Can Bureaucrats be Paid Like CEOs?

School Principal Incentives for Anemia Reduction in Rural China

Presenter: Renfu Luo, Center for Chinese Agricultural Policy, CAS

Grant Miller, Stanford University

Sean Sylvia,, Renmin University

Scott Rozelle, Freeman Spogli Institute, Stanford University

Marcos Vera-Hernandez, University College London

Making Impact Evaluation Matters

4 Sep. 2014

REAP Rural Education Action Program

Public Service Delivery in Developing Countries

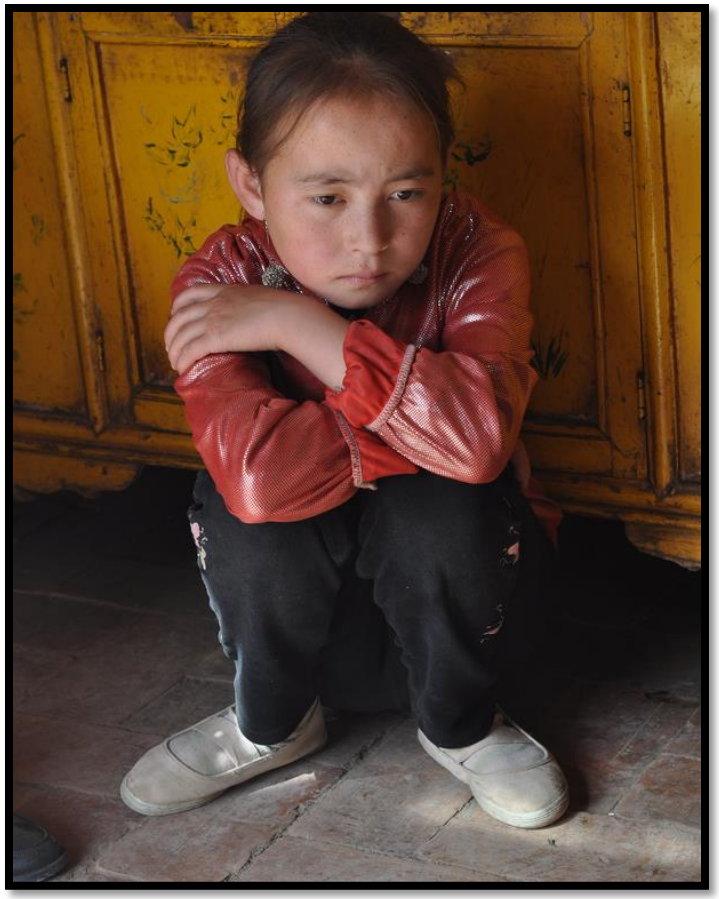
- **Poor quality of public services in developing countries (Banerjee, Deaton, and Duflo, 2004;Das, Hammer and Leonard, 2008;Berendes et al, 2011;Das, Holla et al, 2012)**

- **Two prominent explanations:**
  - **Lack of resources and skills**
  - **Weak or misaligned incentives**

Anemia: What is it and why should we care?

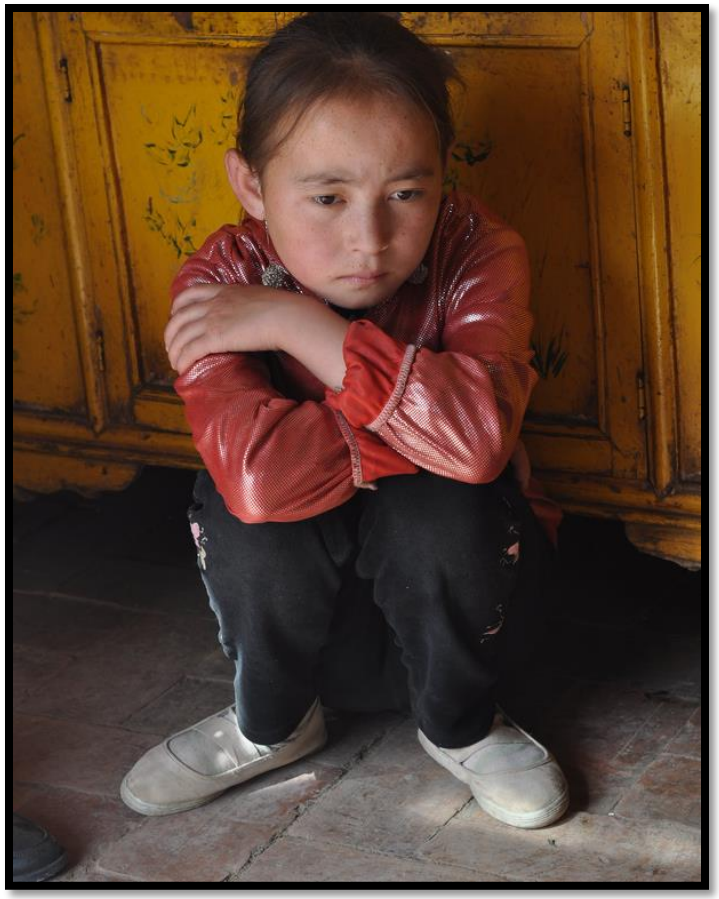
One of the most common forms of undernutrition worldwide is **iron-deficiency anemia**.

→ A lack of dietary iron means that your body cannot carry sufficient oxygen to your brain, leading to lightheadedness and frequent exhaustion.



Anemia: What is it and why should we care?

An oxygen-starved brain does not develop or function as it should, leading to **cognitive impairment** and even **reduced lifetime earnings**.

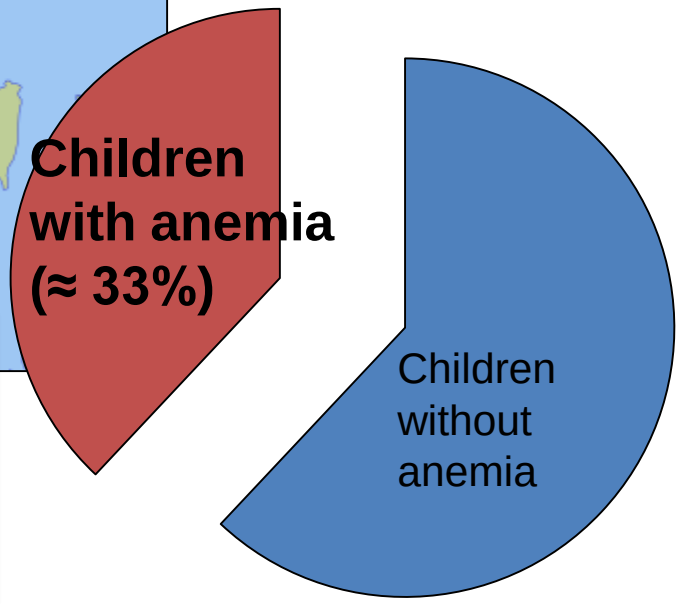


Anemia rates are high in China

	Anemia Rate
Total	**33.7**
Shaanxi—2008	37.5
Shaanxi—2009a	31.6
Shaanxi—2009b	26.2
Qinghai—2009	51.1
Ningxia—2009	25.4
Sichuan—2010	24.8
Shaanxi—2010	33.1

Luo, R., X. Wang, C. Liu, et al. (2011) "Alarmingly High Anemia Prevalence in Western China." *Southeast Asian Journal of Tropical Medicine and Public Health* Vol. 42 No. 5

The bad news:



In poor, rural areas of China, 30-35 million school-aged children are estimated to be suffering from anemia!

What can be done to improve anemia?

- **In principle, iron deficiency anemia is easily addressed through low-cost interventions**
  - **Iron supplements/multivitamins**
  - **Increase dietary iron intake**
    - **Red meat (heme iron)**
    - **Green vegetables (non-heme iron)**
    - **Fruits and vegetables high in Vitamin C and improves iron absorption**

Objective

- **The primary interest of this study is how resources interact with explicit incentives in public sectors.**

- **In this paper we study performance incentives for school administrators and how their responses to incentives vary with the amount of resources under their control.**

Sampling & Randomization

- Sampling frame: Primary schools in 25 officially designated poor counties in Gansu, Qinghai, and Shaanxi with 150-300 students
- 170 schools randomly selected for inclusion
  - 1 school per township
- Stratified randomization to experimental cells using joint quintiles of:
  - Baseline hemoglobin
  - Standardized exams scores (Math & Chinese)

Experimental Design --I

- **All principals of 170 schools uniformly provided with information about:**
  - **Causes and consequences of anemia**
  - **Known effective strategies to address anemia**
  - **Relationship with academic performance based on peer-reviewed studies from China**

Experimental Design --II

- **Random assignment of 170 schools using a 3×2 design:**

	No Incentive	Small Incentive	Large Incentive
Small Block Grant	**32 schools**	**20 schools**	**33 schools**
Large Block Grant	**33 schools**	**20 schools**	**32 schools**

Block Grants

- **Small block grant**: 0.3 yuan/student/day (~$0.05)
  - Sufficient to purchase multivitamins
  - On average, 7,500 yuan/school during the study (~$1,200)
- **Large block grant**: 0.7 yuan/student/day (~$0.11)
  - Sufficient to purchase 60 grams of red meat 3x per week
  - On average, 18,000 yuan/school during the study (~$3000)
- Principals can use grants at their discretion:
  - Any strategy to reduce anemia
  - Other school functions (e.g. school supplies)
- No monitoring

Anemia Reduction Incentives

- **The amount of incentive:** Calculated according to the net reduction in the number of sample students with anemia between the beginning and end of the intervention.

- **Small Incentives:** On average equal to one fifth of monthly salary
  - Pay_{Small} = **12.5** *yuan* (~$2) x ($Anemic_b - Anemic_e$) *if* ($Anemic_b - Anemic_e$) > 0

- **Large Incentive:** On average equal to 2 months salary
  - Pay_{Large} = **125** *yuan* (~$20) x ($Anemic_b - Anemic_e$) *if* ($Anemic_b - Anemic_e$) > 0

- Evidence from other contexts that small incentives or price changes lead to large changes in behavior (Kremer & Miguel 2007; Thornton 2008; Banerjee et al. 2010; Cohen & Dupas 2010; Karlan et al. 2011; Duflo et al. 2011)

Estimation

- **Pre-analysis plan filed before endline data available; analysis follows exactly**

- **Main Specification (for child *i* in school *j* located in county *c*) in sample of children anemic at baseline:**

$$Y_{ijc} = \alpha + T'_{jc}\beta + x'_{ij}\Upsilon + \mu_c + \lambda_j + \varepsilon_{ijc}$$

- Y_{ijc} **Outcome of interest at endline**
- T_{jc} **Vector of treatment dummies and interactions**
  - **Small incentive, Large Incentive, Large Block Grant, (Small Incentive)X(Large Grant), (Large Incentive)X(Large Grant)**
- x_{ij} **Baseline student, household, school characteristics**
- μ_c **County fixed effects**
- λ_j **Randomization strata fixed effects (stratified school-level randomization by mean Hb concentration and exam scores)**

Baseline Balance

	Small Grant, No Incentive		Coefficient (standard error) on:					N	P-value: Equality of All Groups
	Mean	SD	Small Incentive	Large Incentive	Large Grant	(Small Incentive)X (Large Grant)	(Large Incentive)X (Large Grant)		
A: Child Characteristics									
1. Hemoglobin Concentration (g/L)	134.191	12.912	-0.912 (1.127)	-1.192 (1.009)	0.514 (1.028)	0.140 (1.501)	-0.021 (1.476)	8398	0.541
2. Anemic (0/1)	0.233	0.423	0.024 (0.017)	0.017 (0.019)	-0.015 (0.018)	-0.001 (0.024)	0.003 (0.025)	8398	0.222
3. Age (years)	10.713	1.173	-0.172 (0.128)	-0.041 (0.111)	-0.030 (0.106)	0.352* (0.185)	-0.013 (0.144)	8398	0.379
4. 5th Grade (0/1)	0.531	0.499	-0.002 (0.006)	0.001 (0.006)	-0.005 (0.008)	0.007 (0.011)	0.001 (0.010)	8398	0.941
5. Female (0/1)	0.485	0.500	0.003 (0.020)	-0.008 (0.017)	-0.009 (0.019)	0.024 (0.030)	0.010 (0.025)	8398	0.808
B: School Characteristics									
6. Number of Students	207.094	64.823	-1.276 (17.567)	3.623 (14.959)	-5.396 (16.043)	25.344 (25.554)	12.357 (20.856)	170	0.797
7. Has Kitchen (0/1)	0.063	0.246	0.141 (0.101)	0.074 (0.075)	0.059 (0.083)	-0.075 (0.162)	-0.068 (0.120)	170	0.681
8. Student-Teacher Ratio	16.228	4.227	2.538* (1.354)	0.893 (1.210)	-0.286 (1.159)	-1.506 (1.911)	1.064 (1.657)	170	0.257
9. Time to Furthest Village Served (mins)	62.031	36.695	12.218 (13.109)	-2.281 (11.564)	3.878 (12.945)	-7.346 (21.467)	3.764 (17.794)	170	0.921
10. Percent Boarding Students (%)	5.327	11.404	1.511 (4.112)	0.106 (3.006)	0.610 (3.492)	-0.079 (6.293)	-1.611 (5.179)	170	0.991

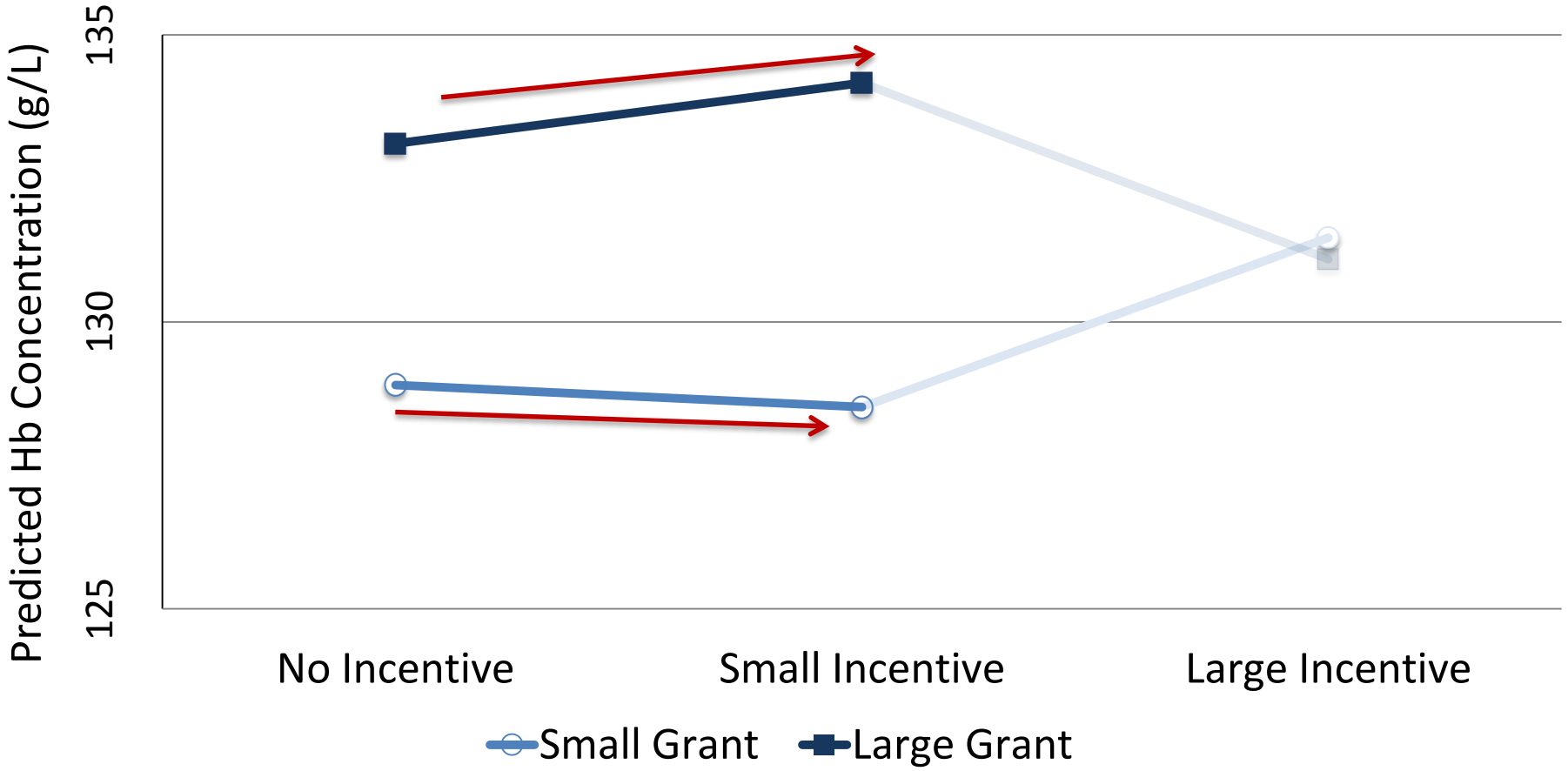
The student and school characteristics are similar among treatment groups according to the balance tests.

Primary Outcomes: Hemoglobin Concentration and Anemia Status

	Children Anemic at Baseline		Full Sample	
	Hemoglobin Concentration (g/L)	Anemic at Endline	Hemoglobin Concentration (g/L)	Anemic at Endline
	(1)	(2)	(3)	(4)
1. Small Incentive	-0.387	-0.012	1.055	-0.028
	(1.101)	(0.040)	(0.987)	(0.020)
2. Large Incentive	2.567**	-0.138***	0.918	-0.045**
	(1.044)	(0.039)	(0.946)	(0.022)
3. Large Grant	4.205***	-0.145***	2.871***	-0.073***
	(1.123)	(0.038)	(0.989)	(0.021)
4. (Small Incentive)X(Large Grant)	1.445	-0.042	-0.859	0.027
	(1.541)	(0.056)	(1.340)	(0.027)
5. (Large Incentive)X(Large Grant)	-4.580***	0.196***	-3.304**	0.086***
	(1.586)	(0.058)	(1.404)	(0.031)
6. Observations	1923	1923	7943	7943
7. R-squared	0.303	0.110	0.348	0.120
8. Mean in Small Grant, No Incentive Group	129.900	0.360	136.330	0.180

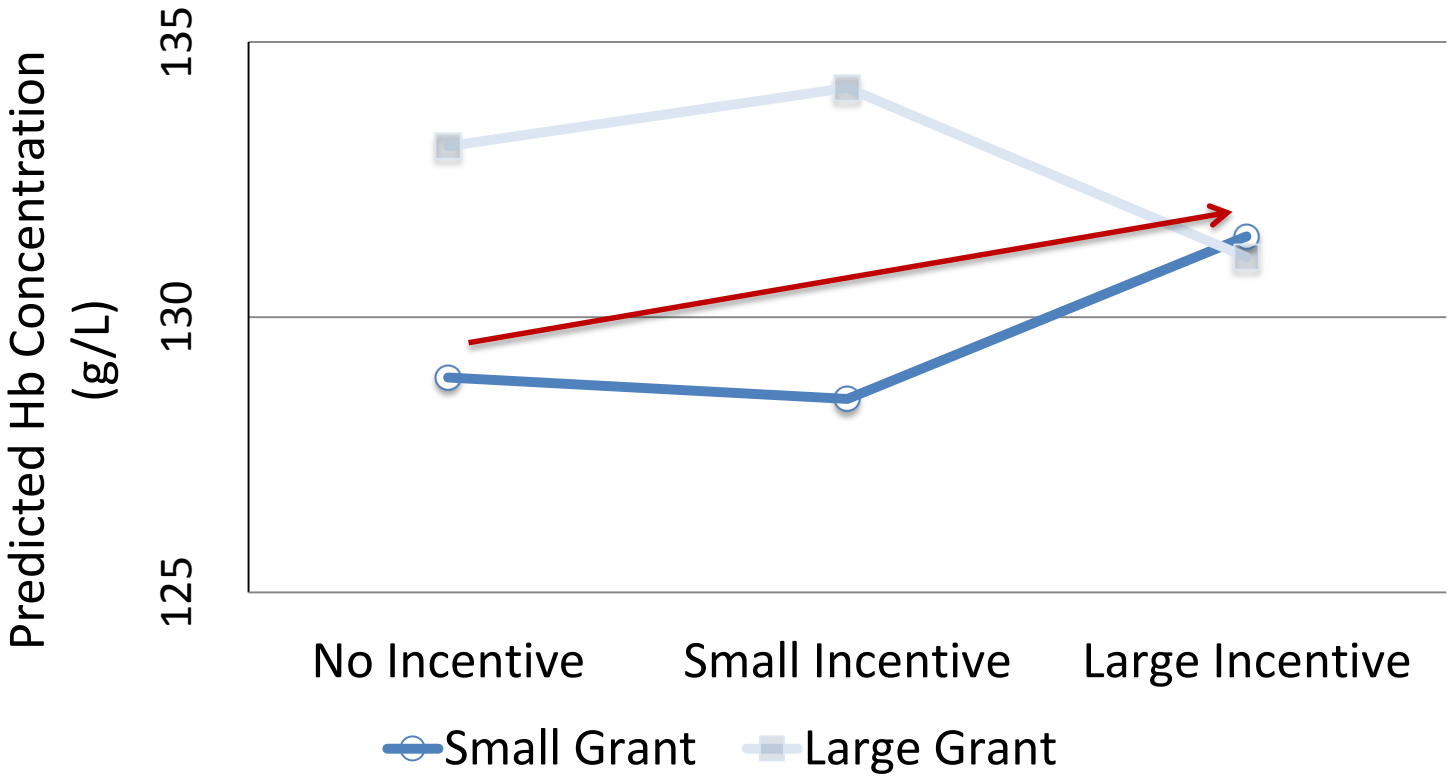
NOTES. Data source: authors' survey. Coefficients and standard errors (in parentheses) shown for treatment group dummy variables and interactions obtained by estimating equation (1) (controlling for baseline hemoglobin concentration, student age, student grade, student sex, number of students in the school, whether the school has a canteen, student teacher ratio, distance to the furthest village served, percent of boarding students, whether the school has implemented the "Free Lunch" policy, county dummy variables, and dummy variables for randomization strata). A child is considered anemic if they have an altitude-adjusted hemoglobin concentration below 120 g/L (per WHO guidelines, WHO 2001). *, **, and *** indicate significance at 10%, 5% and 1%.

Result 1: Small incentives were ineffective



- **Small incentives have little effect on Hb concentration and anemia prevalence.**
  - **True regardless of block grant size**

Result 2: Large incentives were effective



- **With small block grant, large incentive increased Hb concentration (2.6 g/L) and decreased the anemia prevalence (34%) significantly.**

Result 2: Large incentives were effective

	Mean in Small Grant, No Incentive Group	Coefficient (standard error) on: Small Incentive	Large Incentive	Large Grant	(Small Incentive)X (Large Grant)	(Large Incentive) X (Large Grant)	N
A. Iron Supplements							
1. Household received supplements to give to child (Household Response)	0.500	0.038	0.26***	0.101	-0.059	-0.381***	1488
		(0.100)	(0.09)	(0.092)	(0.142)	(0.138)	
2. School provided supplements to children (Child Response)	0.840	0.200***	0.18***	0.19**	-0.444***	-0.332***	1900
		(0.065)	(0.06)	(0.075)	(0.106)	(0.093)	
B. Food Consumption							
10. Times consumed meat at HOME in past week	3.830	0.427	1.12***	1.04***	-1.045*	-1.622***	1923
		(0.402)	(0.36)	(0.394)	(0.571)	(0.597)	
11. Times consumed vegetables at HOME in past week	11.500	0.556	1.39*	1.580*	-1.200	-1.736	1923
		(0.702)	(0.71)	(0.837)	(1.123)	(1.140)	
12. Times consumed fruit at HOME in past week	7.390	0.535	1.04*	1.058	-0.942	-2.212**	1923
		(0.562)	(0.57)	(0.657)	(0.971)	(0.897)	
13. Summary Index	-0.070	0.139***	0.17***	0.26***	-0.263***	-0.334***	1923
		(0.052)	(0.05)	(0.052)	(0.077)	(0.076)	

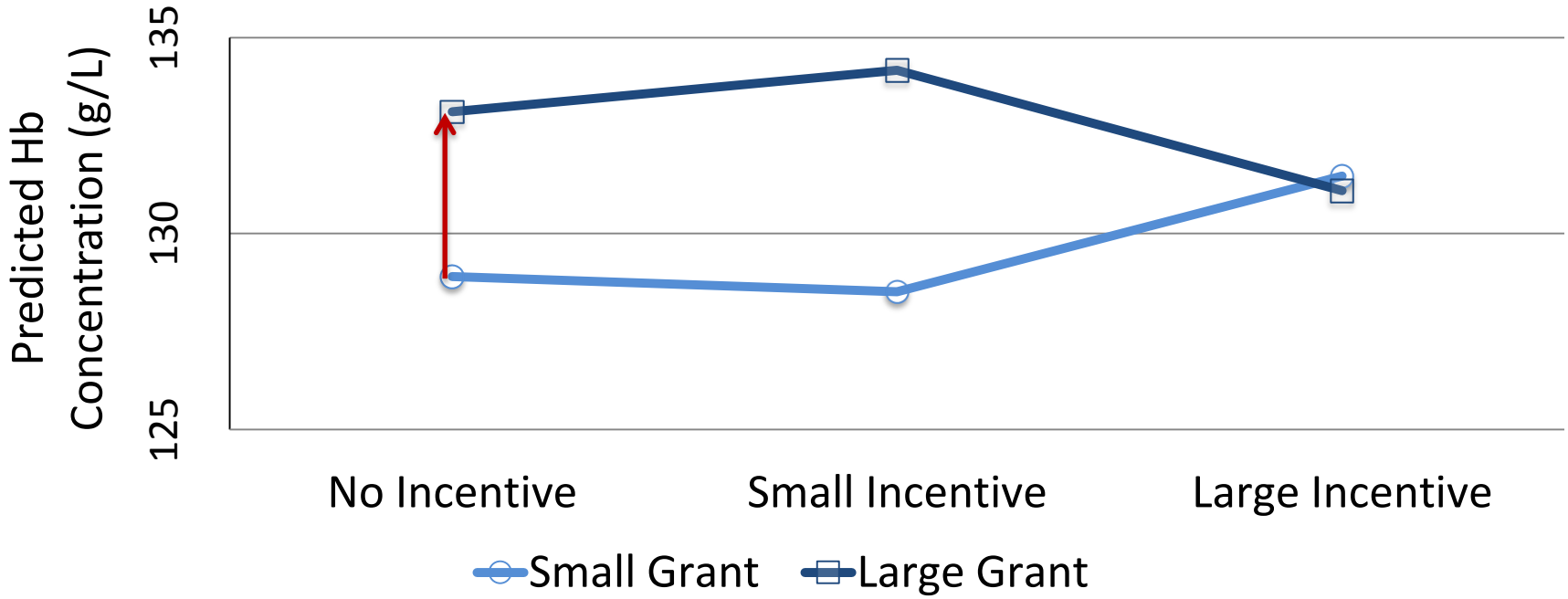
With small block grant, large incentives increased provision of iron at school and provision of information/resources to households and affecting diets at home.

Result 2: Large incentives were effective

More communication between school and households attributable to large incentives

	Mean in Small Grant, No Incentive Group	Coefficient (standard error) on:					N
		Small Incentive	**Large Incentive**	Large Grant	(Small Incentive)X (Large Grant)	(Large Incentive)X (Large Grant)	
1. Number of school-wide parent meetings attended this semester	1.440	0.019 (0.207)	**0.021** **(0.198)**	0.676*** (0.206)	-0.978*** (0.301)	-0.682** (0.286)	1357
2. Number of individual meetings with teacher or principal this semester	0.870	0.110 (0.185)	**0.5**** **(0.2)**	0.660*** (0.251)	-0.735** (0.325)	-0.855** (0.376)	1345
3. School contacted household about student nutrition this semester	0.430	-0.016 (0.077)	**0.12*** **(0.07)**	0.062 (0.095)	-0.062 (0.124)	-0.140 (0.126)	1455
4. Household told to give student foods rich in iron	0.270	0.042 (0.067)	**0.12**** **(0.06)**	0.141** (0.071)	-0.085 (0.105)	-0.273*** (0.101)	1200
5. Parent reports knowing of anemia	0.770	0.055 (0.046)	**-0.044** **(0.043)**	0.017 (0.047)	-0.050 (0.069)	0.037 (0.066)	1473
6. Parent correctly identifies foods that can prevent anemia (iron rich foods)	1.770	-0.021 (0.201)	**0.295** **(0.236)**	0.176 (0.236)	-0.018 (0.317)	-0.410 (0.331)	1516
7. Summary Index	-0.060	0.043 (0.085)	**0.139** **(0.086)**	0.232** (0.116)	-0.318** (0.152)	-0.354** (0.150)	1377

Result 3: Large block grants were effective



- **The "traditional" approach does not fare badly, large block grants alone increased Hb concentration (4.2 g/L) and decreased the anemia prevalence (53%) significantly.**
- **But the large block grants alone are more "expensive" than large incentives**
  - 658 yuan/anemia case averted vs 354 yuan/anemia case averted for large incentives

Results 3: Supplements and Food

Principals with large block grants provided more vitamins, more food at schools – and worked through households by affecting diets at home

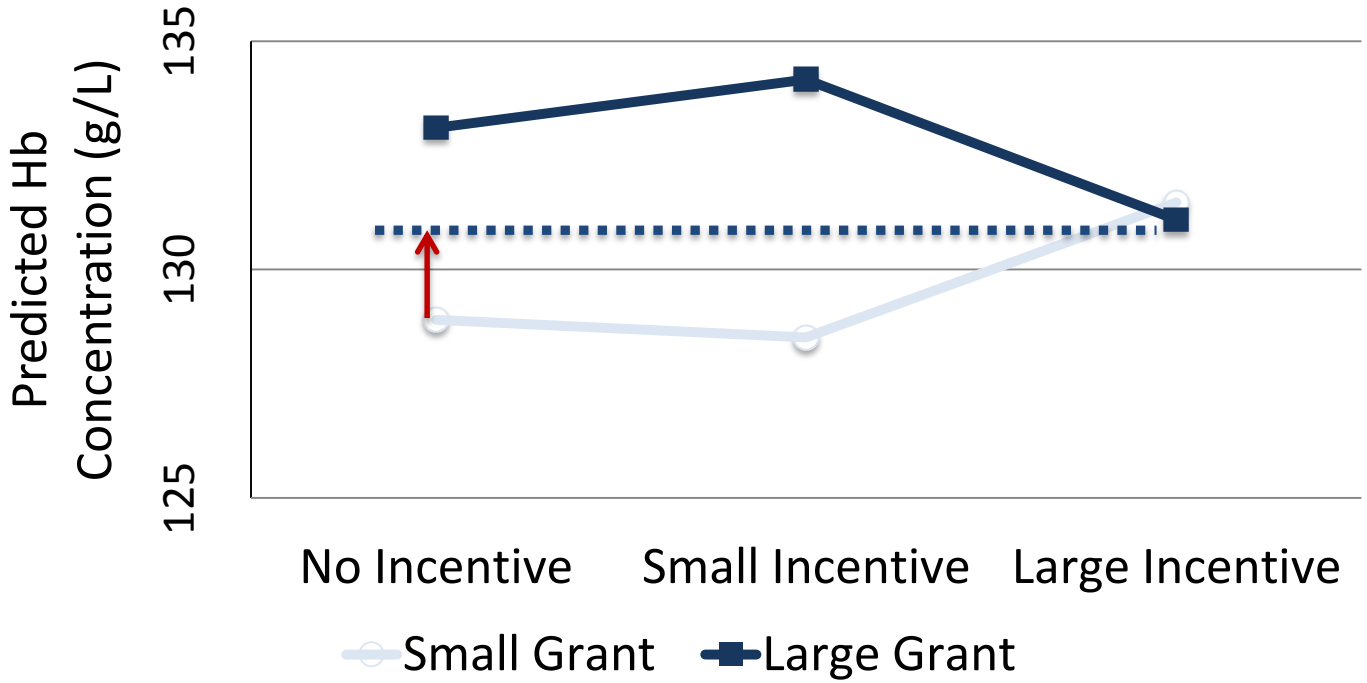
	Mean in Small Grant, No Incentive Group	Coefficient (standard error) on: Small Incentive	Large Incentive	**Large Grant**	(Small Incentive)X (Large Grant)	(Large Incentive)X (Large Grant)	N
A. Iron Supplements							
2. School provided supplements to children (Child Response)	0.840	0.200***	0.180***	**0.19****	-0.444***	-0.332***	1900
		(0.065)	(0.061)	**(0.08)**	(0.106)	(0.093)	
5. All classmates take supplements (Child Response)	0.570	0.202***	0.112	**0.19****	-0.103	-0.113	1833
		(0.068)	(0.068)	**(0.08)**	(0.105)	(0.099)	
B. Food Consumption							
8. Times consumed vegetables at SCHOOL in past week	1.270	-0.675*	0.410	**0.83****	-0.105	-1.454***	1923
		(0.346)	(0.313)	**(0.39)**	(0.563)	(0.545)	
9. Times consumed fruit at SCHOOL in past week	1.300	-0.426	0.275	**1.02****	-0.858	-1.298**	1923
		(0.345)	(0.313)	**(0.46)**	(0.554)	(0.581)	
10. Times consumed meat at HOME in past week	3.830	0.427	1.119***	**1.04*****	-1.045*	-1.622***	1923
		(0.402)	(0.363)	**(0.39)**	(0.571)	(0.597)	
11. Times consumed vegetables at HOME in past week	11.500	0.556	1.387*	**1.58***	-1.200	-1.736	1923
		(0.702)	(0.708)	**(0.84)**	(1.123)	(1.140)	
13. Summary Index	-0.070	0.139***	0.166***	0.259***	-0.263***	-0.334***	1923
		(0.052)	(0.053)	(0.052)	(0.077)	(0.076)	

Result 3: Communication with Households

School managers with large block grants also worked through households by information provision

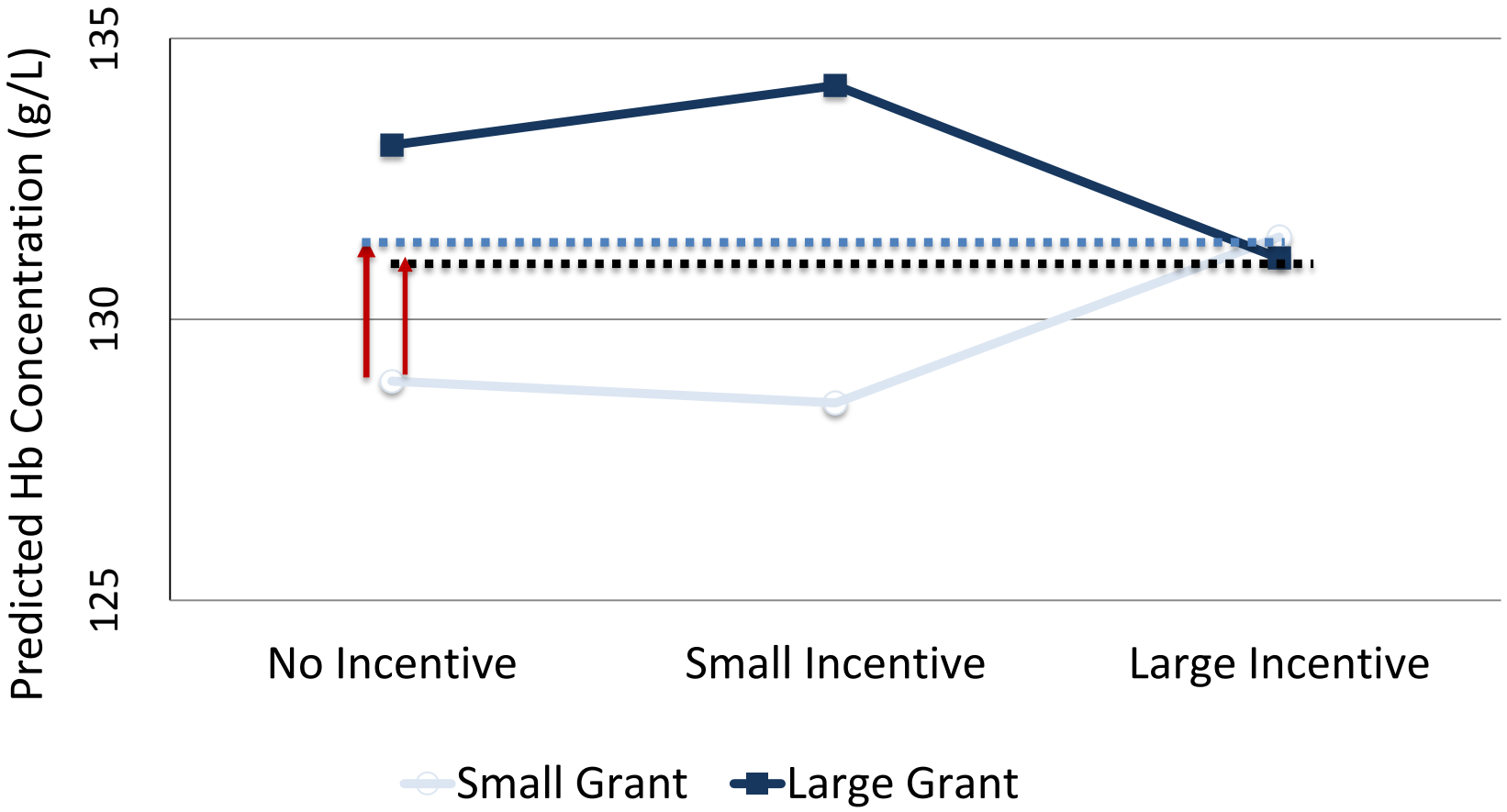
	Mean in Small Grant, No Incentive Group	Coefficient (standard error) on: Small Incentive	Large Incentive	**Large Grant**	(Small Incentive)X (Large Grant)	(Large Incentive)X (Large Grant)	N
1. Number of school-wide parent meetings attended this semester	1.440	0.019 (0.207)	0.021 (0.198)	**0.68*** **(0.21)**	-0.978*** (0.301)	-0.682** (0.286)	1357
2. Number of individual meetings with teacher or principal this semester	0.870	0.110 (0.185)	0.503** (0.231)	**0.66*** **(0.25)**	-0.735** (0.325)	-0.855** (0.376)	1345
3. School contacted household about student nutrition this semester	0.430	-0.016 (0.077)	0.118* (0.066)	0.062 (0.095)	-0.062 (0.124)	-0.140 (0.126)	1455
4. Household told to give student foods rich in iron	0.270	0.042 (0.067)	0.115** (0.055)	**0.14** **(0.07)**	-0.085 (0.105)	-0.273*** (0.101)	1200
5. Parent reports knowing of anemia	0.770	0.055 (0.046)	-0.044 (0.043)	0.017 (0.047)	-0.050 (0.069)	0.037 (0.066)	1473
6. Parent correctly identifies foods that can prevent anemia (iron rich foods)	1.770	-0.021 (0.201)	0.295 (0.236)	0.176 (0.236)	-0.018 (0.317)	-0.410 (0.331)	1516
7. Summary Index	-0.060	0.043 (0.085)	0.139 (0.086)	0.232** (0.116)	-0.318** (0.152)	-0.354** (0.150)	1377

Result 4: Large Incentives + Large Grant



- Combined large incentive + large block grant outperforms comparison group (small grant, no incentive)
  - Anemia prevalence decreased 9 percentage point, p-value = 0.016)

Result 4: Large Incentives + Large Grant



- But, does not outperform large incentives or block grants alone

Conclusions

- **Performance pay for managers can improve service delivery under some circumstances**
  - **Performance incentives need to be sufficiently strong**
- **When tied to outputs produced jointly with beneficiaries, performance pay can create incentives for providers to engage with beneficiaries (e.g. encourage principals to engage households about nutrition at home)**
- **Increasing resources under control of managers (school principals) can improve service delivery (specific to our context?)**
  - **Effects on effort, not just budgetary allocation**
- **Performance pay for managers and block grants are substitutes**
  - **"Crowding-out" may be specific to context**
- **Critical importance of understanding institutional features and existing incentives in the design of performance pay**