Resource constraints in the delivery of maternal and child health

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1. Introduction

- Low levels of maternal and child health / human capital frequently attributed to the low quality of front-line institutions responsible for delivery
    - In health, AWCs
- Primary reason for low quality – low quality of front line health workers
- Theories of economic growth and persistent poverty: human capital as a primary constraint, generating persistence through inter-generational effects

Difficult to test empirically

- Because of decentralized policies, education of frontline workers reflects that of the community
- Little variation in their education, because of educational restrictions (eg AWW: 8 years of schooling)
- In schooling: Research on adding on a contract teacher (less education)
    - Difficult to separate effect of “labour” constraint from “human capital” constraint

This paper: assesses the specific resource constraints that explain quality of AWWs, using a pilot programme in Bihar

UDDEEPAN:

- Attempt to reduce human capital constraint by providing one (more) educated worker (12+ education), *Uddeepika*, to each GP
- Targeted at improving health of children<=3 years and pregnant women
- Focus on growth monitoring, nutrition, breast-feeding, through support to AWWs for home visits, regular activities, VHSND, etc.

Contribution of this paper: Separately identify effect on human capital and labour constraint

- Effect on human capital constraint: difference in human capital of Uddeepika and GP pop
  - Measure this using test scores for Uddeepika and all other (eligible) applicants in GP
  - 12^{th} standard test scores for all applicants in a GP
  - Modelling human capital as a public good, effect of additional human capital is not affected by variation in the number of AWCs per GP
  - Structural estimates enable estimates at different levels of education
- Effect on labour constraint varies (unforeseen): Uddeepika expected to divider he time equally across all AWCs in GP, and considerable variation in the number of AWCs per GP

Related literature:

- Important role of public health institutions (Deaton 2006; Preston 1980) – low explanatory power of household SES variables, including income, on child health

- Access to local institutions (Lim et al 2010; Oster 2009; Basinga et al 2011; Barber and Gertler 2009).

- No relationship between availability of health centers and child mortality (World Bank 1998a; Pitt, Rosenzweig and Gibbons 1993).

- Reason: poor quality of govt institutions, and hence “bypassing” in favour of private clinics (PIEDR 1994; Akin and Hutchinson 1999).

- Large literature on early childhood interventions, documenting significant effects that persist(?) Conti, Heckman and Pinto (2015); Garcia, Heckman, Leaf and Prados 2016; Currie and Thomas 1995; Araujo, Lazarte, Rubio-Codina and Schady 2016; Attanasio, Cattan, Meghir and Rubio-Codina (2015)

Results

- Significant effects of the programme on child WAZ
- Effects reflect reduction of labour constraint; reduction in human capital less imp
- Not just because improvement in human capital was small: returns appear small
- The largest improvement in population per worker ratios occurred in GPs where pre-program ratios were the highest (most resource constrained).
    - This positive (unanticipated) effect of the programme may explain its large impact
    - Suggests importance of (identifying) and focusing on most constrained areas

Rest of this presentation

- The programme
- Programme area, survey sample
- Programme implementation
- Methodology
  - Graphic support
- Results
- Discussion

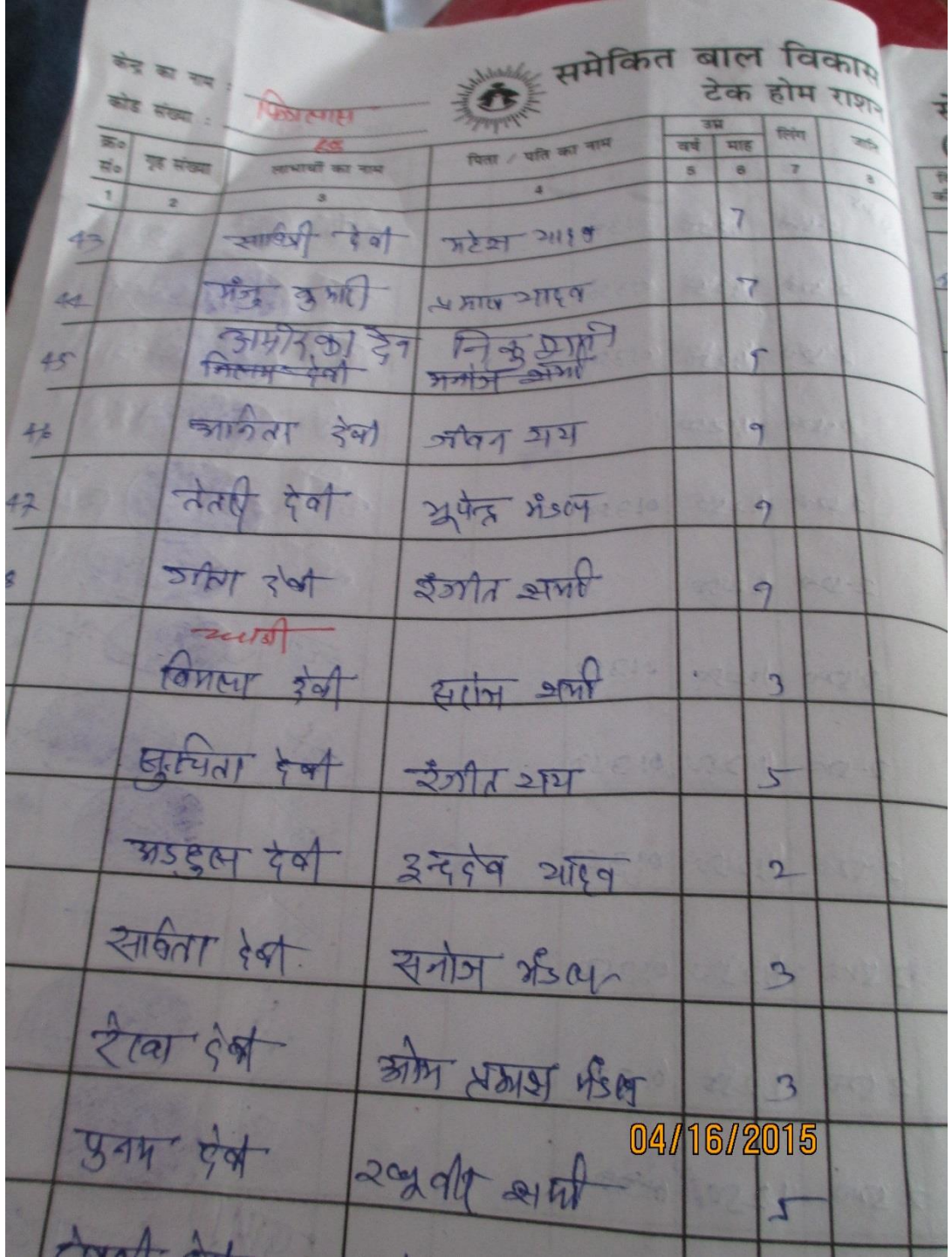
Background

- Bihar (NFHS 4, 2015-16) – Rural children <=5 years:
  - 49% stunted
  - 45% underweight
  - 33% of mothers receive ante-natal checkups in the first trimester of pregnancy
  - Only 3% report full ante-natal care (4 ANCs, at least 1 tetanus toxoid injection, 100 days of cc of folic acid pills)
  - Much greater progress in:
    - (rural) institutional delivery: 63% (19% in 2005-06)
    - Immunizations: 62% between the ages of 12 and 23 months are fully immunized (31% in 2005-06)

AWCs

- Significant increase in numbers, with Supreme court universalization order (2008-09)
    - 91,677 in 2012-13 versus 34,925 in 2004-05
- Caused significant resource constraints (labour, human capital):
- National average number of targeted beneficiares (pregnant and lactating women, children <=3 years) per AWC :70
- Bihar: 175

Human capital constraints



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44		मंजु कुमारी	प्रभाष यादव	0	6		
45		निरमा देवी	मनोज शर्मी	0	9		
46		आशिता देवी	जीवन राय		8		
47		तेतरी देवी	रूपेन्द्र मंडल		9		
		गीता देवी	इंजीत शर्मी		8		
		आशी विभा देवी	सरोज शर्मी	22	2		
		सुचिता देवी	इंजीत राय	23	4		
		अइदुल देवी	इन्द्देव यादव		1		
		साविता देवी	सनोज मंडल		2		
		देवा देवी	ओम प्रकाश मंडल		2		
		पुनम देवी	रघुवीर शर्मी	21	4		
		देवकी देवी	उपेन्द्र शर्मी	22	2		

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The Programme

- GoB + DFID: Sector Wide Approach to Strengthening Health in Bihar (SWASTH)

- Uddeepan(pilot): Only one aimed at strengthening AWCs
  - Targets Pregnant and Lactating women, children under the age of 3

- Phased: Phase 1: 11 most backward districts
    - Composite district index of health vulnerability, based on indicators from DLHS (2007-08), AHS (2012-13), Census (2011).

    - Of these, Supaul was kept aside as a “control” district
    - Phase 2 districts also identified

- Programme started in 2014, closed between March and May 2016

Cluster organization of AWCs

- With universalization order and increase in the number of AWCs, organized in a cluster approach for the purposes of training / monitoring
    - ICDS project office (generally at the level of a block)
    - Lady Supervisors (LS): 17-25 AWCs
- Uddeepan: much more intensive approach
        - Cluster is a GP: One AWC in a GP is developed as a “nodal” AWC
        - Provides an additional worker at the level of the GP

Uddeepika

- Selected from within the GP
- 12+ education
- >=60% in entrance examination testing general education

- Job:
  - Visit all AWCs at least twice a month
  - Provide “hand-holding” support to AWW in home visits
  - Help AWW with monitors so as to establish an effective nutrition surveillance system (Growth monitoring)
  - Weekly cluster meetings
  - Coordination with higher level functionaries

Survey Region and sample

- Bihar NE: Madhepura, Kishanganj, Supaul (control), Katihar (Phase 2)
- Survey: 100 GPs, 300 AWCs, and approximately 4,500 households.

- Baseline survey (Aug – Dec 2015)
- Endline survey (June – Sept 2016)

- Programme was intended to start in GPs in 2014, before baseline survey.

- Difference-in-difference comparison between implementing and non-implementing districts would provide estimates of increase in 9 months (after 1 year start)

Implementation: very weak. Status on October 2014

Activities	Araria	Kishanganj	Madhepura	Supaul
Number of total Anganwadi centres	2155	1774	2075	1983
Number of Panchayats	218	126	170	181
Number of notified Anganwadi centres	218	126	170	181
Date of Written Examination	June 8, 2014	February 23,2014	June 8, 2014	May 26,2014
Uddeepika on board	94	52	57	19
6 dates Induction training held		14-19 July, 2014	October 13-18, 2014	
No. of trained Uddeepikas		52	57	

Madhepura: 57 / 170 (34%) GPs had initiated the programme by October 2014

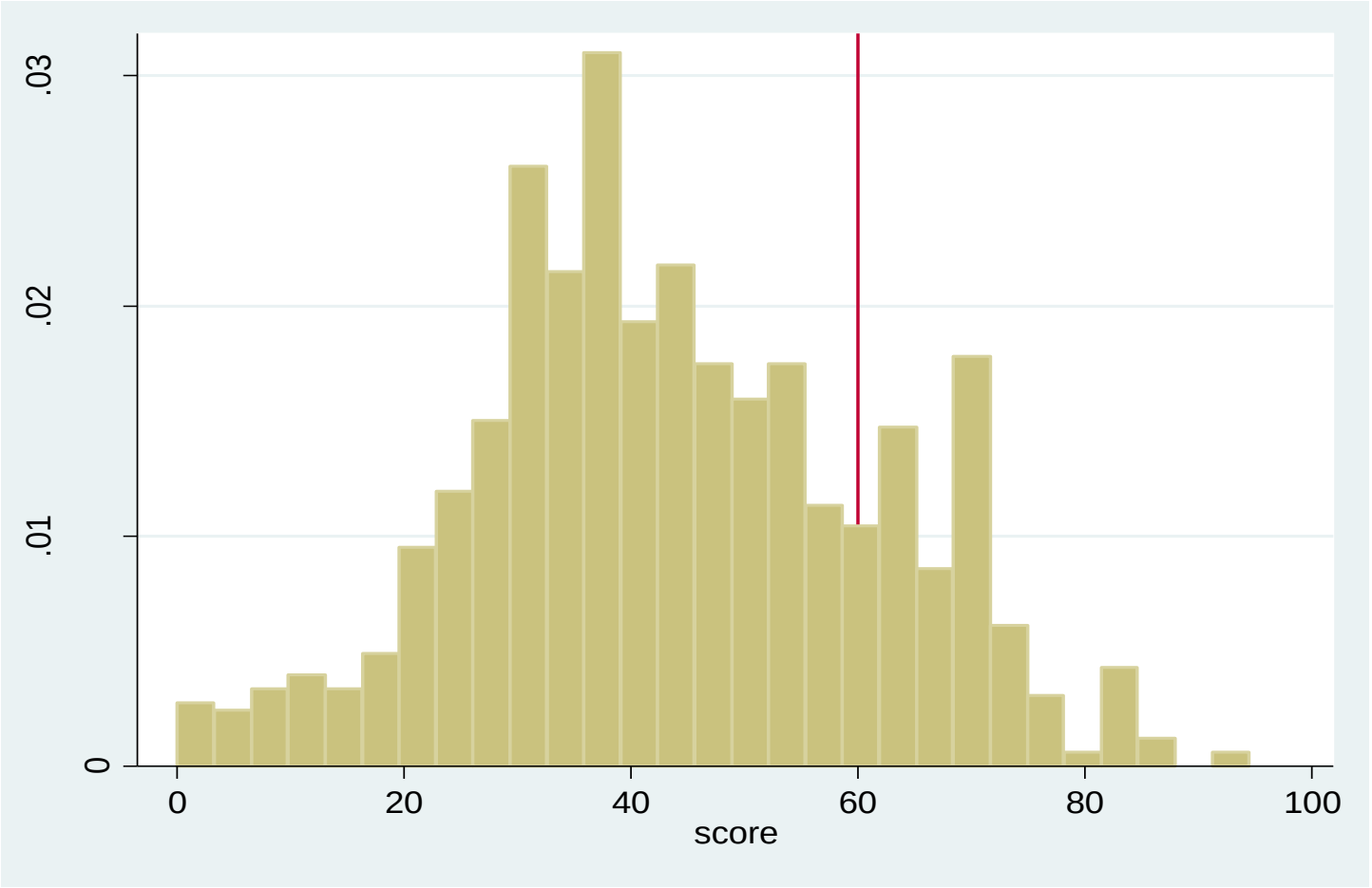
Kishanganj: 52 / 126 (41%)

Reasons

- Administrative delays at the district level in getting out recruitment notices, etc
- GP level :
- lack of eligible candidates: 55% of higher in 12^{th} standard examination
- candidates with 60% score

Figure 2: Test scores of eligible Uddeepikas in Madhepura district

Source: B-TAST implementation records



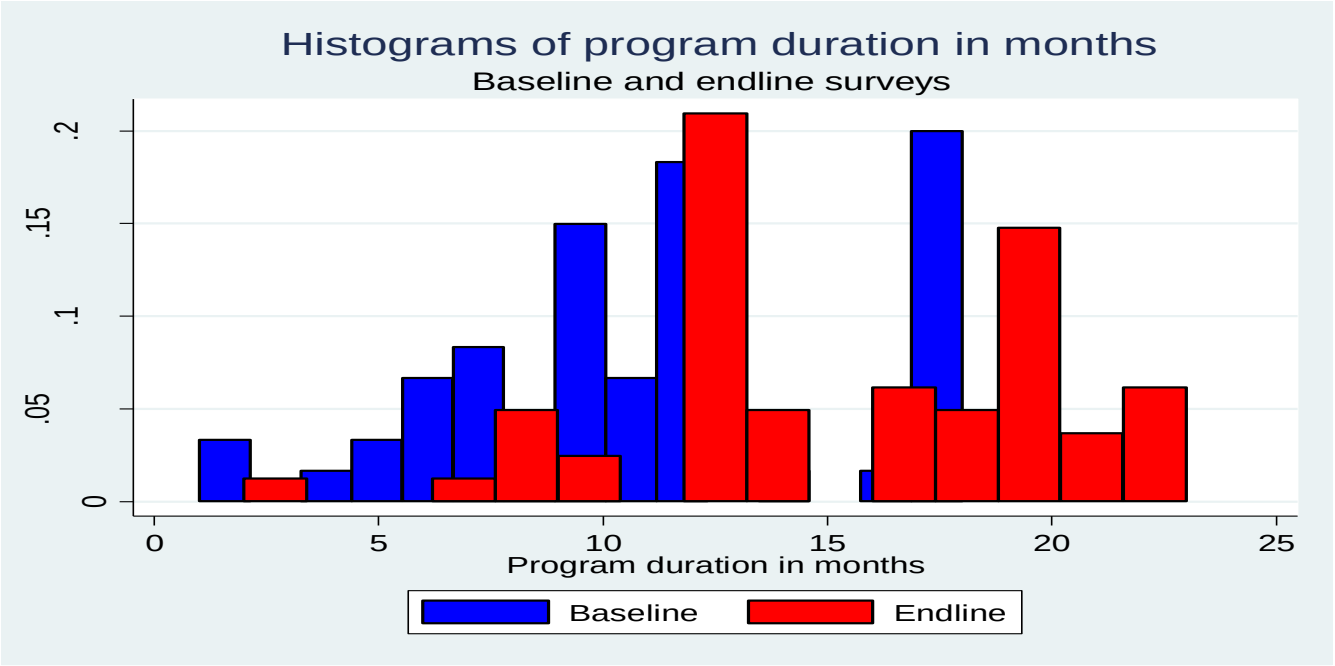
Dec 2015: cut-off score reduced to 45%
Implementation status, May 2015

District	Sanctioned position of Uddeepika	Uddeepika already in place	Additional recruits with relaxation of norms (Dec14)	Balance positions to be recruited	Date of training of Uddeepikas				
					July 2014	Oct, 2014	Nov, 2014	Feb, 2015	March 2015
Araria	218	144		74				144	
Purnia	246	100	40	106			99		41
Banka	185	128		57				128	
Jamui	153	98		55				98	
Kishanganj	126	52	27	47	52				27
Madhepura	170	57	37	76		57			37
Madhubani	399	280		119				280	
Sheohar	53	28	5	20		28			
Supaul Evaluation district	181	19	10	152			0		
Total	1731	906	119	706			0	650	105

Methodology: Exploit cross-sectional phasing

- Standard DiD: Change in WAZ in treatment districts relative to control

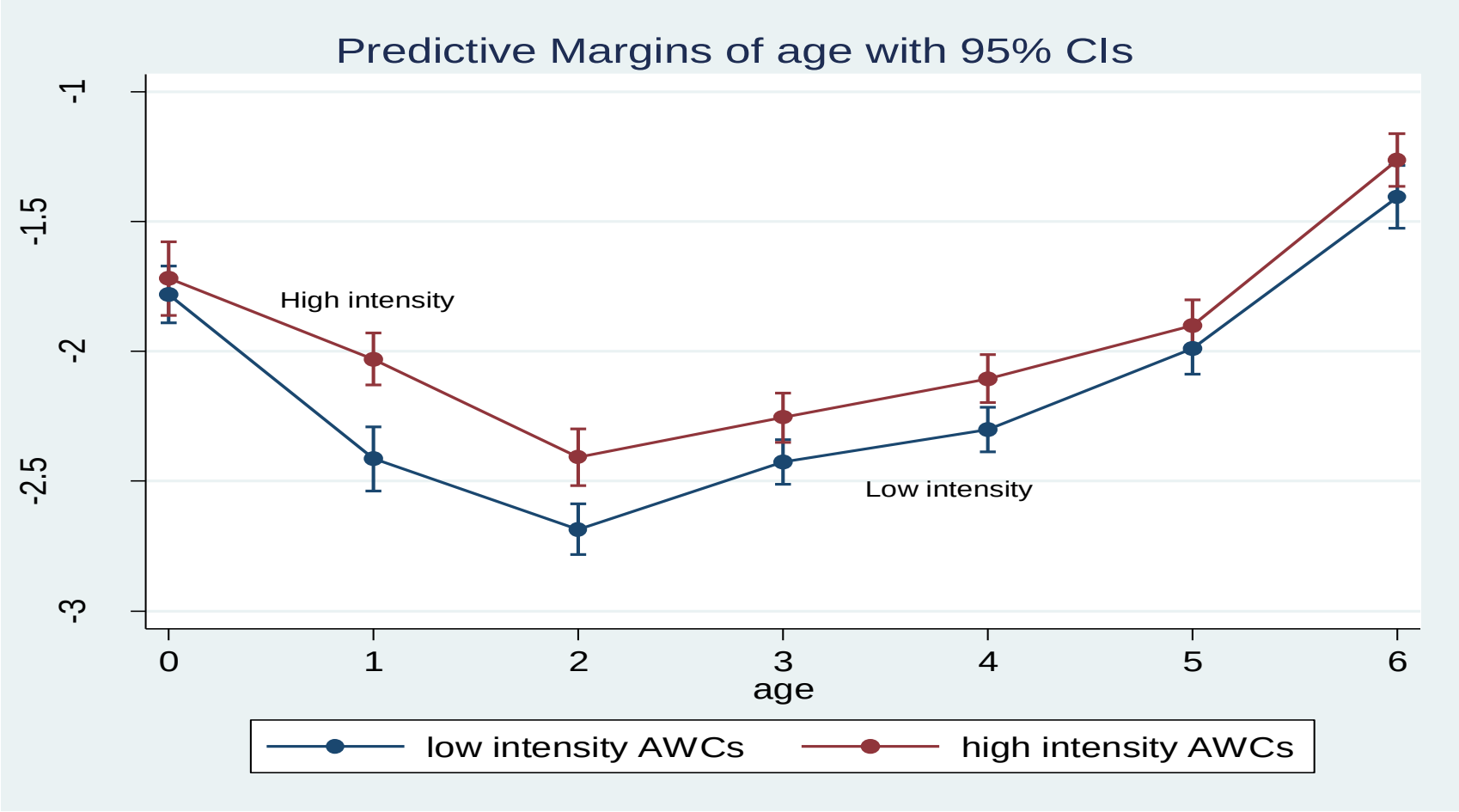
- Short time span between surveys means little variation in programme intensity (exposure to programme) over time.



Simple evidence from Cross-sectional Difference-in-Difference

- Distinguish between high and low intensity GPs
  - program duration >7 months, median across all GPs including non-implementing
- Selection bias: High intensity GPs are those with more educated women
- Exploit age effects: identification from interaction of GP with Age
- Simple form: program targets children less than 3 years of age at start of program
- Age cut-off varies across GPs, with program start dates, so not defined for control GPs
- Compare high and low intensity GPs for children of same age

$$WAZ_{ijkt} = \alpha_0 + \alpha_1 High_{kt} * I[Age_{ijkt}] + \delta_k + u_{ijkt}$$



Regressions based on continuous measure of exposure to programme

- High intensity indicator ignores considerable variation in program duration across GPs
- Replace with duration of program in GP (in months)
    - varies across GPs and across rounds
- Interact with age effects
    - Don’t need to impose heterogeneity by age
    - Variation in age built in, in child’s exposure to program

Effects of child's age

- Let $P_{ij}(age, GP) = 1$ if age at program start >0

$$Exposure_{ij} = Dur\_GP_j * P_{ij} + age_i * (1 - P_{ij})$$

$$Exposure_{ij} = \left(Dur_{GP\,j} - age_i\right) * P_{ij} + age_i$$

Child's exposure reflects a non-linear relationship between program exposure at GP and age.

As in DiD, identify with GP fixed effects, round fixed effects, and age effects

Robustness check: IV estimates

- Instrument program duration by R2 x number of women in the GP who met the 60% cutoff
- Identification: number of women who meet this cut-off unlikely to affect child outcomes directly, in regressions that also control for mother's education, GP fixed effects and interaction of R2 with mean education years of mothers in the GP
- To predict child exposure, interact instruments with child's age
- Under null of valid instruments, IV generates consistent but inefficient estimates relative to OLS
- Standard Hausman test by including predicted value

Decomposing effects of human capital and labour constraints

- $H = f(Q(apop, aeduc), X)$
  - Anganwadi population per worker (apop); Highest level of education amongst workers (aeduc)
- Dynamic production function: Resources are those in place till current period. Let *exp* be months of program duration, and normalize total time to 1
- $apop = (1 - exp)apop\_old + exp * apop\_new$

$$= apop\_old - exp * (apop\_old - apop\_new)$$

- $aeduc = aeduc\_old - exp * (aeduc\_old - aeduc\_new)$
- Effect of exposure varies with change in resources

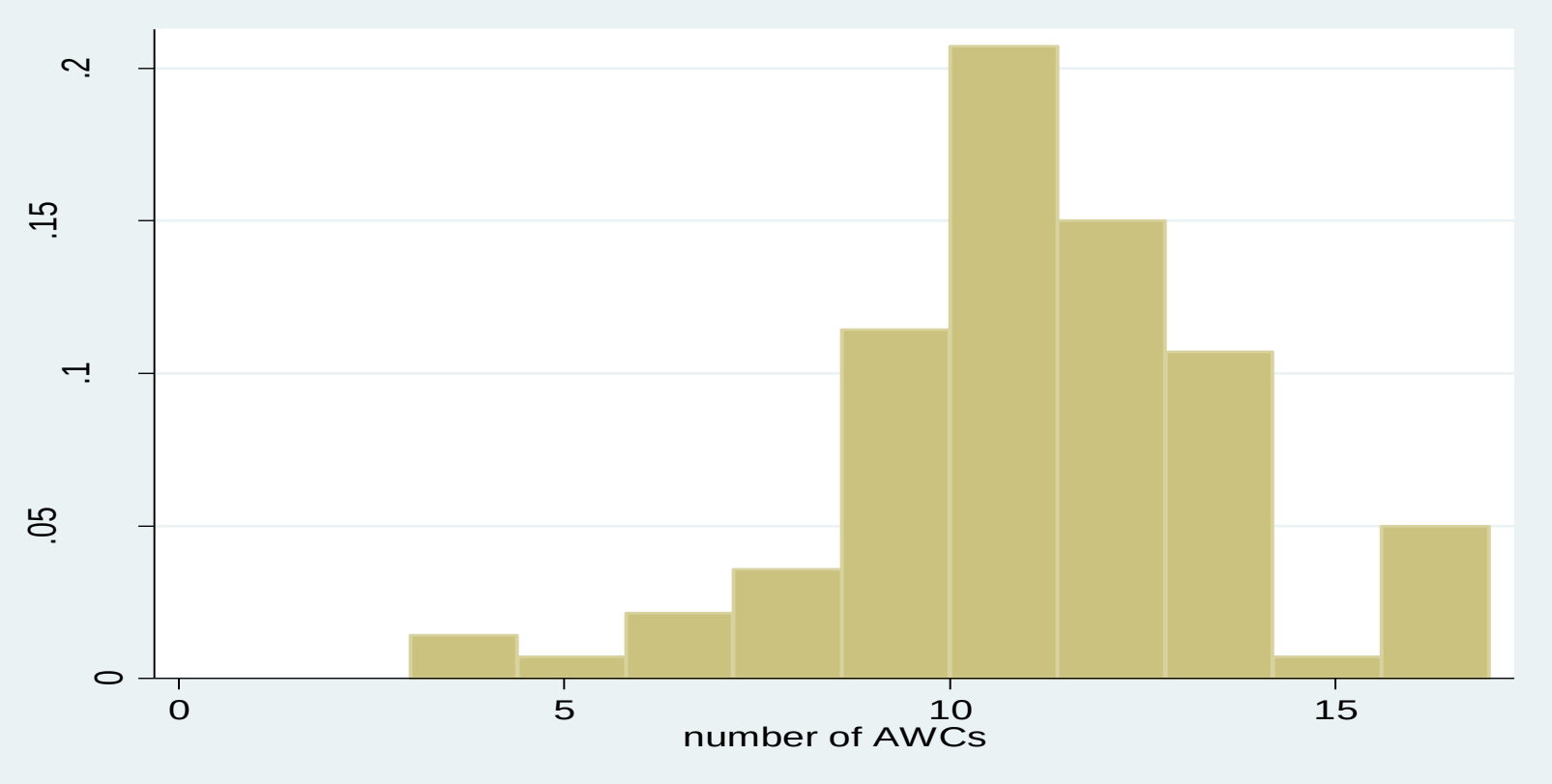
Change in resources: Labour

- For Labour, weight each worker by wage (Sevika 1; helper 0.5; Uddeepika 1.67). Let P be an indicator variable for program GP:

- $apop = \frac{anganwadi\ population}{1.5+\frac{1.67\ P_k}{number\ of\ AWCs}}$

- Variation comes from number of AWCs in a GP

Histogram of number of AWCs per GP



Change in resources: human capital

- Difference in the test score of the Uddeepika relative to the mean test score of all applicants who took the entrance exam (regardless of whether they made the cut-off)

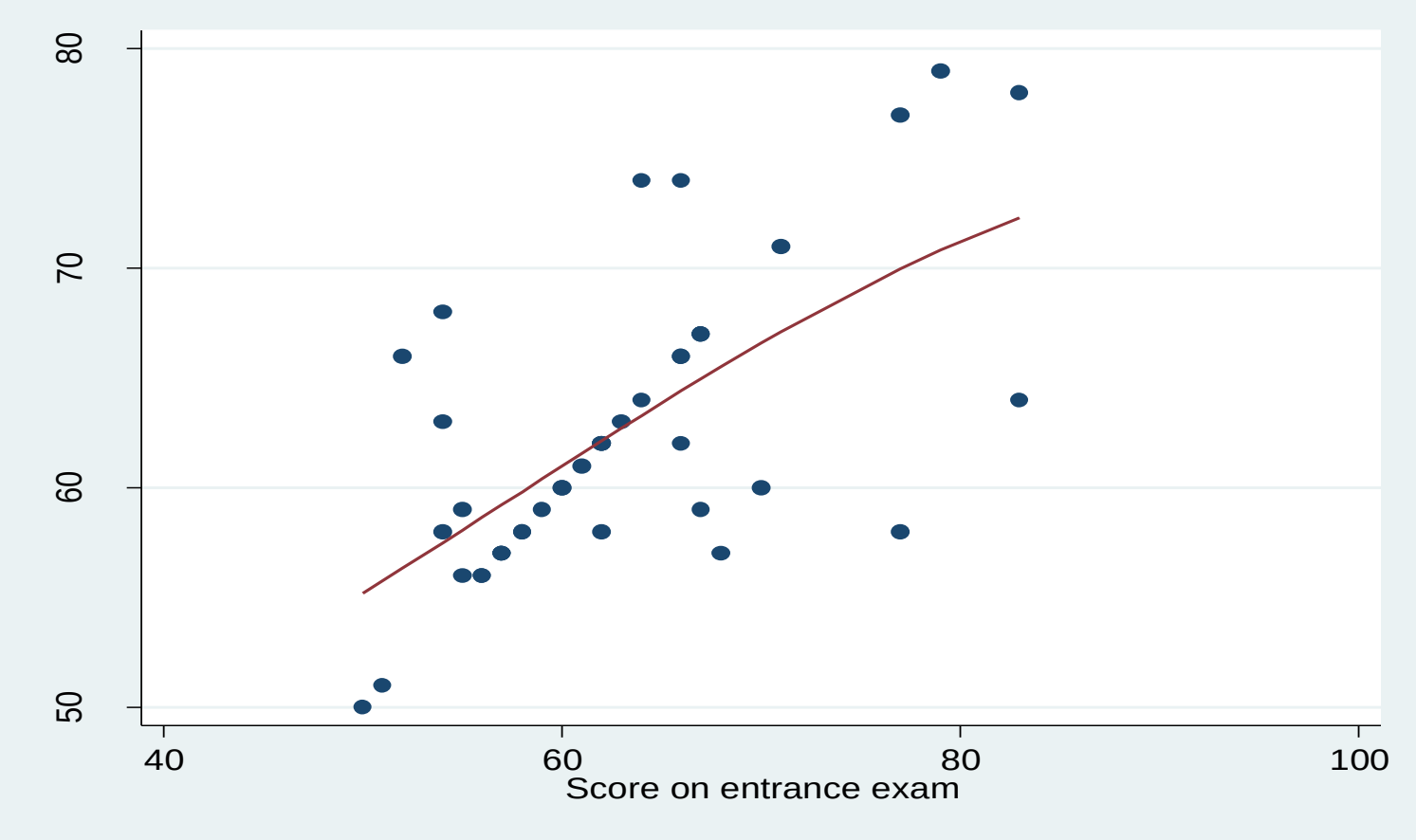
- Takes the mean score of all applicants as a measure of the mean education ability of the pool from which AWWs are drawn.

- Validate results by also using 12th standard exam scores

    - Larger pool (all applicants, not just those who were deemed eligible and took the written test)

    - Matched Uddeepika's score by name and GP, but not able to match all, so a reduction in sample size

Correlation of 12th standard and entrance exam scores



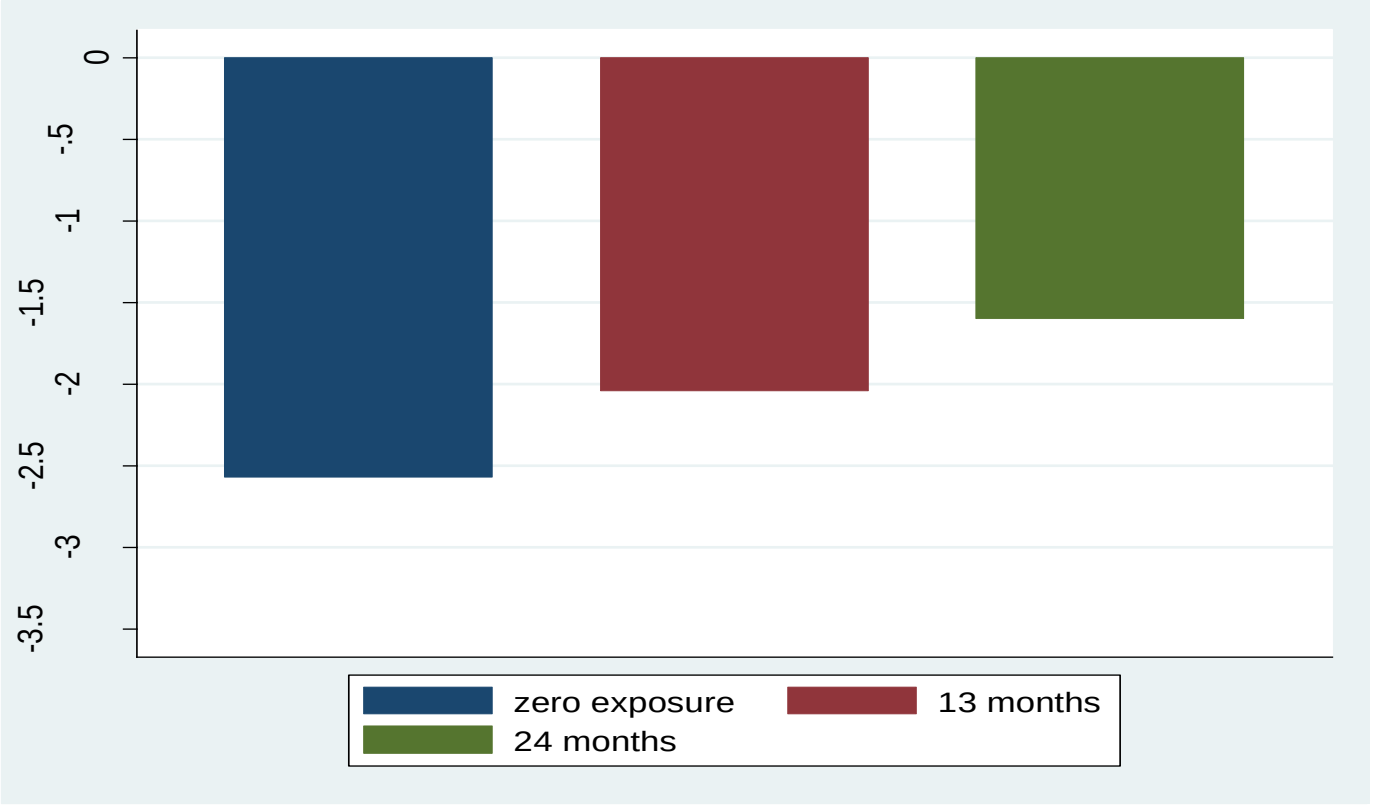
Program effects on Child WAZ (All regressions include GP and round FE)
DiD: one additional month increases WAZ by 0.07 sd

	Dependent variable: WAZ		
	(1)	(2)	(3)
Indicator for Program in GP in survey round (DiD)	0.42*	--	--
Child's exposure to program	--	0.02* (0.008)	--
NAWC x exposure	--	--	0.026 (0.008)
AWC x exposure	--	--	0.021 (0.008)
Interaction of round 2 dummy with:			
AWC population per worker	0.019 (0.014)	0.019 (0.01)	0.018 (0.014)
Number of AWCs in GP	-0.008 (0.01)	-0.01 (0.01)	-0.01 (0.01)
GP population ('00s)	0.0003 (0.002)	0.002 (0.002)	0.002 (0.002)
GP mean mother's educ yrs	-0.04 (0.05)	-0.04 (0.05)	0.10 (0.15)
Regression F (Prob. >F)	52.41 (0.00)	53.41 (0.00)	52.07 (0.00)
Sample size	12,710	12,710	12,714

Table 6: Instrumental Variable regressions for robustness check

	WAZ	Child's exposure	WAZ Hausman test
	OLS-FE	OLS-FE	
Instruments			
R2 x number eligible	--	-0.50^{+} (0.28)	
R2 x child's age x number eligible	--	0.009* (0.003)	
Child's age x number eligible	--	0.01* (0.002)	
Child's exposure to program	0.05* (0.01)	--	0.04* (0.01)
Child's exposure (instrumented)	--	--	0.04 (0.05)
Regression F / Wald (Prob. >F / χ^2)	145.96 (0.00)	200.00 (0.00)	164.82 (0.00)
Sample size	6,381	6,381	6,381

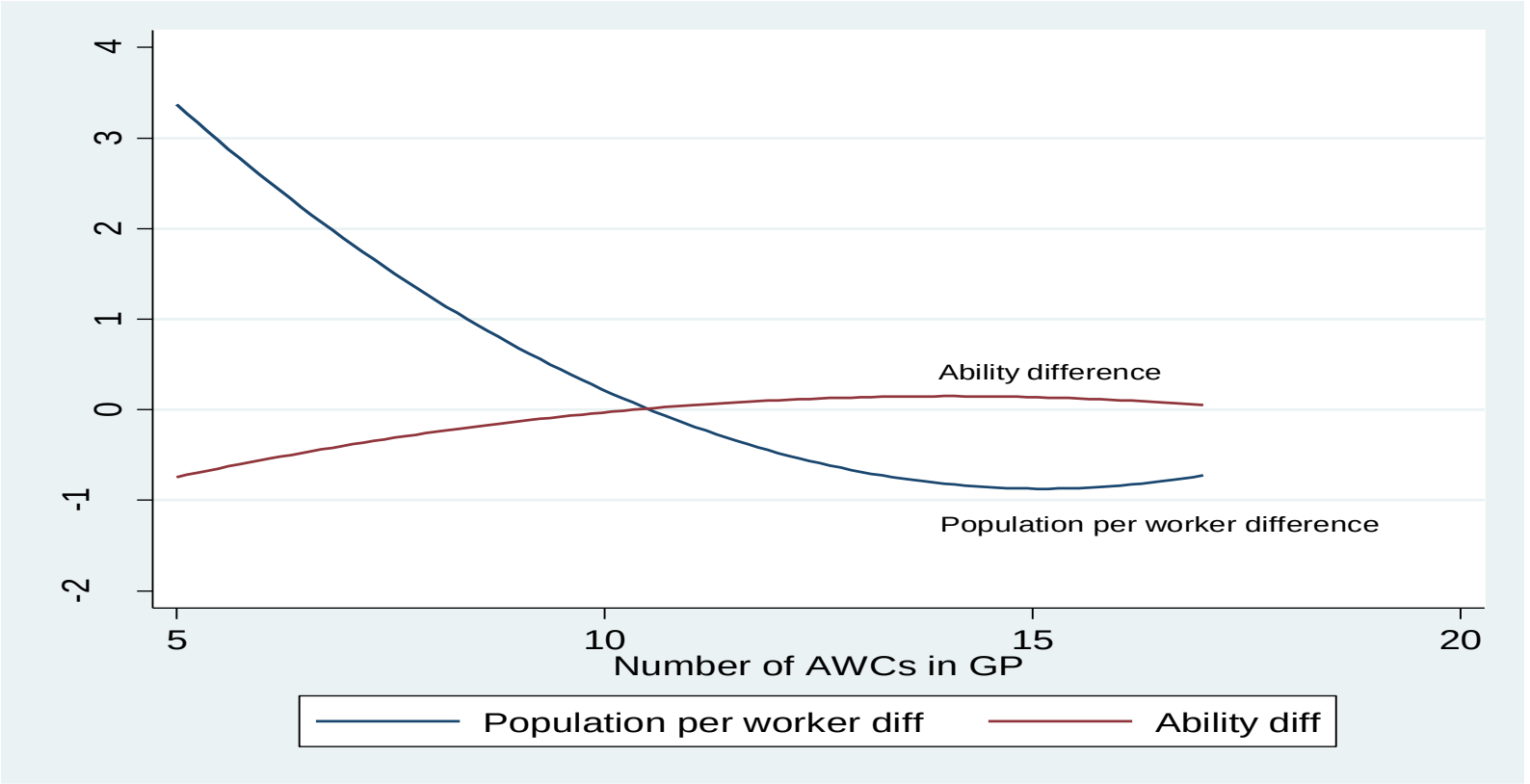
Predicted WAZ at different months of exposure



Decomposing returns: OLS-GP FE regressions

	WAZ		WAZ – with 12th std exam scores
	(1)	(2)	(3)
Child's exposure to program	0.04*	-0.02	-0.002
	(0.01)	(0.02)	(0.02)
Exposure x pop. per worker difference	--	0.07*	0.07*
		(0.02)	(0.02)
Exposure x ability difference	--	0.001*	0.0016*
		(0.0004)	(0.0008)
Regression F (Prob. >F)	168.66	199.82	333.83
		(0.00)	(0.00)
Sample size	6,381	6,381	5,882
Sample	Full	Full	Full

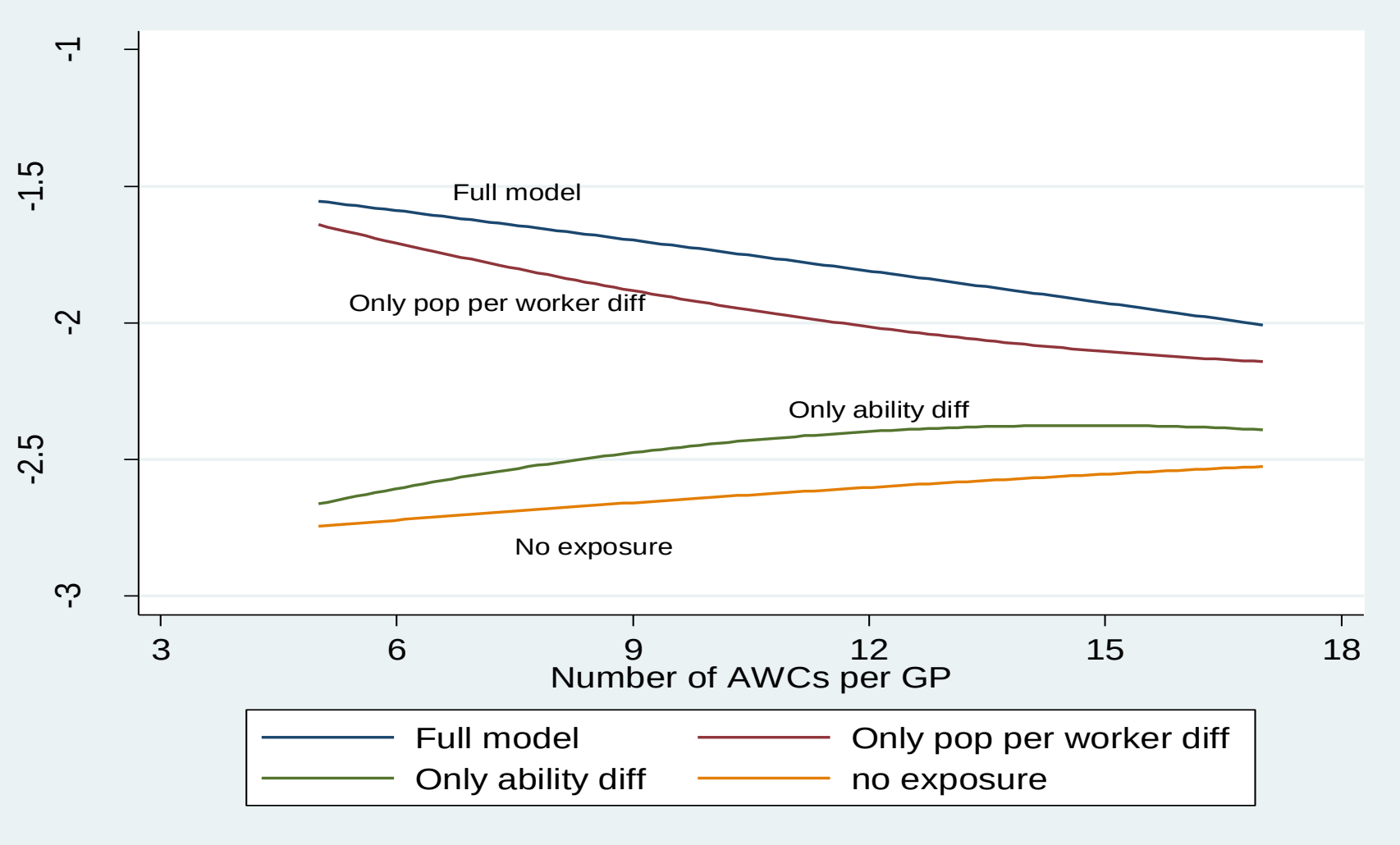
Program differentially affected resource constraints across GPs: Ability and population per worker differences under the program by number of AWCs in a GP



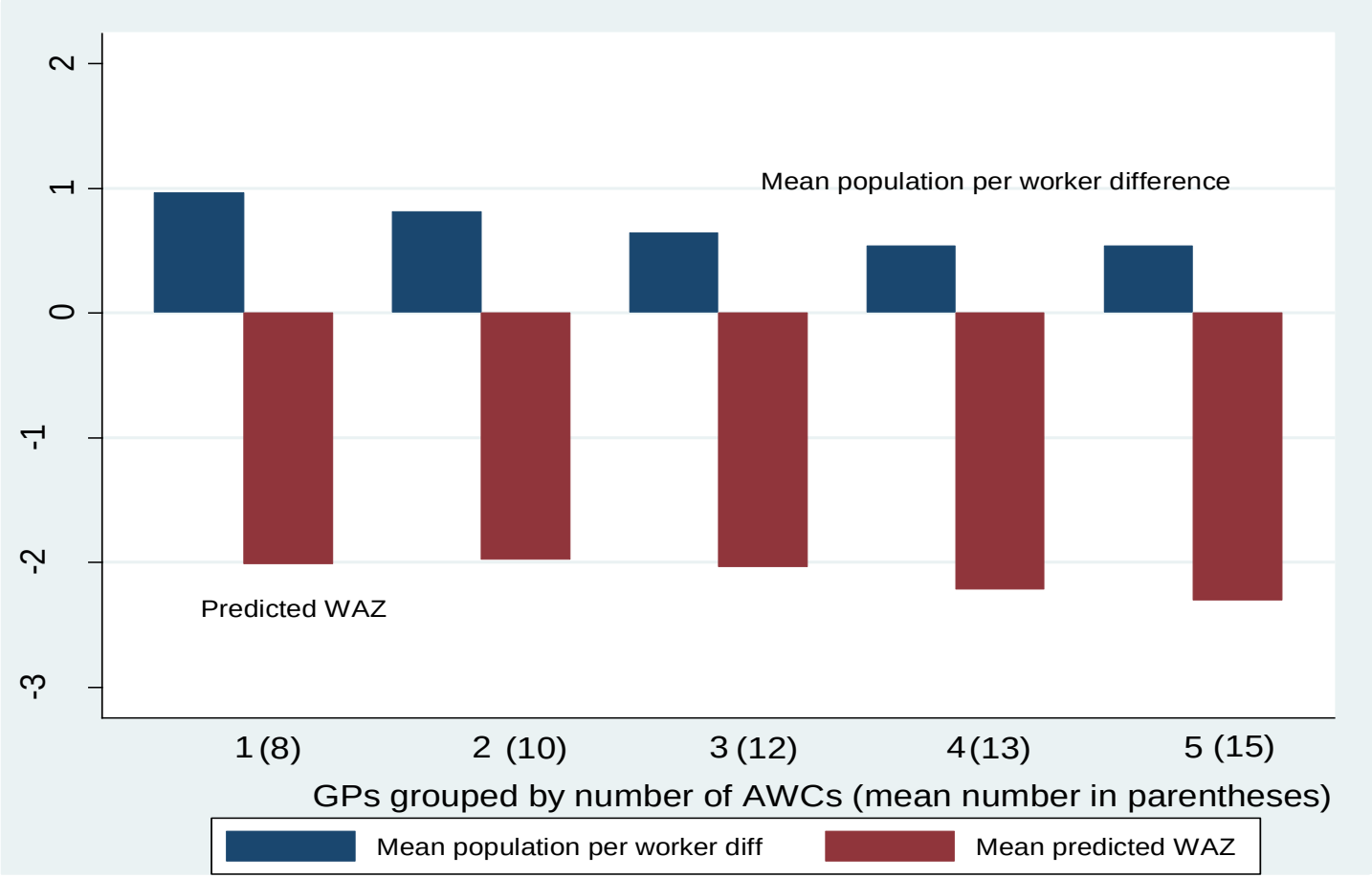
Limited improvement in human capital: reflects the programme's requirement to hire locally

Predicted WAZ under different assumptions regarding constraints:

(Returns fall with AWCs per GP; primarily reflect reduction in labour constraints)

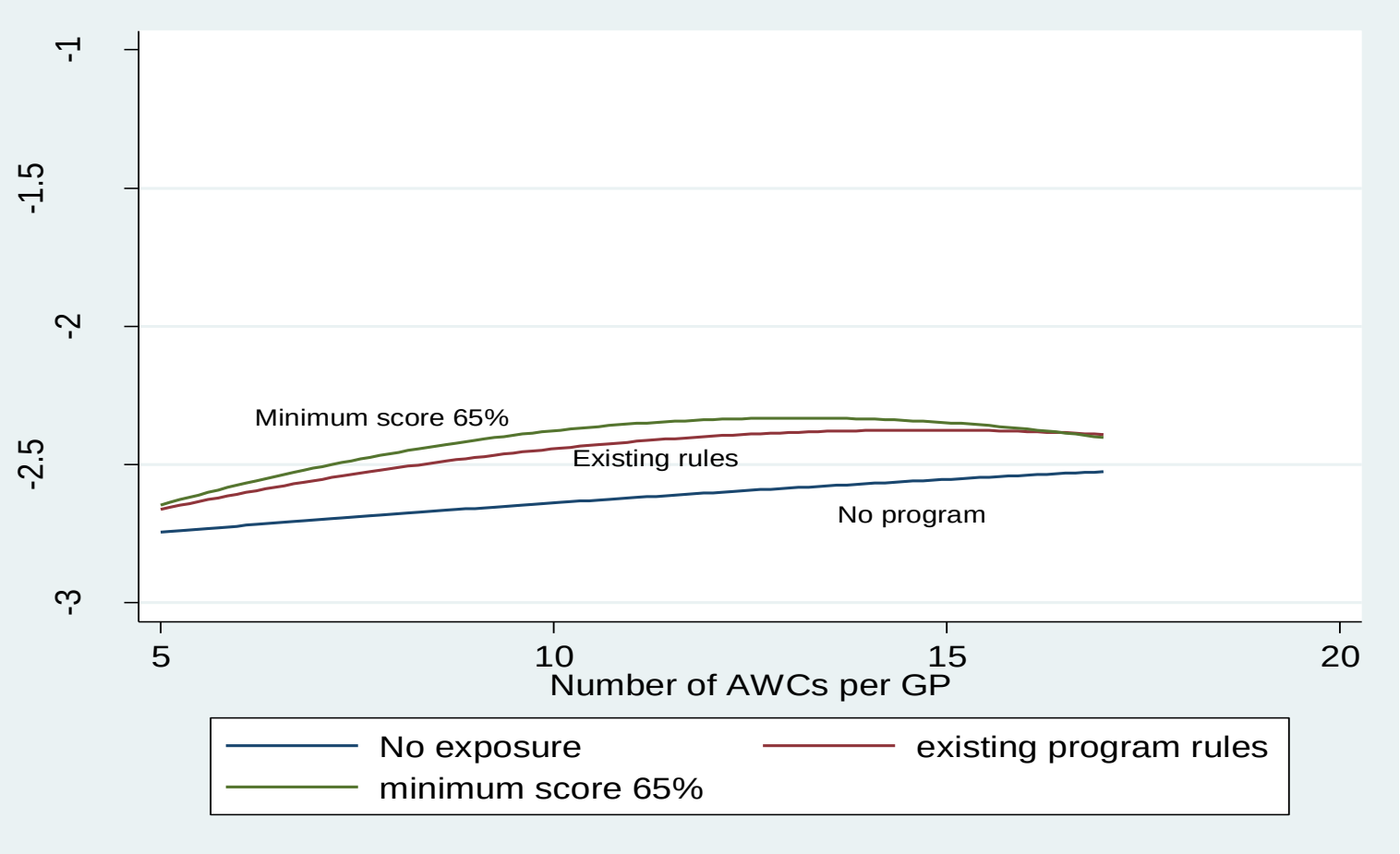


Predicted WAZ and population change per AWC by GP, by quintile of number of AWCs:
Greatest improvement in GPs with fewest AWCs



Regression: replace pop per worker difference with number of AWCs in GP (interacted with exposure)

Low effect of education :Effect of ability of AWC workers on child health, in current environment, is low



Summary Statistics: mother's knowledge, AWW visits

	Early adopters		Late Adopting GPs		No program GPs	
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Mother's knowledge composite score	41.47 (25.70)	46.37 (27.27)	40.69 (24.57)	43.04 (28.38)	38.02 (25.86)	43.04 (26.96)
Know duration of breast feeding	0.32 (0.47)	0.48 (0.50)	0.30 (0.46)	0.41 (0.49)	0.28 (0.45)	0.50 (0.50)
Know dpt dosage	0.14 (0.35)	0.22 (0.41)	0.16 (0.36)	0.21 (0.41)	0.12 (0.33)	0.14 (0.35)
AWW home visits and information						
AWW visited in last 3 months	0.63 (0.48)	0.47 (0.50)	0.60 (0.49)	0.47 (0.50)	0.47 (0.50)	0.41 (0.49)
Discussed months of breast feeding	0.24 (0.43)	0.24 (0.43)	0.25 (0.44)	0.25 (0.44)	0.17 (0.38)	0.22 (0.41)
Discussed when to start suppl foods	0.21 (0.41)	0.22 (0.42)	0.19 (0.39)	0.23 (0.42)	0.16 (0.36)	0.21 (0.41)
Discussed child's weight gain	0.11 (0.31)	0.19 (0.39)	0.13 (0.33)	0.20 (0.40)	0.07 (0.25)	0.12 (0.32)
Sample size	729	723	713	746	944	989

Table 8: Effect of program on mother's knowledge and interaction with AWW/VHSND (Sample: pregnant mothers and mothers with child <=1 year, program districts)

	Mother's knowledge overall score		Reports AWW visited home in last 3 months		Reports attendance at VHSND in last 3 months	
	(1)	(2)	(5)	(6)	(7)	(8)
Mother exposure to program	-0.22 (0.31)	-0.79 (0.96)	0.002 (0.005)	0.005 (0.009)	-0.005 (0.005)	-0.01 (0.01)
Exposure x pop diff	--	0.73 (0.86)	--	-0.01 (0.01)	--	-0.005 (0.01)
Exposure x ability diff	--	0.01 (0.013)	--	0.0001 (0.0002)	--	0.001* (0.0002)
Regression F	5.82 (0.00)	6.60 (0.00)	13.40 (0.00)	14.11 (0.00)	18.91 (0.00)	30.86 (0.00)
Sample size	2,094	2,094	2,094	2,094	2,094	2,094

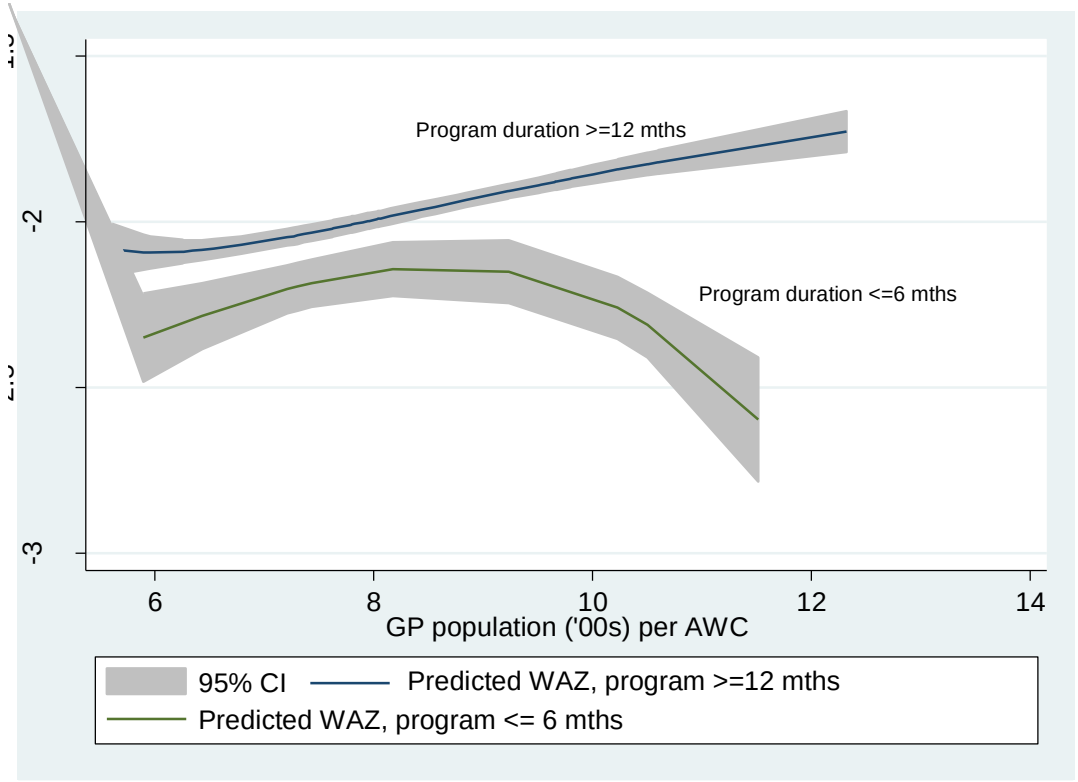
Possible explanation: complementarities between physical and human capital

- Poor physical capital / infrastructure of AWCs
- Lack of essential equipment like weighing scales, measurement tapes etc
- Unable to set up “nutrition surveillance system”
- In areas where higher levels of education could have made a difference, the lack of physical capital impeded such an effort

Factors behind relatively large effects?

- “High priority zone” characterized by very poor health indicators
- Primary effect of the programme is through its effect on labour constraints
- Unintended effect: reduced labour constraints the most in areas that were previously most constrained (highest GP population per AWC)

Programme had its largest effect in most constrained GPs: Predicted WAZ by GP population per AWC and program duration intensity



Predictions from OLS-FE regression of WAZ on exposure, exposure x labour difference, exposure x human capital difference

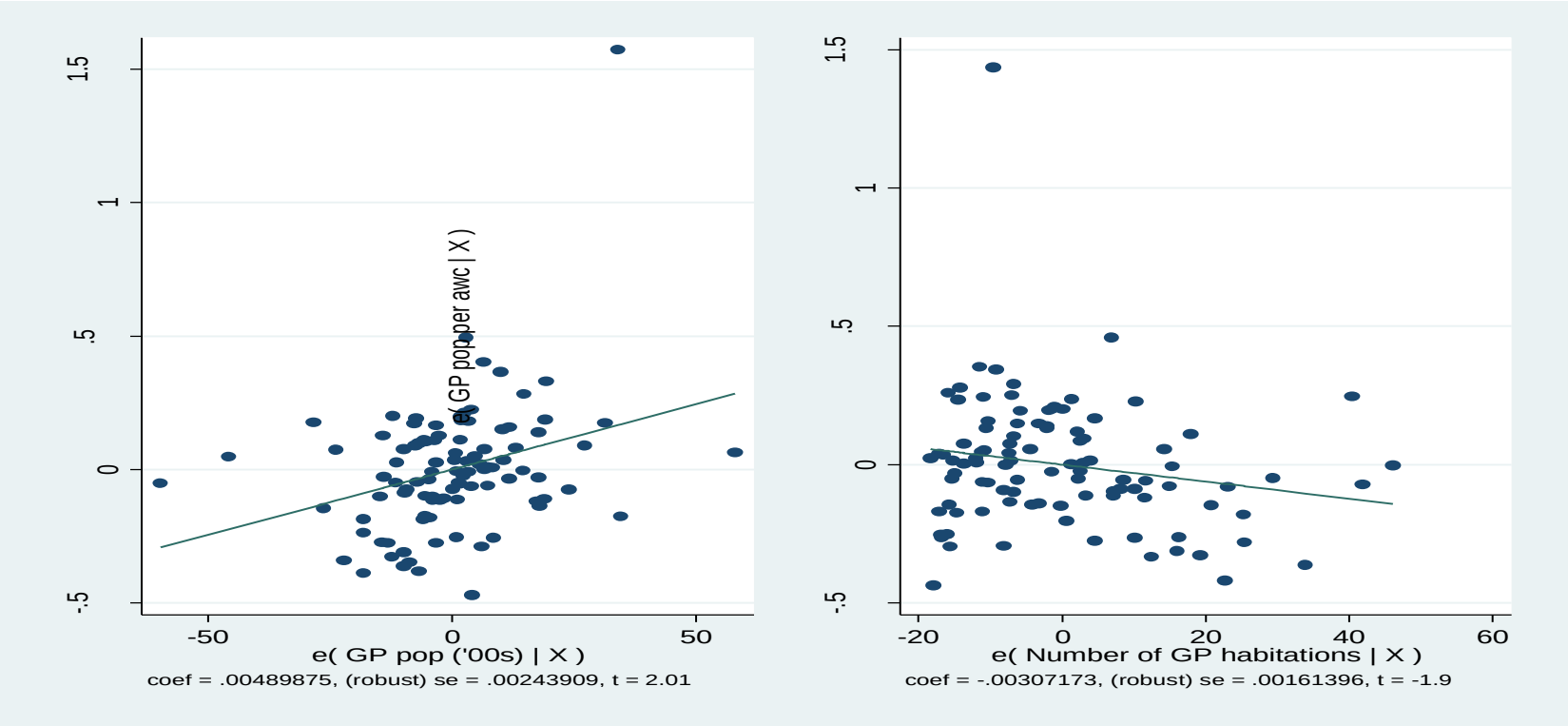
GPs with fewest AWCs are most constrained

- Number of AWCs in a GP:
  - Increases with GP population (one AWC per 800 population)
  - GP population per AWC is smallest in GPs with fewest AWCs (Population rule)
  - Those with fewest AWCs are LEAST constrained

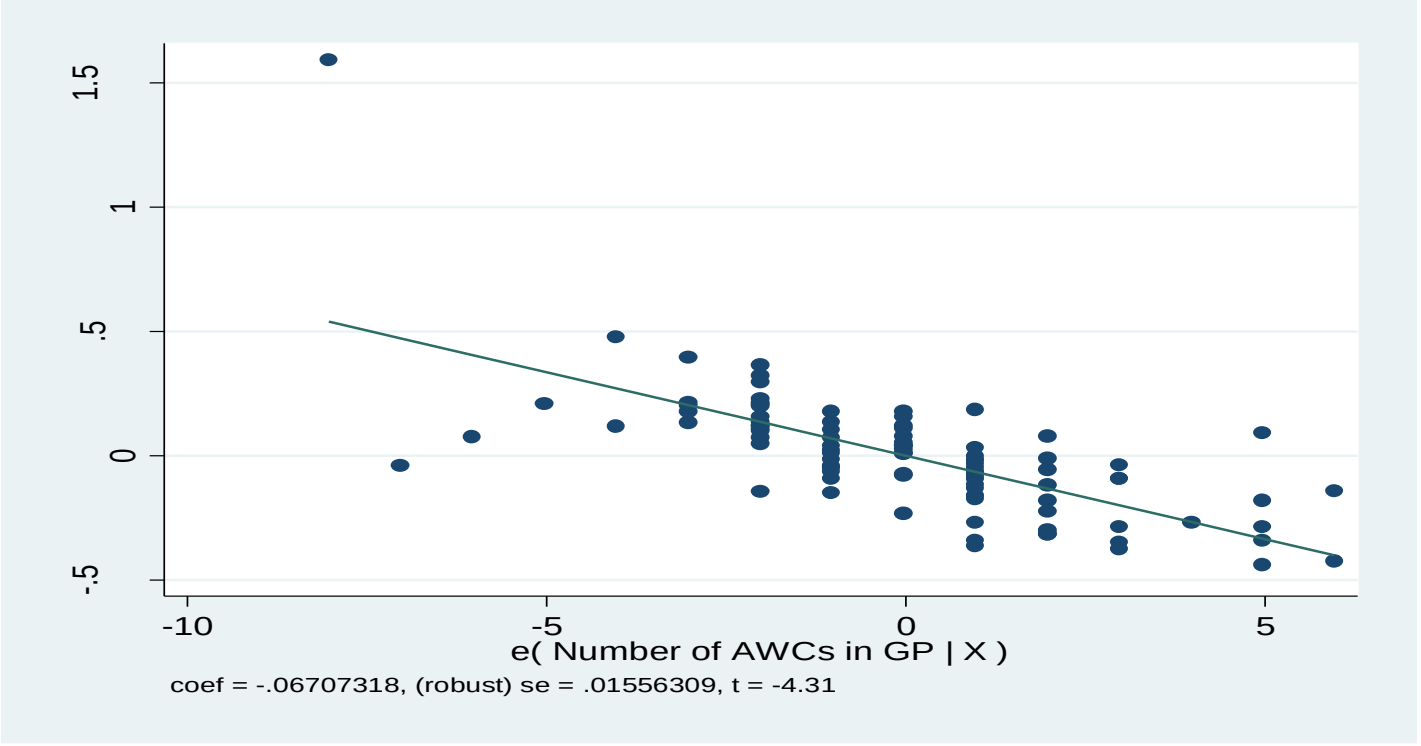
- Number of AWCs in a GP:
  - Increases with number of hamlets
  - GP population per AWC falls as number of hamlets increases
  - Those with fewest AWCs are MOST constrained

Added value plots of GP population per AWC on GP population and number of GP habitations

(Constraints increase with GP population but fall with number of hamlets)



Labour constraint most binding in GPs with fewest AWCs



Conclusions

- Improving quality of AWCs can significantly improve child health
- Constraint that was assumed binding was human capital; but improvements came because the provision of an educated worker reduced labour constraint
- Education side:
    - Decentralized policies are unlikely to reduce human K constraint
    - In current context, improvement in education would not have helped