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Incentivising doctor attendance in rural Bangladesh: a latent class analysis of a discrete choice experiment

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ABSTRACT

Objective Doctor absenteeism is widespread in Bangladesh, and the perspectives of the actors involved are insufficiently understood. This paper sought to elicit preferences of doctors over aspects of jobs in rural areas in Bangladesh that can help to inform the development of packages of policy interventions that may persuade them to stay at their posts.

Methods We conducted a discrete choice experiment with 308 doctors across four hospitals in Dhaka, Bangladesh. Four attributes of rural postings were included based on a literature review, qualitative research and a consensus-building workshop with policymakers and key health-system stakeholders: relationship with the community, security measures, attendance-based policies and incentive payments. Respondents' choices were analysed with mixed multinomial logistic and latent class models and were used to simulate the likely uptake of jobs under different policy packages.

Results All attributes significantly impacted doctor choices (p<0.01). Doctors strongly preferred jobs at rural facilities where there was a supportive relationship with the community (β=0.93), considered good attendance in education and training (0.77) or promotion decisions (0.67), with functional security (0.67) and higher incentive payments (0.5 per 10% increase of base salary). Jobs with disciplinary action for poor attendance were disliked by respondents (−0.63). Latent class analysis identified three groups of doctors who differed in their uptake of jobs. Scenario modelling identified intervention packages that differentially impacted doctor behaviour and combinations that could feasibly improve doctors' attendance.

Conclusion Bangladeshi doctors have strong but varied preferences over interventions to overcome absenteeism. We generated evidence suggesting that interventions considering the perspective of the doctors themselves could result in substantial reductions in absenteeism. Designing policy packages that take account of the different situations facing doctors could begin to improve their ability and motivation to be present at their job and generate sustainable solutions to absenteeism in rural Bangladesh.

Key questions

What is already known?

► Doctor absenteeism is a widespread and pervasive problem in Bangladesh, limiting access to care and reducing the impact of health expenditure.

► There is limited evidence of successful interventions to overcome the problem and traditional approaches focusing on increased monitoring and enforcement of sanctions for absent doctors have not had sustained impact doctor attendance.

What are the new findings?

► Through a novel application of a discrete choice experiment, we elicited doctor preferences over key drivers of absenteeism and potential policy interventions and identified how this varied across our sample.

► We identify a subset of doctors who appear susceptible to behaviour change through feasible levels of policy intervention.

What do the new findings imply?

► By incorporating the preferences of this subset of doctors into policy design and addressing the key drivers of absenteeism, feasible and pragmatic packages of interventions can be developed likely to reduce absenteeism across the system.

INTRODUCTION

Health worker absenteeism is widespread in many low-income and middle-income countries and is a major obstacle to achieving universal health coverage as it disproportionately affects vulnerable groups.[1–3] In Bangladesh, absenteeism is a particular problem among doctors. Although data are scarce, it has been estimated that 40% of doctors are absent from their posts at one any time, and, when a facility is staffed by a single doctor as is often the case in rural areas with underserved communities, absenteeism can be as high as 74%.[3] Traditionally, research on rule breaking has been dominated by frameworks based on neoclassical economic formulations of behaviour change that see absenteeism as a result of poor governance and is prone to moralising descriptions of those who violate

contracts as profit-maximising opportunists who seek to exploit weaknesses in the system. From this viewpoint, interventions developed to overcome absenteeism have focused on formal, technical fixes (government policies and institutional and organisational reform often aimed at improving oversight or punishment for rule-breakers).[4] In Bangladesh, for example, the Government has responded to the widespread absenteeism of doctors by installing fingerprint scanners to verify attendance by health workers in rural health clinics and publishes attendance rates online to expose and punish individual providers.[5] These approaches reproduce standard 'anticorruption' approaches to public sector rule violations to address the problem of absenteeism but have not delivered good results. This is because they do not account for the prevailing social and political context driving the behaviour. There is limited evidence of the positive impact of such measures on absenteeism in Bangladesh,[6–9] reflecting a lack of evidence for similar approaches globally.[7]

Recent frameworks developed to investigate rule-breaking in other sectors may offer a new way forward to address health worker absenteeism.[10] Through this new approach, we seek to recast absenteeism as a structural rather than moral issue with increased recognition of broader systemic factors driving doctor absenteeism,[4 11] to develop, as Gaitonde *et al* call for, 'locally tailored interventions born from a deeper understanding of local dynamics rather than focus on solutions that are universal or up-scalable'.[7] Through qualitative research with junior doctors in Bangladesh, we found doctors often found rural facilities to be dangerous and difficult to work in.[4] The high burden of work (exacerbated by absenteeism across the system) undermined their time to study for professional examinations and poor relationships with local communities made working hours stressful and sometimes frightening. Housing was often described as inadequate, sometimes non-existent and transport difficult, and for female doctors both dangerous and stressful. Doctors were found to be differentially able to be absent without sanction. For those who were well connected politically, it was relatively easy to leave a rural area and get a placement elsewhere. These doctors would be officially absent and then be officially relocated. For those who had weaker political connections, a considerable amount of time was spent absent from the health facility seeking support to be relocated. Those with no political connections were the ones who were mostly at the health facilities as they had no network to draw on and no scope to leave the rural area that they were placed in.

In this context, where absenteeism is widespread, top-down measures to enforce adherence to health system arrangements (eg, their contracts to work in rural areas) are ineffective, and enhanced enforcement would be risky as some junior doctors may leave the profession in even higher numbers leading to gaps in delivery. Further, such strategies represent large investments from scarce health budgets being directed to uses with limited impact on population health. In contrast, identifying the most profound structural drivers of doctor absenteeism could inform strategies that would induce and enable most doctors to be at their place of employment in rural areas. Targeted interventions to encourage and enable those who wish to be present at their posts but find it too challenging would leave a much smaller group who would continue to be absent. This minority could be addressed in other ways. In other sectors, when these supportive set of policies are in place, they have made space for novel forms of collective action to emerge and horizontal approaches to regulation where the rule-following majority becomes involved in peer-monitoring. We have described this type of strategy, which relies on first creating conditions that reduce reasons for rule breaking and then creates novel forms of horizontal governance as *designing for differences*.[12]

Developing appropriate strategies requires an understanding of the determinants of absenteeism, doctors' preferences over different components of their job and trade-offs they would be willing to make between them. Discrete choice experiments (DCEs) offer a means to do so and they have been shown to be useful for informing policies in a range of areas including health worker motivation and retention in many countries.[13] While context specific, these studies have generally shown the importance that health workers place on improved work conditions and benefits, such as bonus payments, promotion or educational opportunities and show that they are generally willing to accept certain undesirable job characteristics if balanced by positive ones that they value.

METHODS

We used a DCE to assess preferences of doctors in regard to determinants of absenteeism in rural facilities in Bangladesh and to identify areas for potential intervention. This study was conducted by the Anti-Corruption Evidence Research Consortium (SOAS-ACE) which works in Bangladesh, Nigeria and Tanzania. This component forms part of a mixed-methods study examining doctor absenteeism in rural Bangladesh (2017–2019).

Attribute development

As recommended in the literature,[14 15] DCE attributes were developed through a multistage, mixed-methods process including literature review, qualitative interviews and consensus-building workshops with policymakers and health-system stakeholders. The review examined measures to address absenteeism in South and South-East Asia.[9] This informed qualitative interviews with a purposively selected sample of 30 doctors who work or have recently worked in rural facilities, to explore their perceptions of what drives absenteeism and their views on potential solutions. Emerging themes informed attributes for the experiment, which were iteratively refined into nine candidate attributes presented to policymakers and clinicians working in the Bangladeshi health system.

Table 1 Candidate attributes included in pilot study and reason for inclusion

Attribute	Reason for inclusion	Propositions
Relationship between the doctor and the local community	Qualitative work highlighted that the doctors felt that having a good relationship with the community was the key determinant of how manageable the demands placed on them were. Further, many noted that if there was a good relationship, it would be unlikely that there would be security issues.	Doctors expected to prefer facilities that enabled a strong relationship with powerful individuals within the community.
Safety at workplace	Security was found to be a concern to the doctors both at workplace and living place. Many facilities did not have appropriate or functional security measures while many interviewees told of situations where they had either been verbally or physically abused while in the workplace.	Doctors expected to prefer facilities with effective security measures.
Workload	Many doctors reported that due to high numbers of patients, staff shortages and social pressures from the local community, they found their workload unmanageable and outside of their control.	Doctors expected to prefer facilities with better workload management practices.
Monitoring absenteeism	Doctors reported that monitoring mechanisms were often either non-functional or inconvenient to use (eg, having to sign in at central locations away from the facility).	Doctors expected to prefer facilities with either minimal or efficient monitoring systems.
Policies to address absenteeism	Doctors reported that policies to control absenteeism were often not enforced and findings from the literature suggest that there is limited evidence of successful interventions to overcome absenteeism.	Doctors expected to prefer facilities that reward good attendance. Punitive measures were expected to be disliked by most doctors although some noted that appropriate enforcement would reduce absenteeism and thus their personal workload.
Incentive for working in rural facility	Incentive payments are used in the Bangladesh health system to encourage doctors to work in the Hills districts and would thus be familiar to doctors and allow for a numerical assessment of the importance of attributes.	Doctors expected to prefer higher incentive payments.

Participants in a consensus-building workshop were asked whether the attributes and levels depicted realistic options and their relative policy importance. From this process, six attributes were included in the pilot DCE (table 1). We theorised that doctors would accept greater monitoring and measures intended to manage absenteeism if accompanied by greater opportunities or improvements in community relationships, personal security or rewards for good attendance.

Piloting
Given this study's sensitivity and novelty, the questionnaire was piloted over two rounds among 15 doctors at two tertiary hospitals in Dhaka to ensure acceptability, appropriateness and understandability of the questionnaire. This was followed by short interviews where respondents were asked for feedback on the questions and process. In light of feedback, the number of attributes and levels were reduced to the final four outlined in table 2 and slight changes were made to the way the scenarios were presented.

DCE design
The hypothetical choice sets for DCE were designed using Ngene software V.1.2.1. We specified a d-efficient, fractional factorial design using a multinomial logit model. No interaction terms were specified in the design. Estimated coefficients for each level were derived from pilot data and used as prior estimates to generate the final survey tool. The final survey consisted of 12 unlabelled choice sets, asking participants to choose between two hypothetical jobs that varied in levels of the attributes outlined in table 2. A two-stage question format was used to ensure some preference data were collected, while also enabling participants to opt out of accepting the job presented to avoid overestimation of preferences (figure 1).[16 17] Figure 1 shows an example of the choice scenario in English although the final questionnaire was translated into Bengali.

Data collection and sample size
The DCE was conducted in 2019 on doctors currently working at four tertiary hospitals in Dhaka with experience of working at rural facilities within the past 10 years

Table 2 Final attributes and levels used in discrete choice experiment

Attribute	Level 1	Level 2	Level 3	Level 4
Relationship between the doctor and the local community	Unsupportive relationship with community	Supportive relationship with community, for example, monthly meetings of doctors, administrators, community leaders		
Safety at workplace	No active dedicated security guard and functional CCTV	Active dedicated security guard and functional CCTV		
Career path based on attendance	Disciplinary action, for example, salary cut, for poor attendance	Good attendance does not lead to any further benefit	Good attendance taken into account for promotion and transfer	Good attendance rewarded by bonus points for placement in higher education/training
Incentive for working in rural facility	No additional financial incentive for posting	Incentive payment of 15% of basic salary for posting	Incentive payment of 30% of basic salary for posting	

(mean total rural posting was 3 years, range: 1–12 years). Researchers explained the study, read the introductory statement, explained the job sets and went through a practice question with all participants. Given the sensitivity of the topic, often several visits were required to provide additional explanations and reassure the respondents; this approach significantly improved the response rate. The team implemented procedures to maintain quality and rigour. Methods for calculating the required sample sizes for DCEs are contested in the literature.[18] While there is no precise power calculation for DCEs, given our intent to conduct latent class analysis with our data, we targeted a sample size of at least 300 to ensure sufficient power to examine differences across groups.[19] This was in line with previous published DCEs in similar cohorts, including those using latent class analysis.[19–22]

Analysis

DCEs are theoretically based on random utility theory where independent rational actors act to maximise their individual utility;[23] we assume participants chose the job that maximises their individual benefit or utility, which depends on the attributes included in the experiment (online supplemental appendix). For the opt-out choice, all attributes were coded as 0. Two models were estimated, the first using panel mixed multinomial logit methods to estimate preferences across all participants, and second, latent class analysis to investigate heterogeneity in preferences across our sample. This was to test our hypothesis that incentives will differ significantly for different groups such that some doctors will never accept to work in rural areas. In contrast, others may choose to stay if the

	Job A	**Job B**
Relationship between the doctor and the local community	Unsupportive relationship with community	Supportive relationship with community, e.g. monthly meetings of doctors, administrators, community leaders
Safety at workplace	Active dedicated security guard and functional CCTV	No active dedicated security guard and CCTV
Career path based on attendance	Good attendance does not lead to any further benefit	Good attendance rewarded by bonus points for placement in higher education/training
Incentive for working in rural facility	Incentive payment of 30% of basic salary for posting	No financial incentive for posting

Which job would you take?

Job A	
Job B	
Neither	

If you answered 'neither', we would still like to know which job you prefer?

Job A	
Job B	

Figure 1 Example choice set presented to respondents.

right mix of benefits is offered, thus informing interventions targeting this group.[4] Unforced choice data (with options coded as A, B or neither job) were used for all analysis with the respondents' choices as the dependent variable.[17 24] All attribute levels were effects coded and, in the mixed model, all parameters were modelled as random with a normal distribution. Constant terms were included to depict respondent preference to not accept either presented job. A three-class model was used in the latent class analysis as model fit statistics showed minimal gains from more classes, the authors' assessed a three-class model as the most appropriate to interpret the data and class sizes becoming too small for meaningful interpretation for larger class models (online supplemental appendix).[19] Estimated probabilities were used to assign respondents to groups (with participants assigned to the group with the highest probability of membership) to examine characteristics associated with each group.

A willingness to pay analysis was conducted to estimate the notional amount of incentive payment that respondents would be willing to sacrifice (as a percentage of their base salary) to gain access to different levels of the attributes. Finally, we modelled the potential impact of different policy packages on the probability of accepting a rural job first for the entire sample and then for each identified latent class. All analyses were conducted using NLOGIT software V.6.0).

Patient and public involvement

This research was done without patient involvement due to the subject area and methods chosen (which were focused on the doctors' own preferences and choices). Patients were not invited to comment on the study design, interpret the results or to contribute to the writing or editing of this document for readability or accuracy.

RESULTS

General characteristics

The general characteristics of respondents are summarised in table 3. In total, 308 doctors completed the DCE, almost all of whom were married (92%), 46% were female, 76% were aged under 35% and 14% had completed postgraduate training.

Predictors of choice for the entire sample

The results of the mixed multinomial logit model are presented in table 4. All attributes significantly predicted the choices of participants. The constant for not accepting either job was the largest predictor of respondents' choice, suggesting that respondents would only accept a job if it included a suitable set of attributes (across all choices respondents opted-out 41% of the time). The presence of a supportive relationship with the community was the most preferred attribute across the sample, followed by bonus points in the competition for subsequent places in further education or training, consideration of good attendance in promotion and transfer decisions and personal security. Respondents

Table 3	General characteristics of cohort		
Respondent characteristics		**N**	**%**
Total respondents		308	100
Age			
30 or less than 30		57	18.5
31–35		178	57.8
36–40		42	13.6
41 and above		31	10.1
Female		143	46.4
Married		283	91.9
Completed postgraduate training		43	14.0
Reported that they felt physically unsafe in previous rural posting		215	73.1
Reported any challenge in previous posting		297	96.4
Reported having access to important people in case of transfer or training			
Yes, always		75	24.4
Yes, occasionally/in exceptional circumstances		135	44.0
No		97	31.6
Member of a professional association		225	74.0

preferred higher incentive payments but the willingness to pay analysis (table 4) shows a willingness to sacrifice higher payments in exchange for other positive attributes. The presence of the disciplinary attribute where poor attendance was punished by a salary cut was significantly disliked by respondents. The random parameters' estimated SD showed significant heterogeneity in preferences for attributes across the sample except for the two attributes relating to rewards for good attendance that appear to be universally preferred.

Latent class analysis

The latent class analysis identified three quite different groups with distinct preferences (table 5), with the most striking difference evident with the constant depicting whether a doctor took a job presented. Group 1 (accounting for 19.8% of our sample), who we have named *Resisters*, were extremely unlikely to take any job offered, regardless of the attribute levels presented, while Group 2 (32.1%), *Acceptors*, were unlikely to reject a job presented. Group 3 (48.1%), *Traders,* generally preferred to not accept the job presented, however, the size of this effect was much smaller than for the *Resisters* and so could be balanced out by the impact of the presented attributes. Estimated background characteristics of latent classes are shown in online supplemental appendix.

Policy simulations

Figure 2 shows how the overall sample and latent groups identified are predicted to respond to different policy packages. Under the baseline scenario, 45.3% of doctors were predicted to accept the job offered, slightly higher

Table 4 Results mixed multinomial logit model for full sample

Variable	Coefficient	SE	P value	Willingness to pay (as a % payment of base salary)
Constant for not accepting either job	1.25*	0.14	<0.01	NA
Supportive community	0.93*	0.05	<0.01	16% (12.4–19.7)
Presence of security	0.67*	0.05	<0.01	12.3% (10.2–14.3)
Disciplinary action for poor attendance	−0.63*	0.06	<0.01	−12.9% (−11.8 to −13.9)
Good attendance considered in promotion and transfer decisions	0.67*	0.06	<0.01	13.5% (12.3–14.7)
Good attendance rewarded with bonus points for placement in higher education or training	0.77*	0.06	<0.01	16% (14.8–17)
Incentive payment for posting (per 1% of base salary)	0.05*	0.00	<0.01	NA
Estimated SD for random parameters				
Constant for not accepting either job	2.6*	0.16	<0.01	NA
Supportive community	0.6*	0.05	<0.01	NA
Presence of security	0.53*	0.05	<0.01	NA
Disciplinary action for poor attendance	0.27*	0.10	<0.01	NA
Good attendance considered in promotion and transfer decisions	0.2†	0.11	0.06	NA
Good attendance rewarded with bonus points for placement in higher education or training	0.25†	0.14	0.07	NA
Incentive payment for posting (per 1% of base salary)	0.03*	0.00	<0.01	NA

*p<0.05
†p<0.1

than if the only intervention enacted is punishment for poor attendance (44.7%). If punishment for poor attendance is accompanied by a supportive community and secure facility, this proportion grows to 58.7% and 63.9% if good attendance is also rewarded by bonus points for placement in further education. Under the conditions

Table 5 Results of latent class analysis

Variable	Group 1%–19.8% of sample			Group 2%–32.1% of sample			Group 3%–48.1% of sample		
	β	SE	P value	β	SE	P value	β	SE	P value
Constant for not accepting either job	4.47‡	0.61	<0.01	−1.75‡	0.21	<0.01	1.5‡	0.11	<0.01
Supportive community	1.56‡	0.38	<0.01	0.59‡	0.06	<0.01	0.8‡	0.06	<0.01
Presence of security	0.62‡	0.18	<0.01	0.43‡	0.04	<0.01	0.58‡	0.05	<0.01
Disciplinary action for poor attendance	0.059	0.28	0.85	−0.50‡	0.09	<0.01	−0.61‡	0.09	<0.01
Good attendance considered in promotion and transfer decisions	0.93‡	0.33	0.01	0.38‡	0.08	<0.01	0.64‡	0.08	<0.01
Good attendance rewarded with bonus points for placement in higher education or training	−0.07	0.49	0.88	0.64‡	0.09	<0.01	0.74‡	0.08	<0.01
Incentive payment for posting (per 1% of base salary)	0.05‡	0.02	<0.01	0.04‡	<0.01	<0.01	0.05‡	<0.01	<0.01

McFaddens' Pseudo R^2=0.25, AIC=6165.6, AICc=6331.5.
*, ‡ indicate statistical significance at p=0.1, 0.05 and 0.01, respectively.
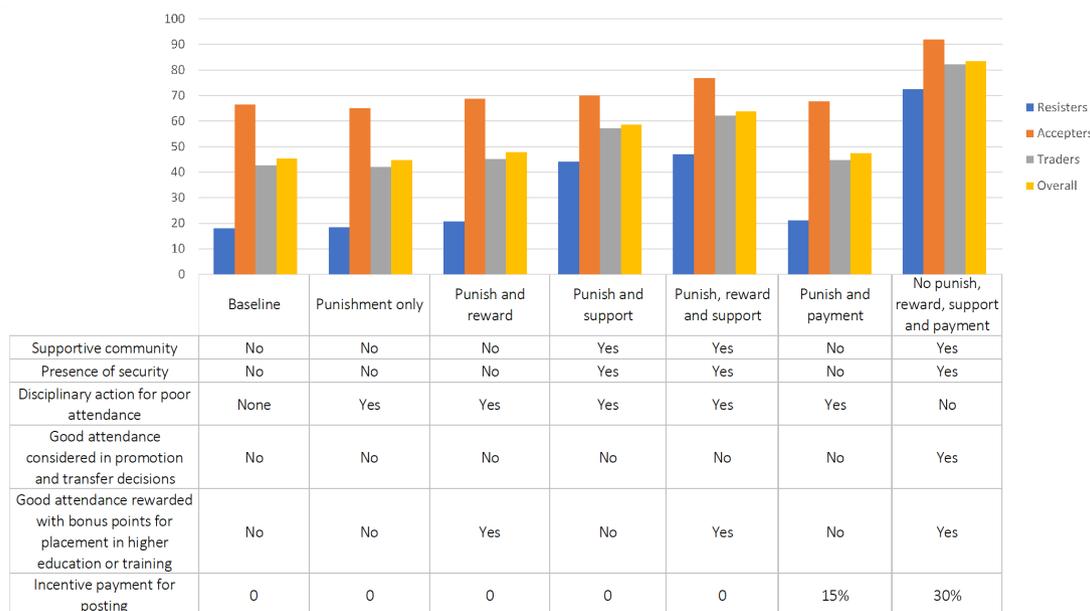NA, not applicable.

Figure 2 Predicted uptake of jobs for different groups under different policy settings.

most preferred by doctors, with no punishment accompanied by rewards for good attendance and a 30% incentive payment, 83.4% of doctors would choose to accept a job in a rural facility. While the *Acceptors* were consistently more likely to accept a rural job, the proportions of *Resisters* and *Traders* were dependent on the specific policy combinations presented. In all but the most attractive scenario, the percentage of doctors in the *Resisters* accepting a rural posting never rises above 50%.

DISCUSSION AND CONCLUSIONS

Health worker absenteeism is increasingly recognised as a major impediment to accessible and effective healthcare in LMICs.[25][26] It is described by Transparency International Bangladesh as part of the 'corruption and irregularities' that adversely affect citizens seeking healthcare and contributes to widespread mistrust that sees the health sector repeatedly ranked as among the most corrupt in Bangladesh and around the world.[27][28] Recognising this harm, there is support for addressing or preventing absenteeism—traditionally using legal or regulatory mechanisms that have viewed it through an often moralistic lens that sees absenteeism as rule-breaking that emerges from ungoverned spaces where actors seek to maximise their gain by seeking to exploit weaknesses in the system. However, evidence on the effectiveness of the strategies used to reduce rule breaking and support health system functioning is scarce. As a consequence, there is an ongoing misalignment between official policy and realities of activities on the ground where much absenteeism may be driven by reflect difficult working conditions and survival strategies employed by the providers as well as deliberate rule-breaking for private gain.

Recent approaches have sought to examine what can be done beyond sanctions and crude monitoring which have been seen to be easy to bypass, instead examining changing the incentives of those who break or ignore the rules. In a recent paper in this journal, we proposed a nuanced new approach drawing on 'developmental governance'[4] which helps to examine the sociopolitical context in which these rule breaking (or corrupt) behaviours occur. An understanding of this context and the organisational context of the health systems can inform the development of sociopolitically attuned interventions that can gain the support of key local actors.[7] The first step is to understand the viewpoint of doctors and the conditions under which they would be able and willing to abide the rules.

We investigated doctors' preferences regarding determinants of absenteeism in Bangladesh. The most important finding is that there are significant differences in preferences and therefore in the likely response to incentives and sanctions across three groups of doctors. This finding is important for informing the development of a package of feasible interventions to overcome absenteeism. We estimated the potential impact of different interventions on doctors' behaviour, highlighting the importance of moving beyond traditional top-down regulatory and accountability-focused approaches to addressing absenteeism.[4] The latter assumes that most doctors are adhering to their contracts and the few who do not can be persuaded to do so using standard transparency and accountability measures, however these are not working in practice. Instead, we argue that understanding doctors' preferences, and using this information to design targeted interventions to influence their behaviour is potentially more effective. Our findings

are broadly consistent with the limited existing literature that has investigated health worker absenteeism in Bangladesh and other low-income and middle-income nations, but the use of a DCE allowed us to assess differences between groups of doctors and identify a subset who appear to be motivated to be present at their places of work under certain conditions. Our findings do not negate the need for far-reaching measures to improve financing and delivery of health services in Bangladesh, underpinned by effective forms of developmental governance. However, even within existing constraints, our approach suggests that understanding the perspectives of doctors is a critical first step that can inform policy development and find improvements that work for them.

From previous literature,[4 26 29] we hypothesised that a significant minority of doctors would be unwilling to accept rural placements even with targeted interventions to improve conditions; this was borne out in our data. Except under the most attractive (and most costly) conditions, a group of doctors consistently rejected rural posts. Nonetheless, we can now suggest a way of *designing for differences* to achieve enhanced levels of adherence. A substantial minority, almost half the cohort, appears willing to alter their decisions about job postings if the right conditions apply. By targeting this group and addressing drivers of particular structural reasons for absenteeism (such as safety of facilities and fostering better relationships between doctors and the communities that they serve), it appears that attendance can be improved across the system through building a coalition of doctors for whom attendance is aligned with their own preferences. We think this will not only have a direct effect on attendance by those responding to these measures, but it will also create an environment in which violations by others are less likely to be tolerated. When motivation to adhere to health system rules (eg, being present at their rural primary health care (PHC) post) increases to levels where doctors who wish to serve their patients can do so without making huge personal sacrifices, a constituency will be created that can exert peer pressure and support the imposition of sanctions on doctors who continue to be absent.

On the other hand, our results are also consistent with historical experience that biometric or other forms of monitoring have not been effective on their own. Large-scale absenteeism also means that peer group pressure is likely to be absent. Interestingly, doctors' choices in the first latent class were not significantly influenced by the presence of the punishment attribute. This suggests that in addition to being unwilling to attend a rural post, this group may have had sufficient connections or power to prevent them from being threatened by enforcement mechanisms. Crucially, improving incentives without understanding doctors' heterogeneity may lead to excessively high levels of incentives (and implementation costs) that still fail to work. This is a novel but fundamentally important finding in the limited literature that has examined health worker absenteeism, which has tended to consider the problem and potential solutions as applying to a uniform set of workers.

While the use of financial incentives is familiar in the Bangladeshi health system as they have been used to encourage workers to take up posts in remote areas like the Chittagong Hill Tracts, feasible salary increases are unlikely to address other key drivers of absenteeism and thus, are unlikely to have a large enough impact to overcome absenteeism sustainably without other concurrent intervention. Our results demonstrate the potential benefits of non-financial incentives, with respondents willing to trade potential incentive payments of significant value in exchange for other job attributes. Many of the areas for intervention we identified are not explicitly focused on absenteeism itself. Interventions that increase community support for doctors (often relying on the support of powerful local elites, as shown in the qualitative study) and protect them from the threat of violence by service users, are likely to have many benefits for the health system. While we believe that the importance of non-financial incentives in addressing absenteeism is likely to be generalisable, the precise form that these interventions will take should be determined in the light of specific contexts, given that the particular issues we identified reflect characteristics of the society in which our respondents operated. Thus, when applying our findings elsewhere, further work will be needed to understand the wider environment within which people work and the power dynamics within and around the health system. Moreover, we have shown how a DCE can be used to derive a quantitative estimate of the importance of the issue to doctors and provided a method that can be replicated in other settings. When coupled with qualitative studies, this will help to improve retention and job satisfaction among rural doctors.

Our study has several limitations. First, as with all DCEs, our results are based on respondents' stated preferences rather than observing actual behaviour. If the stated choices differ from how the doctors would behave in practice our results could be biased. This could be a particular issue in an area as sensitive as absenteeism. We attempted to minimise the impact of such bias through a range of measures including an opt-out option, and an extensive attribute development process followed by piloting. This ensured that the attributes captured the key drivers of absenteeism and job characteristics valued by doctors and were clearly understood by participants. Second, due to resource constraints, our sample comprised doctors working in four large urban hospitals with recent experience of working at rural facilities, and thus may not be generaliseable to the broader doctor population. A significant portion of our sample had undertaken postgraduate training already, which could impact the importance placed on the education attribute (if they thought

there was no further benefit available to them), however, we sought to make the attribute broad enough to apply to these doctors too and subgroup analysis for these doctors only and with them removed made no significant difference to the results (online supplemental appendix).

In conclusion, we were able to suggest a way to address absenteeism, a widespread problem undermining access to and quality of care in LMICs. Top-down regulatory and managerial approaches have had limited success. In contrast, we believe understanding the perspectives of the Bangladeshi doctors about the difficulties they face when working in rural areas and capturing their preferences on different aspects of their jobs can inform pragmatic solutions to reduce absenteeism, which are largely feasible in the context of Bangladesh, and potentially of interest to other LMICs.

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Contributors BA designed the study and analysed the data jointly with RI and DB, and with support from KM and MMc. RI and NN conducted the fieldwork supported by SMA. All authors contributed to drafting and writing the text. DB oversaw the study.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. We have included all data relevant to the analysis in the manuscript. As envisaged in our data management plan, we cannot make the raw data fully open access due to its highly sensitive nature. But we are making the data available to our collaborators' institutions for further analysis, for example, for PhD theses.

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Supplementary Appendix

Theoretical background to analysis

DCEs are theoretically based on random utility theory where independent rational actors act to maximise their individual utility [28]. We assume participants will choose the job that maximises their individual benefit or utility which depends on the attributes such that:

$$U\ (Job\ A\ or\ Job\ B)$$
$$= \beta_1 * Relationship + \beta_2 * Safety + \beta_3 * Punishment + \beta_4 * Promotion + \beta_5 * Education * \beta_6 * Incentive + \varepsilon$$

Where:

Relationship = The relationship with the local community;

Safety = Whether there were active security guards and CCTV;

Punishment = The presence of disciplinary action for poor attendance;

Promotion = Good attendance considered in promotion and transfer decisions;

Education = Good attendance rewarded by bonus points for placement in further education;

Incentive = Incentive payment attached to the post.

For the opt-out choice, all attributes were coded as 0 such that $U(No\ job\ taken) = 0$.

Model fit statistics for latent class models

Table S1 - Number of latent classes	2	3	4	5
Log-likelihood function	-3198.77	-3059.78	-3010.29	-2972.52
Pseudo R^2	0.212	0.246	0.259	0.268
AIC	6427.5	6165.6	6082.6	6023
AICc	6535.8	6331.5	6306.2	6304.4
BIC	6520.8	6308.5	6275.2	6265.4
Size of the smallest group (proportion of sample)	39.9%	20.8%	13.9%	7.5%
Size of the smallest group (estimated respondents)	123	64	43	23

AIC: Akaike information criterion

AICc: Akaike information criterion with a correction for finite sample sizes

BIC: Bayesian information criterion

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Estimated characteristics of latent class groups

Table S2 – General characteristics of estimated groups	Group 1	Group 2	Group 3
Average age	34.2	33.2	33.1
Proportion aged over 40	10.77%	7.84%	11.35%
Proportion female	47.69%	50.00%	43.26%
Completed Postgraduate training	15.38%	14.71%	12.77%
Proportion with 2 or more kids	47.69%	48.04%	33.33%
Proportion who rated their financial situation over the past year as good or very good	63.08%	54.90%	51.06%
Proportion who responded professional network was important to promotion	32.31%	32.35%	28.37%
Proportion who responded personal network was important to promotion	20.00%	18.63%	26.95%
Proportion who responded political network was important to promotion	32.31%	32.35%	36.88%
Proportion that experienced any challenge in their previous rural post	98.46%	98.04%	100.00%
Proportion member of a professional association	71.88%	68.32%	79.14%
Proportion who served their full rural placement without interruption	80.00%	67.00%	76.81%

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Mixed multinomial results excluding respondents with postgraduate training

Table S3 – Results mixed multinomial logit model for sample excluding those with postgraduate education	McFadden's Pseudo R^2 = 0.27		
Variable	Coefficient	Standard error	P-value
Constant for not accepting either job	1.28***	0.16	<0.01
Supportive community	.97***	0.06	<0.01
Presence of security	.67***	0.05	<0.01
Disciplinary action for poor attendance	-.64***	0.07	<0.01
Good attendance considered in promotion and transfer decisions	.67***	0.06	<0.01
Good attendance rewarded with bonus points for placement in higher education or training	.82***	0.07	<0.01
Incentive payment for posting (per 1% of base salary)	.06***	<0.01	<0.01
Estimated standard deviations for random parameters			
Constant for not accepting either job	2.6***	0.17	<0.01
Supportive community	.64***	0.06	<0.01
Presence of security	.56***	0.05	<0.01
Disciplinary action for poor attendance	.34***	0.10	<0.01
Good attendance considered in promotion and transfer decisions	0.3***	0.10	<0.01
Good attendance rewarded with bonus points for placement in higher education or training	.17	0.11	0.11
Incentive payment for posting (per 1% of base salary)	.03***	<0.01	<0.01