effect of offering the Juntos programme for eligible mothers and children irrespectively of whether they were actually enrolled, and is thus analogous to an intention-to-treat (ITT) analysis, where participants are analysed based on allocation arm rather than on whether or not they received the intervention. We estimated the effect of the Juntos programme at the district level in spite of the fact that not all eligible households within the district were direct beneficiaries of the programme. This ITT estimate is not only more appropriate because it captures the real world effect on communities in which uptake is less than 100%, but also because it captures the indirect benefits that occur when nonparticipants are affected by participants, rather than being directly affected by the programme themselves. To identify comparable controls in both analyses, we used propensity score matching, based on the distributions of measured characteristics posited to confound the effect of the treatment.

Study setting

The World Bank considers Peru as a higher-middle income country, but there is still a big gap between the richest and the poorest in the country ('Country and Lending Groups | Data' 2013). Poverty and poor health outcomes are concentrated in rural areas. Anaemia in children and pregnant women are prevalent in the country. In 2014, the prevalence of anaemia in children under 5 years was 46.8% and in rural areas was 68.4%. In addition, the prevalence of anaemia in pregnant women was 53.6% in the Andes and 70.1% in the Peruvian Amazon Jungle (Becerra et al. 1998; Munares-García et al. 2012). Underweight is also prevalent in Peru, with a prevalence of 11.9%. Overweight and obesity are an emerging problem, reaching a prevalence of 62.3% in some subpopulations. Acute malnutrition in children is fortunately declining across Latin America, but in Peru, there are areas with a prevalence of 2.1% (Tazza & Bullón 2006; Mispireta et al. 2007; Sobrino et al. 2014).

Study participants

We used data from the Peruvian DHS. These repeated cross-sectional surveys have been administered annually by the National Institute of Statistics and Informatics (INEI) in Peru since 2005. The DHS collects information on socio-demographic characteristics, fertility and reproduction, access to and use of health services, health and health behaviours and other characteristics, including a 5-year birth history, from a nationally representative sample of women between 15 and 49 years of age. Respondents are selected using a multistage stratified sampling design. Trained interviewers and standardized assessment tools and instruments are used to increase the quality and comparability of data collected across regions and waves (Instituto Nacional de Estadística e Informática 2012; Loret de Mola et al. 2014).

We created four separate samples of participants for our individual- and district-level analyses of maternal and child health outcomes. For the individual-level analysis we used information collected between 2009, when information on enrolment in Juntos was added to the DHS, and 2012. For the district-level analysis we used information collected between 2007 and 2013. In both cases, we restricted the analyses to participants meeting the inclusion criteria for Juntos (Table SI in appendix). We used indicators of poverty at the individual-level because these were available and provide much finer adjustment for confounding than district-level indicators. For women, this included those who were in poverty (located in the second lowest quintile by income) or extreme poverty (located in the lowest quintile by income) who were head of household or partner of the head of household, and who were pregnant or caregivers of a child less than 17 years of age. For children in intervention districts, this included those living in households in poverty or extreme poverty, who were the child of the head of household and who were born after the programme was implemented in their district of residence. In the district-level analysis, the children in the control group included those born after the programme was implemented in the country, but who lived in non-intervention districts.

Measures

Exposure

In the individual-level analysis, the treatment variable was enrolment or not in the Juntos programme, which was determined using the participant's response to a