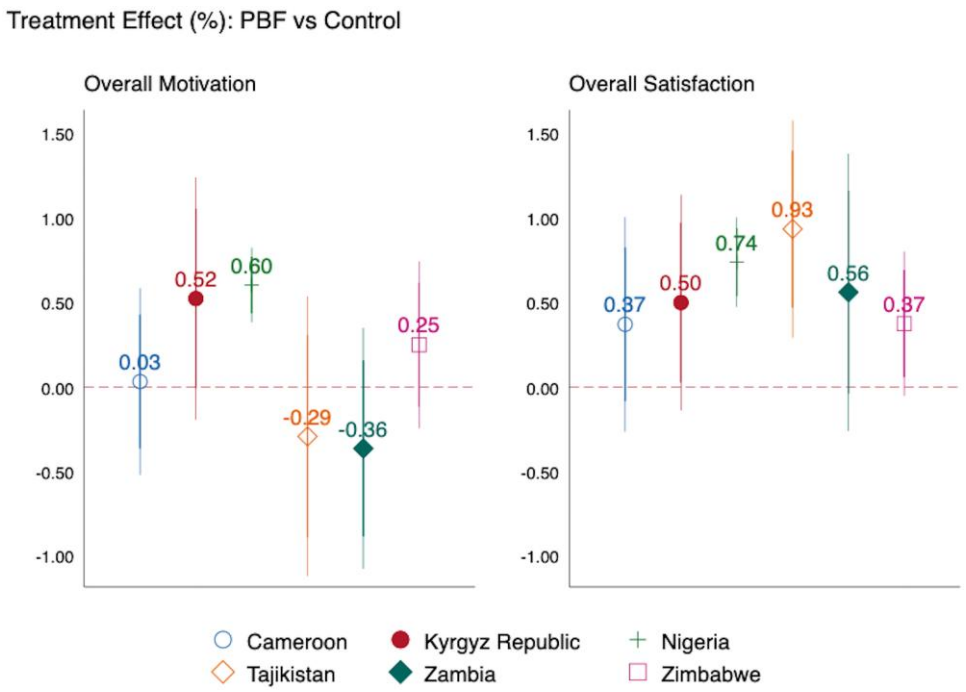

Figure 1. Treatment effect (%) from estimating DID on the effect of PBF (compared with business-as-usual) on overall health worker motivation and satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models, which include all individual health worker level controls available at the country level.

workers in both treatment and control facilities, and treatment effects (Column III) from the DID regressions that we estimated using the approach outlined above. Health workers in treatment facilities located in Nigeria reported an increase in overall motivation between baseline and endline while workers in PBF facilities in Kyrgyz Republic reported fairly consistent levels of motivation over time. In contrast, the health workers in comparison facilities in both Nigeria and Kyrgyz republic show a decrease in overall motivation between the two rounds.

Supplementary Table 1 and Figure 1 shows that there was an increase in health worker satisfaction between baseline and endline among health workers in PBF facilities compared with health workers in control facilities in all countries. We find increases significant at 95% level in Kyrgyz Republic (0.50 standard deviation increase), Nigeria (0.50 standard deviation increase), Tajikistan (0.93 standard deviation increase), and Zimbabwe (0.37 standard deviation increase). Further, we find an increase in Zambia (0.56 standard deviation increase) significant at the 10% level and the increase in Cameroon (0.37 standard deviation increase) just missing the cutoff for 10% significance. Supplementary Table 1 shows that health workers in treatment facilities in all countries reported an increase in overall job satisfaction. Health workers in control facilities in Cameroon, Kyrgyz Republic, and Tajikistan, also similarly reported an increase in overall job satisfaction between the two rounds (smaller than those in treatment facilities), whereas health workers in control facilities in Nigeria, Zambia, and Zimbabwe show a decrease in overall job satisfaction between the two rounds.

Supplementary Table 10 replicates the analyses presented in Supplementary Table 1 but uses the same specification and control variables for all six countries. We estimate DID with only the common controls of the sex of the health worker, their education level, and their cadres, and cluster standard errors at the district level (or ward level for Nigeria). Results are appreciably the same with the exception that we find a negative effect of PBF on health worker motivation, which is significant at 90% in Zambia and a positive effect of PBF on health worker satisfaction which is significant at 95% for Cameroon.[6]

Subconstructs of motivation and job satisfaction

What drives our overall motivation results? As mentioned earlier, we take a multidimensional approach or a compositional approach to motivation to be able to unpack the sources of motivation and examine the phenomenon of 'intrinsic motivation crowding out' in the context of the six countries. The motivation scales in the six countries were not designed to capture the entire continuum of the types of motivation in self-determination theory—extracted constructs of motivation consist of elements that are autonomous (intrinsic) and controlled (extrinsic) and can be at best considered to be partly controlled and partly autonomous. Therefore, we name the

[6] Given that this result for Zambia is a rare example (here) of an adverse impact of PBF on motivation, we conduct additional analysis to explore why this result loses precision with a fuller set of health worker characteristic controls. We determine that two worker characteristics influence what would be a null result in the full specification but a negative result in the limited specification that does not include these two measures—(a) whether salary has been paid on time or in full and (b) whether the health worker is local to the facility. These results are presented in Supplementary Table 12. It appears to be demotivating to not receive a full and timely salary, perhaps especially if the health worker is not local to the facility. In this sense, what can be regarded as an implementation failure—i.e. the failure to pay a full and timely salary—is a mediator of PBF influence in Zambia. Regarding mediators or causal channels more broadly, unfortunately few mediators are consistently measured across the six studies. For example, facility management was granted relative autonomy over budgetary decisions under PBF, but we don't have consistent meaningful measures of management autonomy at the facility level. We believe we can infer one likely mediator, at least with regard to the "pure control", and that is an increase in worker earnings, as job satisfaction with earnings is consistently higher among PBF exposed workers

motivation subconstructs based on the source of the motivation rather than the extent to which they are autonomous or controlled or the degree to which they are self-determined. We use these subconstructs to tease out the effect of PBF on sources of overall motivation. These subconstructs may be differentially driven by intrinsic and extrinsic motivation in turn. See Supplementary Tables 21 and 22 for a snapshot view of the subconstructs of M&S extracted for each of the six countries. Figures 2 and 3 show the effect of PBF on each of the M&S subconstructs for each of the six countries.

We find that the positive effect of PBF on overall health worker motivation in Nigeria is driven by a positive impact of PBF on almost all extracted subconstructs of (i) Workplace Relationships & Job Content, (ii) Self-Concept, (iii) Procedures and Performance, (iv) Coping with Changes in the Health Sector, and (v) Difficulties with Supervisors and Peers (Fig. 2).

Workplace Relationships & Job Content consists of motivation from sources such as staff and supervisor relationships, sharing and treating each other as family, as well as perceived complexity of the job, and perceived benefits of the job to the community. Our results suggest that compared with health workers in control facilities, health workers in Nigerian PBF facilities experienced a 0.32 standard deviation increase in motivation driven by Workplace Relationships & Job Content between baseline and endline. Self-concept consists of the statements 'I always wanted to be a health worker', 'I am proud to tell others that I am a health worker' and 'I am confident about my ability to do my job'. We find that health workers in Nigerian health facilities that were part of the PBF intervention experienced a 0.38 standard deviation increase in motivation driven by Self-concept between baseline and endline surveys compared with health workers in control facilities. This suggests that Nigerian health workers likely did not experience any 'intrinsic motivation crowding out'—in fact motivation driven by Self-concept which we can argue are a combination of intrinsic and extrinsic factors showed an increase. Similarly, we find that health worker motivation driven by Procedures and Performance, Coping with Changes in the Health Sector, and Difficulties with Supervisors and Peers increased by 0.41 standard deviations, 0.56 standard deviations, and 0.50 standard deviations between baseline and endline respectively (all significant at 99%) among health workers in PBF facilities compared with those in control facilities.

In contrast, in Kyrgyz Republic, we do not find a precisely estimated effect of PBF on any of subconstructs of motivation of Leadership, Teamwork, and Procedures and Performance. Although, we did not find that the precisely estimated effect of PBF on overall health worker motivation in Zimbabwe, we find positive result in terms of subconstructs of

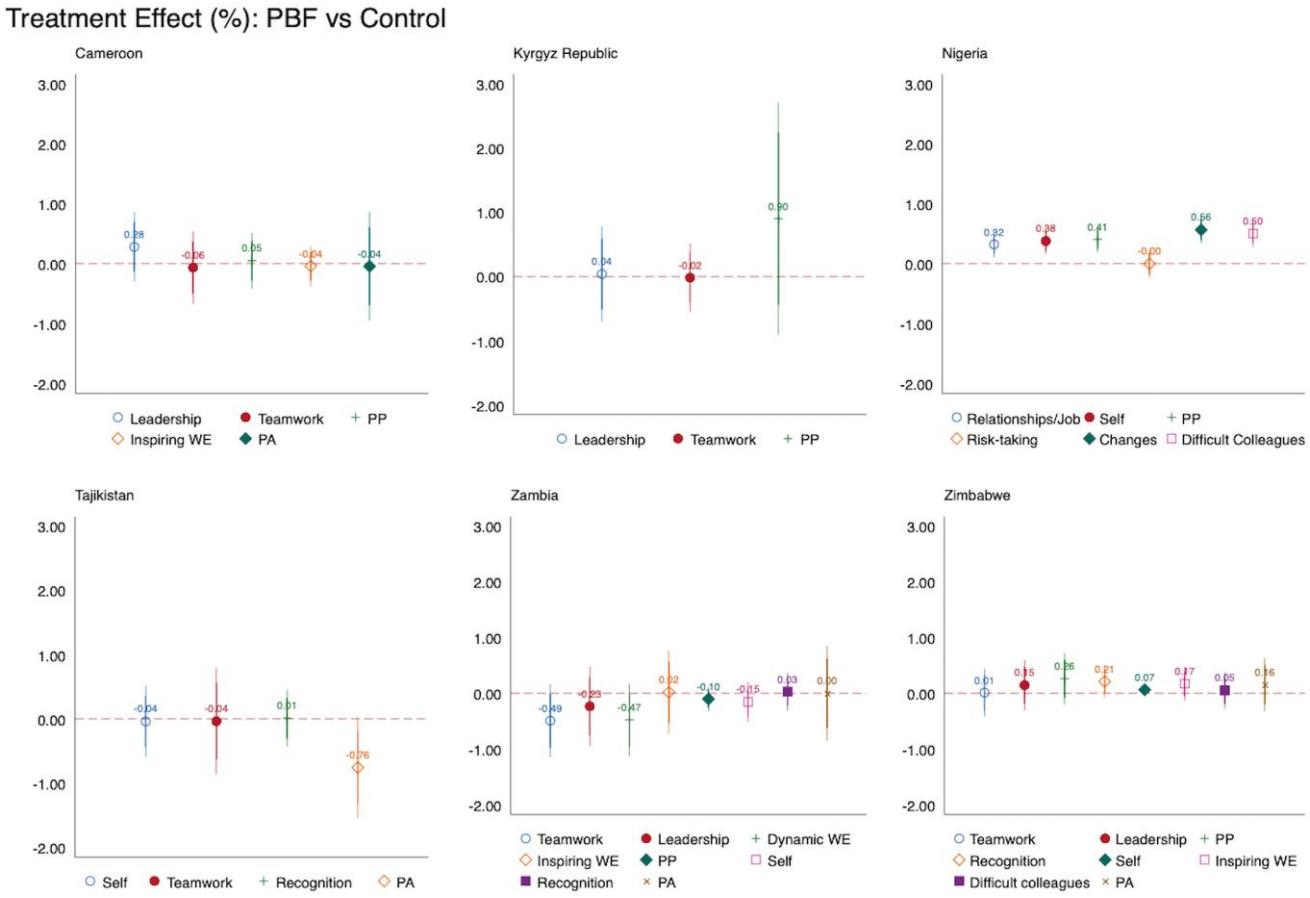

Figure 2. Treatment effect (%) from estimating DID on the effect of PBF vs control on subconstructs of motivation. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models which include all individual health worker level controls available at the country level. WE, work environment; PP, procedures and performance; Self, self-concept; PA, peer attitudes.

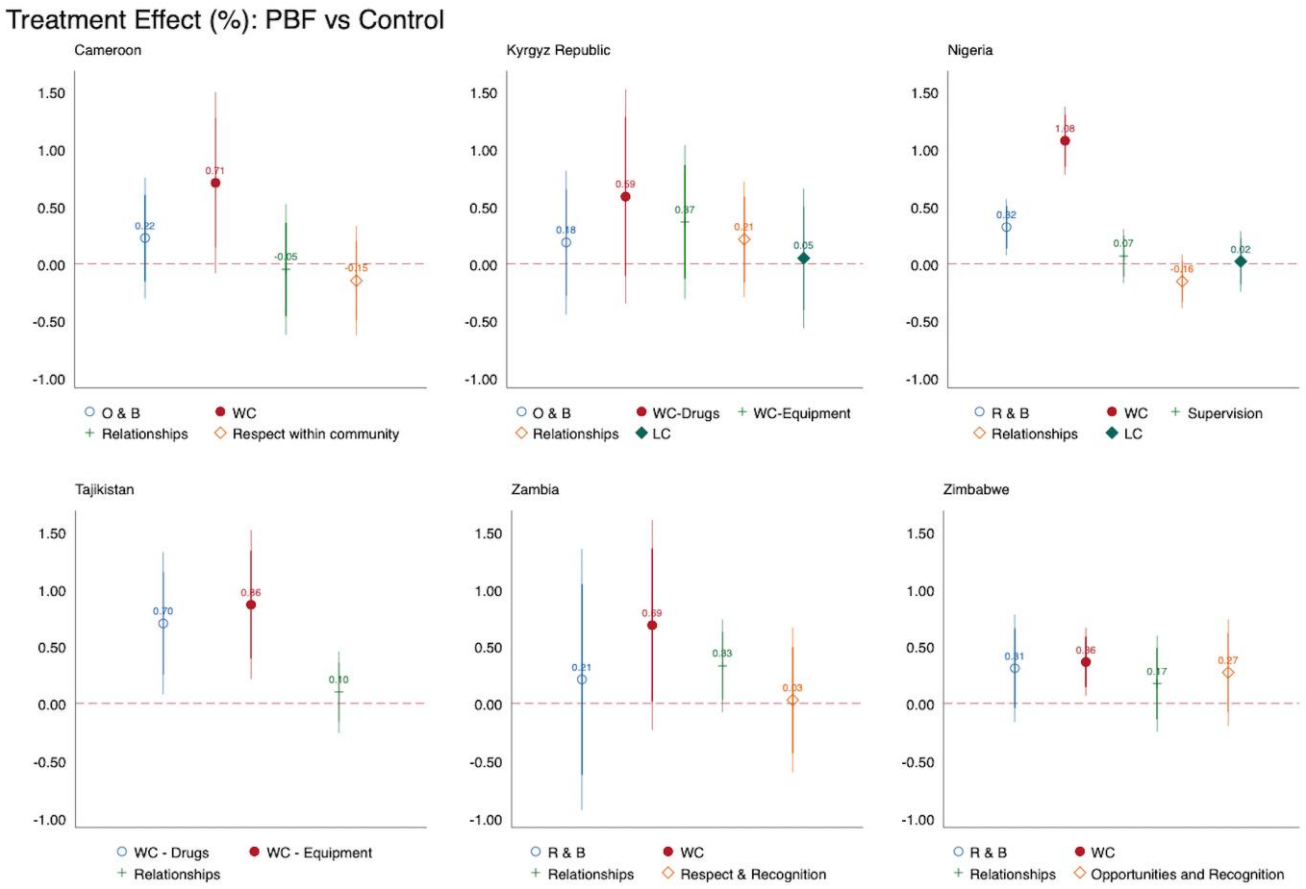

Figure 3. Treatment effect (%) from estimating DID on the effect of PBF vs control on subconstructs of satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models which include all individual health worker level controls available at the country level. WC, Working Conditions (specific to drugs, equipment, or overall); LC, Living Conditions; R & B, Rewards & Benefits; O & B, Opportunities & Benefits.

Recognition in this country (0.21 standard deviation increase which is significant at 95% level). Recognition consists of the statements 'It is important for me that the community recognizes my work as a professional' and 'It is important for me that my peers recognize my work as a professional'. We also find a borderline positive effect of PBF on motivation driven by Self-concept for Zimbabwe (Fig. 2). Self-concept in the Zimbabwean context is composed of the statements 'I complete my tasks efficiently and effectively', 'I am a hard worker' and 'I am punctual about coming to work'. We also do not find precisely estimated effect of PBF on motivation driven by Self-concept in the Tajikistan and Zambia. Note the difference between the composition of the subconstruct Self-concept across the four countries. Although these constructs are not comparable, we can conclude that we do not find any evidence of 'intrinsic motivation crowding out' in all these contexts in so far as subconstructs most closely linked to intrinsic motivation show no relative decline. We do not find any statistically significant effect of PBF on the other subconstructs of motivation in the other four countries of Cameroon, Kyrgyzstan, Tajikistan, and Zambia except for a reduction in motivation from Peer Attitudes in Tajikistan and a reduction in motivation form Teamwork and Dynamic Work Environment in Zambia which are all significant at 95%.

Parallel to the approach taken for motivation, we break down our satisfaction results to understand the effect of PBF on subconstructs or sources of satisfaction. Figure 3 shows the effect of PBF on each of the satisfaction subconstructs for each of the six countries. We find that among all the countries where we observe an increase in health worker satisfaction in PBF facilities between baseline and endline compared with control facilities in Fig. 1 these appear to be driven by increases in health worker satisfaction from Working Conditions (Fig. 3). Working Conditions consist of the physical condition of the health facility, including its building, infrastructure, as well as the availability of equipment, drugs, consumables, and other supplies. We observe large increases in health worker satisfaction from Working Conditions (WC) of 1.08 standard deviation in Nigeria (significant at 99%), and 0.69 standard deviations in Zambia (significant at 95%), and 0.36 standard deviation in Zimbabwe (significant at 99%). Although we do not observe a significant increase in overall health worker satisfaction in Cameroon in Fig. 1, we observe increases in health worker satisfaction from WC of 0.71 standard deviation (significant at 95%) in the country. In Tajikistan too, the subconstructs of Working Conditions–Drugs and Consumables as well as Working Conditions–Equipment and Infrastructure increased by 0.70 and 0.86 standard deviations between the baseline and endline

for health workers in PBF facilities compared with those in control facilities. Working Conditions–Drugs and Consumable includes statements such as 'Quality of medicines available in the health facility'. Working Conditions–Equipment and Infrastructure that consist of the statements such as the 'Quantity of equipment in the health facility', 'The physical condition of the health facility building' among others. Figure 3 also shows a 0.32 standard deviation increase in health worker satisfaction from Rewards and Benefits (R & B) among health workers in PBF facilities in Nigeria compared with control facilities in Nigeria—the only subconstruct of Satisfaction directly tied to monetary benefits that are part of performance-based interventions. Overall, these results present suggestive evidence that the improvement in 'Working Conditions' in PBF facilities compared with business-as-usual facilities was a source of increased job satisfaction among health workers in virtually all countries. In contrast, we don't see improvements in 'Opportunities and Benefits (O & B)' or 'Rewards and Benefits (R &B)', which are related to monetary benefits, emerge as source of increased job satisfaction except in Nigeria.

Heterogeneous effects

We examine heterogeneity in the treatment effect of PBF compared with business-as-usual by individual characteristics of health workers. More specifically, we look at heterogeneity in terms of the sex, age, marital status, and cadre of health workers. We create four binary variables that take the value 1 (and 0 otherwise) for health workers who identify as women, are married, who are nurses, midwives, or nurse assistants by profession, and are aged 40 and above. These results are detailed in Supplementary Tables 6–9. Health worker cadres covered in the survey differed across the six countries, which made disaggregating cadres beyond identifying nurse and midwives as a separate group challenging (see Supplementary Table 27 for more details on distribution of cadres in each country).

In Supplementary Table 6A, we see that both male and female health workers in PBF health facilities in Nigeria experienced an increase in their motivation compared with control facilities by 0.65 standard deviation and 0.58 standard deviations but the difference (of 0.07 standard deviations) between male and female health workers is not significant. In Supplementary Table 6B, we find that both male and female health workers in PBF facilities in all countries experienced improvements in their job satisfaction compared with health workers in control facilities. However, male health workers experienced greater improvements —the negative interaction term for females is significant at 95% only for Zimbabwe.

In Supplementary Table 7, we find evidence for heterogeneity in treatment effects by the marital status of health workers only for Zimbabwe. The interaction term for the binary married is negative and significant, which suggests that unmarried health workers in PBF facilities experienced greater improvements in their motivation compared with married health workers in PBF facilities in Zimbabwe. Results in Supplementary Table 8A suggest relative gains in motivation for older health workers in Nigeria but relative gains in motivation for younger health workers below the age of 40 years in Tajikistan. Furthermore, gains in health worker satisfaction are most pronounced among younger health workers in Zimbabwe.

In Supplementary Table 9A, we find evidence of heterogeneity in treatment effects by whether the health workers in a nurse or midwife for Tajikistan. In this setting health workers who are not nurses or midwives in PBF facilities (i.e. family physicians, obstetricians, gynecologists, junior doctors, feldshers, and others) experienced a reduction in their motivation compared with control facilities by 0.65 standard deviations. On the other hand, nurses, and midwives in PBF facilities experienced a 0.12 increase in their motivation

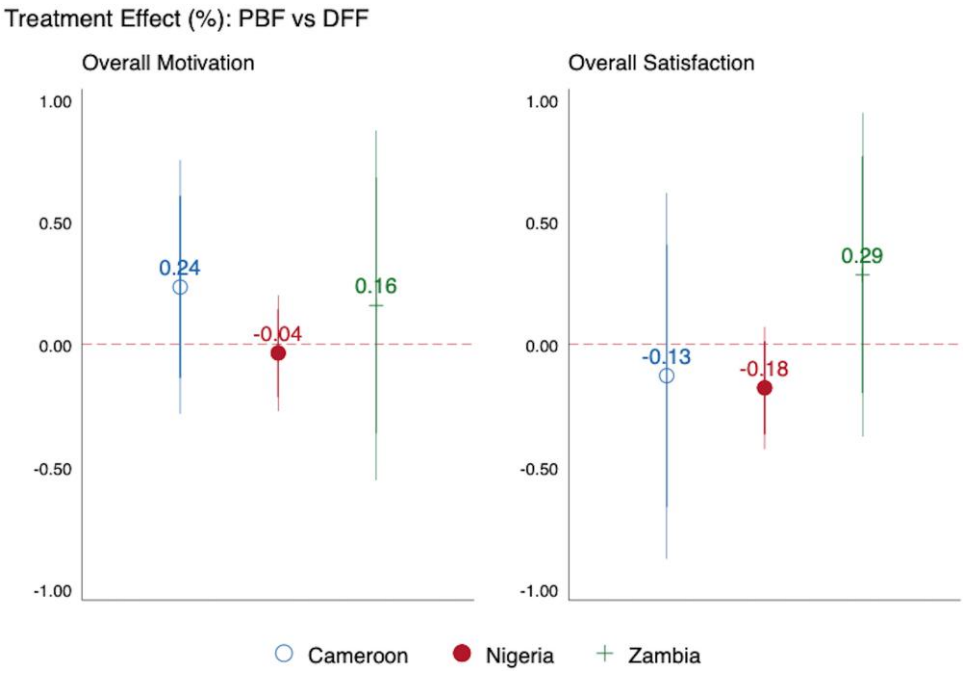

Figure 4. Treatment effect (%) from estimating DID for the effect of PBF (compared with DFF) on overall health worker motivation and satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models, which include all individual health worker level controls available at the country level.

compared with those in control facilities in Tajikistan. On the contrary, in Supplementary Table 9B, we find that nurses and midwives in PBF health facilities in Nigeria and Tajikistan experienced significantly lower improvements in their job satisfaction between rounds compared with other cadres, when compared with health workers in control facilities in these countries—the interaction term is negative and significant. Increases in health worker satisfaction in these countries were disproportionately greater among the non-nursing staff.

Policy alternatives to PBF

PBF compared with DFF

Figure 4 presents the DID coefficient for the treatment effect of PBF coefficient compared with DFF for regressions including controls on health worker motivation (Figure 4A, Left), and satisfaction (Figure 4B, Right;).[7] Figure 4A shows that PBF did not have any systematic motivating or demotivating effects when compared with DFF across the 3 country contexts of Cameroon, Nigeria, and Zambia where these financing alternatives were tested. For Nigeria, Figure 4B shows that, health workers in PBF facilities experienced approximately 0.18 standard deviation decrease in satisfaction between baseline and endline compared with health workers in DFF facilities—and this decrease is significant at the 10% level (Supplementary Table 2).

PBF compared with enhanced supervision

Figure 6 presents the DID coefficient for the treatment effect of PBF coefficient compared with ES for regressions including controls on health worker motivation (Figure 6A, Left), and satisfaction (Figure 6B, Right).[8] Figure 6A shows that PBF did not have any systematic motivating or demotivating effects when compared with ES across the 2 country contexts of Cameroon and Kyrgyz Republic where these two financing alternatives were tested. For Cameroon, Figure 6B shows that health workers in PBF facilities experienced a 0.43 standard deviation increase in satisfaction between baseline and endline compared with health workers in ES facilities—significant with a *P*-value equal to 0.06 (Supplementary Table 4). In short, we do not find evidence that PBF led to the crowding out of motivation compared with the policy alternatives of DFF and ES in contexts where these were tested.

Discussion

We find that, compared with business-as-usual, PBF interventions in the six countries we study did not adversely impact overall motivation among health workers in participating health facilities. Instead, the intervention improved overall motivation in two contexts, and improved satisfaction in five contexts. Our EFA does not enable us to unpack overall motivation into intrinsic and extrinsic motivation in all the six country contexts, as the scales do not capture the entire continuum of types of motivation in self-determination theory. However, using the subconstructs of motivation driven by elements of intrinsic motivation such as Self-Concept in Nigeria, Tajikistan, Zambia, and Zimbabwe, we do not find any evidence of intrinsic motivation crowding out in either of these four countries (and a statistically significant positive effect on motivation driven by Self-concept in Nigeria). Comparing PBF to notable supply-side alternatives of DFF and ES, we also did not find evidence of significant impacts. Our study findings suggest that PBF interventions either do not typically affect health worker M&S above and beyond business-as-usual or other policy alternatives or they increase measures of M&S. Our findings do not provide any empirical backing for the popular critique of PBF interventions that they crowd out intrinsic motivation. PBF remains a viable intervention in terms of impacts on worker M&S. PBF as a policy tool is principally targeted towards increasing the coverage of health services, the quality of health services, or both (see De Walque *et al.* 2022). In the settings studied here, PBF does not negatively and inadvertently impact worker M&S in the course of striving to achieve these goals.[9]

As we are interested in a broad-based examination of the effects of PBF on health worker motivation, it is this overarching takeaway—that PBF did not reduce health worker M&S and in fact at times increased it—that takes precedence over a particular result from one country or program comparison. We reiterate that the six studies we leverage were designed to be harmonized and pooled for exactly such a cross-cutting take on the impacts of PBF—principally on targeted outcomes such as service availability and quality as well as on health worker motivation and satisfaction. Further, we believe this sort of overarching look at the effects of PBF are particularly important when it comes to health worker motivation and satisfaction. Other work (Deci and Ryan 1985, Gneezy and Rustichini 2000b, Ariely *et al.* 2009, Lohmann, Muula, *et al.*, 2018) has raised significant concerns about the long-term damage to health systems from short-lived PBF programs via the specific channel examined here, detriments to health worker motivation and satisfaction. Rather than provide evidence from a single country study, we show quite broadly (from six disparate settings) that PBF did not degrade health systems through this channel of concern.

We note that while the concern for worker motivation explored here involves a degradation of 'intrinsic' motivation, occupational psychologists' views of worker motivation involve a variety of dimensions that can be said to partially constitute both intrinsic and extrinsic motivation factors. These factors include the importance of working conditions and job resources (Bakker and Demerouti 2007), compensation perceived to be fair (which has antecedents in the psychology literature back to (Adams 1965)), career growth and opportunities for professional development, fostering a facility

[7] Figure 5 presents the DID coefficient for the treatment effect of DFF on health worker motivation (Figure 5A, Left), satisfaction (Figure 5B, Right). For Nigeria, we find that health workers in DFF facilities experience approximately 0.64 standard deviation increase in motivation between baseline and endline compared to health workers in pure control facilities—the increase is significant at 99%. But this is not true for health workers in DFF facilities in Cameroon and Zambia. Health workers in DFF facilities in Nigeria also experienced a 0.92 standard deviation increase in their job satisfaction between baseline and endline compared to health workers in business-as-usual facilities (Figure 5B).

[8] Figure 7 presents the DID coefficient for the treatment effect of ES on health worker motivation (Figure 7A, Left), and satisfaction (Figure 7B, Right) in the countries of Cameroon and Kyrgyz Republic. We don't find any significant effect of the intervention on motivation or job satisfaction for health workers in facilities that received ES compared to health workers in business-as-usual facilities.

[9] Changes in behavioural responses to PBF other than those due to changes satisfaction or motivation, such as "gaming", may be more consequential for program performance. It is hard to assess the relative sizes of changes to motivation and to willingness to misreport or engage in other forms of "gaming", although at least one study suggests that, in a lab-in-the-field setting, reputational concerns greatly limit the extent of the "gaming" response among health workers in Nigeria (Bauhoff and Kandpal, 2024).

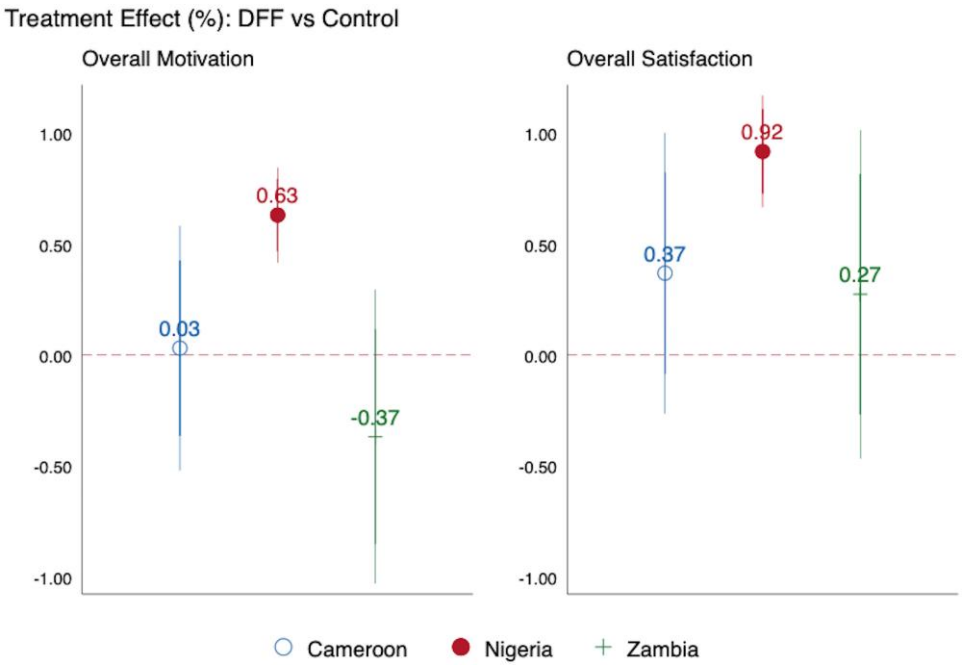

Figure 5. Treatment effect (%) from estimating DID for the effect of DFF (compared with business-as-usual) on overall health worker motivation and satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models, which include all individual health worker level controls available at the country level.

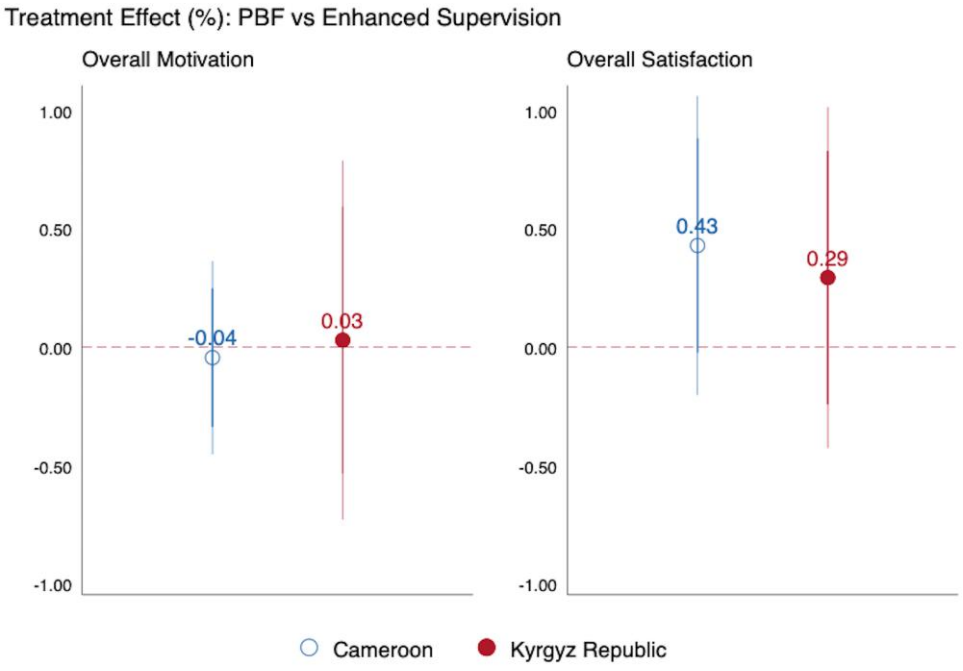

Figure 6. Treatment effect (%) from estimating DID for the effect of PBF (compared with enhanced supervision) and enhanced supervision (compared with business-as-usual) on overall health worker motivation and satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models, which include all individual health worker level controls available at the country level.

environment that is supportive for interpersonal expression and learning (Edmondson 1999), and pro-social motivations. Some of these dimensions can, in principle be improved by PBF or DFF, rather than degraded, and indeed the findings from these six countries are consistent with some degree of improvement or stasis in these dimensions. Other dimensions reflect management styles and other factors largely unrelated to the form of facility payment. Future work can explore how health system managers should effectively intervene to improve health worker motivation and satisfaction in the context of a change in the economic incentives presented at the facility or provider level. Policy reforms principally directed at work motivation and satisfaction to explore alongside PBF (or as a standalone) might include the introduction of supportive

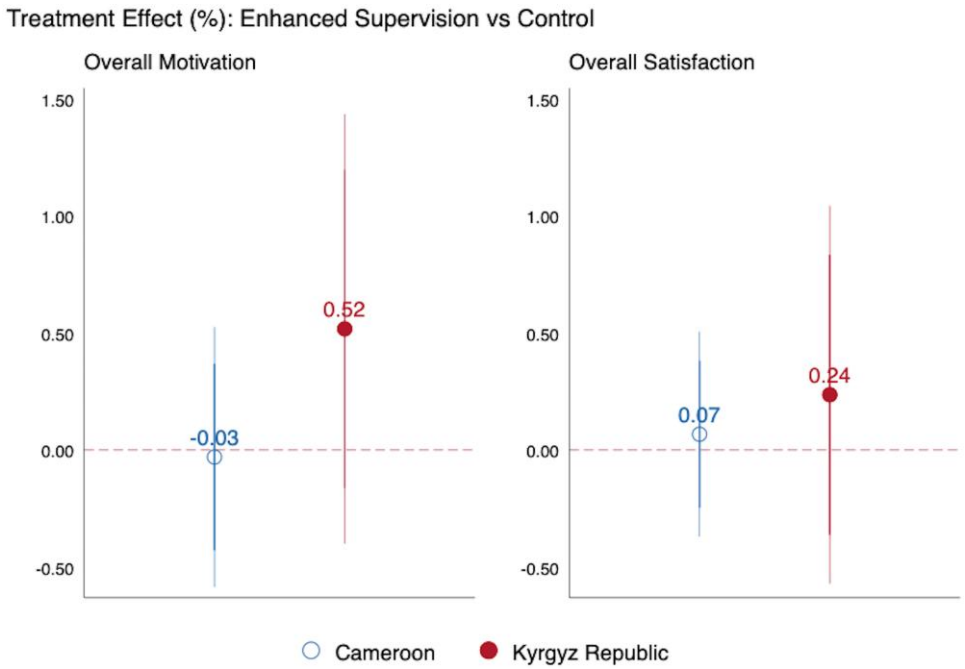

Figure 7. Treatment effect (%) from estimating DID for the effect of enhanced supervision (compared with business-as-usual) on overall health worker motivation and satisfaction. Notes: outcome variables have been normalized. Coefficient plots show 95% and 99% confidence intervals for coefficients derived from estimating DID models, which include all individual health worker level controls available at the country level.

supervision or the offer of career development services (Bailey *et al.* 2016, Kok *et al.* 2018, Mbilinyi *et al.* 2011).

Our analysis certainly has some limitations. First the assessed constructs of motivation and satisfaction were not consistently measured across the six countries and therefore we present results separately for each country rather than conduct a pooled analysis. Second, the assessed individual characteristics of health workers differed across the six countries and therefore we control for different sets of health worker characteristics in each context. However, we show that our results largely do not change if we use the more limited vector of controls common to each country. Third, the same health worker was not interviewed at baseline and endline and—it is possible that health worker composition changed systematically in PBF facilities compared with control facilities and these changes may be correlated with outcomes. Therefore, we include controls for the cadre of the health worker who was interviewed, as well as other worker characteristics, to mitigate this concern.[10] Finally, the period of study in each of the six countries varies but the implementation period lasts for approximately two to three years across the six settings (see Supplementary Table 20). It is possible that potentially demotivating effects of the PBF intervention occur over a longer horizon than three years and therefore we would not be able to identify such effects here. However, previous literature that investigates demotivating effects of financial incentives on pro-social behavior (either in experimental or volunteer settings) identifies such effects over a much shorter timeline—on the order of weeks or months—than the average three-year period investigated here (Upton III 1973, Frey and Goette 1999, Gneezy and Rustichini 2000a).

[10] Interestingly, since the data structure in all six countries contains a panel of facilities and not health workers, we can estimate a specification with facility fixed effects. While controlling for all invariant facility characteristics, including average worker characteristics across periods, the facility fixed effect will also capture some component of the main treatment effect and therefore is not a preferred specification. Nevertheless, the results are quite consistent with the main set of results presented—worker motivation increases in 2 of 6 countries and satisfaction in 3 of 6 countries.

Supplementary data

Supplementary data is available at Health Policy and Planning online.

Author contributions

S.L., E.K., and J.F. conceptualized the research work jointly. E.K. and J.F. were involved in the design of data collection endeavors for multiple countries. S.L. carried out the data analysis. S.L. and E.K. interpreted the analysis and drafted the article jointly, and all three authors provided inputs in critical revisions of the article. All authors approved the final version of the article submitted.

We note that all two out of the three authors are currently based in HICs. The reason for this is as follows. This paper is a pooled analysis of secondary data from six low-and-middle income countries. The data was originally collected for impact evaluation studies of performance-based financing interventions in each country. Associated impact evaluations studies published elsewhere included authors from countries studied. The authors of this study downloaded the data from the World Bank Microdata Catalogue and harmonized the data to carry out a synoptic meta-analysis which includes all six countries to ask a different question than that asked in main impact evaluation studies. We are interested in examining the effect of performance-based financing on health worker motivation and job satisfaction while the main impact evaluations studied health indicators as outcome variables. Given that this study is not part of the original impact evaluation for one

specific country we did not involve local researchers in the conceptualization and analysis for this study.

Reflexivity statement

The authors include 2 women and 1 man with experience working on multiple aspects of health systems in developing countries. One author is a young scholar who is starting out her research career while the other two authors are established researchers in their respective fields. Two authors are originally from India and currently located in India and the United States, while the third author is from the United States and based in the United States.

Ethical approval

Ethical approval for this type of study is not required by our institute. This work involves the secondary analysis of survey data from six earlier projects that have all received IRB approval.

Conflict of interest

All authors declare no competing interests or activities that could appear to have influenced the submitted work.

Funding

None declared.

Data availability

The data used in this study are publicly available in the World Bank Microdata Library. The links for the respective countries are as follows: Cameroon (https://doi.org/10.48529/cjmy-ae11 and https://doi.org/10.48529/t8jj-7q44), Kyrgyz Republic (https://doi.org/10.48529/hw96-xg64), Nigeria (https://doi.org/10.48529/bct1-ga12), Tajikistan (https://doi.org/10.48529/k6ck-gn52 and https://doi.org/10.48529/s143-rw94), Zambia (https://microdata.worldbank.org/index.php/catalog/5894/data-dictionary and https://microdata.worldbank.org/index.php/catalog/5896), and Zimbabwe (https://doi.org/10.48529/h4q7-xy78). The harmonized data underlying this article will be shared on reasonable request to the corresponding author.

References

Adams JS. Inequity in social exchange. In: Advances in Experimental Social Psychology. Vol. 2. Elsevier, 1965, 267–99.

Ahmed T, Arur A, De Walque D *et al.* Incentivizing quantity and quality of care: evidence from an impact evaluation of performance-based financing in the health sector in Tajikistan. *Econ Dev Cult Change* 2023;**71**:667–707. https://doi.org/10.1086/715579

Angelini V, Cavapozzi D, Corazzini L *et al.* Do Danes and Italians rate life satisfaction in the same way? Using vignettes to correct for individual-specific scale biases. *Oxf Bull Econ Stat* 2014;**76**:643–66. https://doi.org/10.1111/obes.12039

Ariely D, Bracha A, Meier S. Doing good or doing well? Image motivation and monetary incentives in behaving prosocially. *Am Econ Rev* 2009;**99**:544–55. https://doi.org/10.1257/aer.99.1.544

Bailey C, Blake C, Schriver M *et al.* A systematic review of supportive supervision as a strategy to improve primary healthcare services in Sub-Saharan Africa. *Int J Gynaecol Obstet* 2016;**132**:117–25. https://doi.org/10.1016/j.ijgo.2015.10.004

Bakker AB, Demerouti E. The job demands-resources model: state of the art. *J Manag Psychol* 2007;**22**:309–28. https://doi.org/10.1108/02683940710733115

Bauhoff S, Kandpal E. Pay-for-performance Contracts in the Lab and the Real World: Evidence from Nigeria. *Center for Global Development, No. 677*. 2024. https://www.cgdev.org/sites/default/files/pay-performance-contracts-lab-and-real-world-evidence-nigeria.pdf

Benjamin DJ, Cooper K, Heffetz O, *et al.* Adjusting for scale-use heterogeneity in self-reported well-being. *Nat Bureau Econ Res*. 2023;**No. w31728**. https://www.nber.org/papers/w31728

Bertone MP, Meessen B. Studying the link between institutions and health system performance: a framework and an illustration with the analysis of two performance-based financing schemes in Burundi. *Health Policy Plan* 2013;**28**:847–57. https://doi.org/10.1093/heapol/czs124

Binyaruka P, Lohmann J, De Allegri M. Evaluating performance-based financing in low-income and middle-income countries: the need to look beyond average effect. *BMJ Glob Health* 2020;**5**:e003136. https://doi.org/10.1136/bmjgh-2020-003136

Borghi J, Lohmann J, Dale E *et al.* How to do (or not to do)… measuring health worker motivation in surveys in low-and middle-income countries. *Health Policy Plan* 2018;**33**:192–203. https://doi.org/10.1093/heapol/czx153

Chandler CI, Chonya S, Mtei F *et al.* Motivation, money and respect: a mixed-method study of Tanzanian non-physician clinicians. *Social Science & Medicine* 2009;**68**:2078–88. https://doi.org/10.1016/j.socscimed.2009.03.007

Daw JR, Hatfield LA. Matching and regression to the mean in difference-in-differences analysis. *Health Serv Res* 2018;**53**:4138–56. https://doi.org/10.1111/1475-6773.12993

Deci EL, Ryan RM. The general causality orientations scale: self-determination in personality. *J Res Pers* 1985;**19**:109–34. https://doi.org/10.1016/0092-6566(85)90023-6

De Walque D, Kandpal E, Wagstaff A *et al.* Improving Effective Coverage in Health: Do Financial Incentives Work?. World Bank Publications, 2022.

De Walque D, Robyn PJ, Saidou H *et al.* Looking into the performance-based financing black box: evidence from an impact evaluation in the health sector in Cameroon. *Health Policy Plan* 2021;**36**:835–47. https://doi.org/10.1093/heapol/czab002

Duflo E, Hanna R, Ryan SP. Incentives work: getting teachers to come to school. *Am Econ Rev* 2012;**102**:1241–78. https://doi.org/10.1257/aer.102.4.1241

Duran D, Bauhoff S, Berman P *et al.* The role of health system context in the design and implementation of performance-based financing: evidence from Cote d'Ivoire. *BMJ Glob Health* 2020;**5**:e002934. https://doi.org/10.1136/bmjgh-2020-002934

Edmondson A. Psychological safety and learning behavior in work teams. *Adm Sci Q* 1999;**44**:350–83. https://doi.org/10.2307/2666999

Engineer CY, Dale E, Agarwal A *et al.* Effectiveness of a pay-for-performance intervention to improve maternal and child health services in Afghanistan: a cluster-randomized trial. *Int J Epidemiol* 2016;**45**:451–9. https://doi.org/10.1093/ije/dyv362

Frey BS, Goette L. Does Pay Motivate Volunteers? *Institute for Empirical Research in Economics* 1999;**No. 7**.

Friedman J, Qamruddin J, Chansa C *et al.* Impact Evaluation of Zambia's Health Results-Based Financing Pilot Project. Washington, DC: World Bank Group, 2016.

Fritsche GB, Soeters R, Meessen B. Performance-based Financing Toolkit. World Bank Publications, 2014.

Gautier L, De Allegri M, Ridde V. How is the discourse of performance-based financing shaped at the global level? A poststructural analysis. *Global Health* 2019;**15**:6. https://doi.org/10.1186/s12992-018-0443-9

Gneezy U, Rustichini A. A fine is a price. *J Legal Stud* 2000a;**29**:1–17. https://doi.org/10.1086/468061

Gneezy U, Rustichini A. Pay enough or don't pay at all. *Q J Econ* 2000b;**115**:791–810. https://doi.org/10.1162/003355300554917

Himmelstein DU, Ariely D, Woolhandler S. Pay-for-performance: toxic to quality? Insights from behavioral economics. *Int J Health Serv* 2014;**44**:203–14. https://doi.org/10.2190/HS.44.2.a

Ireland M, Paul E, Dujardin B. Can performance-based financing be used to reform health systems in developing countries? *Bull World Health Organ* 2011;**89**:695–8. https://doi.org/10.2471/BLT.11.087379

Kalk A, Paul FA, Grabosch E. Paying for performance'in Rwanda: does it pay off? *Trop Med Int Health* 2010;**15**:182–90. https://doi.org/10.1111/j.1365-3156.2009.02430.x

Khanna M, Loevinsohn B, Pradhan E *et al.* Decentralized facility financing versus performance-based payments in primary health care: a large-scale randomized controlled trial in Nigeria. *BMC Med* 2021;**19**:224. https://doi.org/10.1186/s12916-021-02092-4

Kok MC, Vallières F, Tulloch O *et al.* Does supportive supervision enhance community health worker motivation? A mixed-methods study in four African countries. *Health Policy Plan* 2018;**33**:988–98. https://doi.org/10.1093/heapol/czy082

Lazear EP. Performance pay and productivity. *Am Econ Rev* 2000;**90**:1346–61. https://doi.org/10.1257/aer.90.5.1346

Lietz P. Research into questionnaire design: a summary of the literature. *Int J Market Res* 2010;**52**:249–72. https://doi.org/10.2501/S147078530920120X

Lohmann J, Houlfort N, De Allegri M. Crowding out or no crowding out? A self-determination theory approach to health worker motivation in performance-based financing. *Soc Sci Med* 2016;**169**:1–8. https://doi.org/10.1016/j.socscimed.2016.09.006

Lohmann J, Muula AS, Houlfort N *et al.* How does performance-based financing affect health workers' intrinsic motivation? A self-determination theory-based mixed-methods study in Malawi. *Soc Sci Med* 2018;**208**:1–8. https://doi.org/10.1016/j.socscimed.2018.04.053

Lohmann J, Wilhelm D, Kambala C *et al.* 'The money can be a motivator, to me a little, but mostly PBF just helps me to do better in my job.' an exploration of the motivational mechanisms of performance-based financing for health workers in Malawi. *Health Policy Plan* 2018;**33**:183–91. https://doi.org/10.1093/heapol/czx156

Maini R, Lohmann J, Hotchkiss DR *et al.* What happens when donors pull out? Examining differences in motivation between health workers who recently had performance-based financing (PBF) withdrawn with workers who never received PBF in the Democratic Republic of Congo. *Int J Health Policy Manag* 2019;**8**:646–61. https://doi.org/10.15171/ijhpm.2019.55

Mbilinyi D, Daniel ML, Lie GT. Health worker motivation in the context of HIV care and treatment challenges in mbeya region, Tanzania: a qualitative study. *BMC Health Serv Res* 2011;**11**:266. https://doi.org/10.1186/1472-6963-11-266

Mbindyo PM, Blaauw D, Gilson L *et al.* Developing a tool to measure health worker motivation in district hospitals in Kenya. *Hum Resour Health* 2009;**7**:40. https://doi.org/10.1186/1478-4491-7-40

Paul E, Bodson O, Ridde V. What theories underpin performance-based financing? A scoping review. *J Health Organ Manag*. 2021;**35**(3):344–381. doi:10.1108/JHOM-04-2020-0161.

Prendergast C. The provision of incentives in firms. *J Econ Lit* 1999;**37**:7–63. https://doi.org/10.1257/jel.37.1.7

Ravallion M, Himelein K, Beegle K. Can subjective questions on economic welfare be trusted? *Econ Dev Cult Change* 2016;**64**:697–726. https://doi.org/10.1086/686793

Renmans D, Holvoet N, Orach CG *et al.* Opening the 'black box'of performance-based financing in low-and lower middle-income countries: a review of the literature. *Health Policy Plan* 2016;**31**:1297–309. https://doi.org/10.1093/heapol/czw045

Roth J, Sant'Anna PH, Bilinski A *et al.* What's trending in difference-in-differences? A synthesis of the recent econometrics literature. *J Econom* 2023;**235**:2218–44. https://doi.org/10.1016/j.jeconom.2023.03.008

Shepard DS, Zeng W, Mutasa R *et al.* Cost-effectiveness of results-based financing of maternal and child health services in Zimbabwe: a controlled pre-post study. *J Hosp Manag Health Policy* 2020;**4**:32. https://doi.org/10.21037/jhmhp-20-84

Spector PE. Measurement of human service staff satisfaction: development of the Job Satisfaction Survey. *Am J Community Psychol* 1985;**13**:693–713. https://doi.org/10.1007/BF00929796

Sturgis P, Smith P. Assessing the validity of generalized trust questions: what kind of trust are we measuring? *Int J Public Opin Res* 2010;**22**:74–92. https://doi.org/10.1093/ijpor/edq003

Upton WE III. Altruism, Attribution, and Intrinsic Motivation in the Recruitment of Blood Donors. *Dissertation submitted to Cornell University* 1973.

Weiss DJ, Dawis RV, England GW *et al.* Manual for the Minnesota Satisfaction Questionnaire. Minneapolis: University of Minnesota. Industrial Relations Centre, 1967.

Zeng W, Shepard DS, Nguyen H *et al.* Cost–effectiveness of results-based financing, Zambia: a cluster randomized trial. *Bull World Health Organ* 2018;**96**:760–71. https://doi.org/10.2471/BLT.17.207100