

## **The forgotten girls: the state of evidence for health interventions for pregnant adolescents and their newborns in low-and middle-income countries**

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## **Summary**

Every year, an estimated 21 million girls aged 15-19 years become pregnant in low- and middle-income countries (LMIC). Policy responses have focused on reducing the adolescent birth rate whilst efforts to support pregnant adolescents have lagged behind. We did a systematic review of interventions addressing any health-related outcome for pregnant adolescents and their newborns in LMIC and mapped its results to a framework describing high-quality health systems for pregnant adolescents. Although we identified some promising interventions, such as micronutrient supplementation, conditional cash transfers and well-facilitated group care, most studies were at high risk of bias and there were substantial gaps in evidence. These included major gaps in delivery, abortion, and postnatal care, and mental health, violence, and substance abuse-related outcomes. We recommend that the fields of adolescent, maternal and sexual and reproductive health collaborate to develop more adolescent inclusive maternal health care and research, as well as specific interventions for pregnant adolescents. We outline steps to develop high-quality, evidence-based care for the millions of pregnant adolescents and newborns who currently do not receive it.

174 words

## Introduction

The global adolescent fertility rate has more than halved since 1960, from 86 births per 1000 adolescents aged 15-19 years to 41.<sup>1</sup> This is due in part to a strong policy focus on preventing adolescent pregnancy, but also to transformative shifts including increased age at marriage and access to contraception, extended education and employment opportunities for girls and women, and urbanisation.<sup>2,3</sup> Progress has not been universal; adolescent births continue to be high in low- and middle-income countries (LMIC) where 97% of all global adolescent births occur.<sup>4</sup> Although there is global traction around the importance of preventing and delaying pregnancy in adolescents,<sup>5,6</sup> this should not detract from providing high-quality care for millions of girls who become pregnant.

Adolescent pregnancy raises complex and culturally diverse issues. It can occur within or outside committed relationships, be intentional or unwanted, and at times be a potentially positive experience for the girl.<sup>7</sup> Poverty, restrictive gender norms, early marriage, rural residence, poor education, violence and lack of contraceptive use are often associated with adolescent pregnancy.<sup>2,8,9</sup> Adolescents overall experience poorer pregnancy outcomes, including an age-gradient risk of higher maternal mortality compared to 20 to 29-year-olds.<sup>10</sup> Their neonates are at increased risk of mortality, preterm delivery and low birthweight with worse outcomes at lower maternal age.<sup>11</sup> In LMIC, pregnant adolescents often face greater physiological risks, such as those related to nutrition and malaria (where present), as well as higher rates of HIV and other sexually transmitted infections, compared to adult women.<sup>2</sup> Pregnant adolescents face poorer coverage across many maternal care indicators, such as delivering with a skilled birth attendant.<sup>12</sup> Their access to care can be reduced by mobility and financial restrictions,<sup>13</sup> as well as limited autonomy, where their decision making is often constrained by family and community power dynamics.<sup>3</sup> If they do access care, pregnant adolescents often lack the confidence to express their needs, face greater humiliation and disrespect,<sup>14</sup> and receive poorer quality care compared to women.<sup>15</sup> Overall, adolescent pregnancy remains a marker of disadvantage.

Our understanding of health provision has advanced considerably in the Sustainable Development Goals era, including two important developments: a more comprehensive understanding of what constitutes a high-quality health system with the recognition that it should be afforded to all,<sup>16</sup> and an increased emphasis on providing adolescent-friendly care.<sup>17</sup> Neither of these developments have explicitly addressed pregnant adolescents, despite their multiple risks and needs requiring comprehensive multisectoral responses that are adolescent appropriate. Instead, pregnant adolescents are often missing from adolescent health programming. WHO quality standards for adolescent-friendly health services, for example, place little emphasis on pregnancy care,<sup>18</sup> and WHO guidelines<sup>13</sup> addressing skilled maternity care for adolescents were all based on expert consensus, not evidence. Pregnant adolescents tend to fall between programming silos: two comprehensive reviews of programmes to improve maternal and child health<sup>19</sup> and adolescent sexual health<sup>20</sup> both mentioned that the other would cover pregnant adolescents, but neither did. Although providing developmentally appropriate health care across the life course has gained recent attention,<sup>21</sup> there is scope for further reconceptualisation of high-quality adolescent health care, particularly for those with complex and neglected health needs, such as pregnant adolescents. Without a comprehensive framework for high-quality health care, areas for improvement cannot be readily identified and addressed.<sup>16</sup>

In this health policy paper, we present a framework for high-quality health systems for pregnant adolescents across which we map a synthesis of the state of evidence for health interventions in LMIC

for them and their neonates. We report results of a mixed methods systematic review that captures evidence from the last two decades – a period during which adolescent-friendly health services gained prominence in health policy - until the onset of the COVID-19 pandemic which triggered large shifts in adolescent pregnancy risks and outcomes.<sup>22</sup> Our study aims to provide the first comprehensive framework for high-quality health care for pregnant adolescents in LMIC and to use this to highlight gaps in the evidence and identify opportunities to inform health interventions for adolescents and their newborns.

## **Adapting high-quality health systems for pregnant adolescents**

To help map the evidence and identify areas for improvement, we developed a conceptual framework describing a high-quality health system for pregnant adolescents that is comprehensive but not prescriptive (figure 1 and table 1). We adapted the framework proposed by the Lancet Commission on high-quality health systems in the Sustainable Development Goals era<sup>16</sup> to better reflect maternity care and adolescent-specific challenges and developmental needs, such as ensuring coverage of key practices in maternal care, engaging family more directly and providing peer and group support. We did this by drawing on elements of WHO's quality of care framework for maternal and newborn health,<sup>23</sup> and barriers to care faced by pregnant adolescents in LMIC that we identified from around 100 articles (appendix pp 5–7, pp 52–70). The framework describing a high-quality health system for pregnant adolescents, like the original Lancet Commission framework, covers three broad domains; Foundations (how the system functions); Processes of Care (how it is experienced); and Quality Impacts (the benefits received from health care, including better health outcomes) (see table 1).<sup>16</sup> These three components are embedded in a learning and improvement cycle. The entire framework is informed by principles of resilience, efficiency for people and equity, which is of particular relevance for pregnant adolescents who often face compound discrimination encompassing gender, race, age and social class.

## **Evidence for high-quality health systems for pregnant adolescents in LMIC**

Our systematic search identified 49 560 publications on potential health interventions. Another 507 were found through grey literature searches and reference checks (figure 2). Based on title and abstract screening, we retrieved 1 440 reports and reviewed their full text for any outcomes provided for adolescents. 195 of these reports moved into the third stage of screening for final eligibility (see methods panel for search strategy and selection). A total of 75 reports on 61 interventions and one meta-analysis were included in the review. 35 interventions targeted pregnant adolescents, 14 studies performed sub-analyses on intervention effects in adolescents and the remaining targeted various populations, such as young married couples. Very few studies included pregnant adolescents younger than 15 years.<sup>24-31</sup>

Studies were conducted in 29 countries (figure 3): ten of the 75 reports were in Portuguese, nine in Spanish and one in Farsi. 46% of studies were from Latin America, primarily from Brazil (23%).

Only three quantitative studies were at low risk of bias (ROB), 12 were at moderate risk and the other 38 were at high risk (appendix pp 18–28). 12 qualitative studies provided pertinent insights.

We mapped interventions identified in our systematic review according to the period of maternity care they addressed; antenatal, delivery and postnatal (up to 42 days post-delivery), and the three domains

of the adapted conceptual framework. We used a convergent approach<sup>32</sup> with textual narrative synthesis<sup>33</sup> to integrate qualitative and quantitative data related to the three domains (methods panel, appendix pp 29-38). Many interventions fell across more than one domain.

Below, we map findings for studies of low to moderate ROB below. Effect sizes for these studies are given in table 2. Evidence on effective interventions for pregnant adolescents is sparse across all components (figures 4a, 4b).

## **Foundations**

### *Population*

Most interventions under this component aimed to improve maternal health knowledge and literacy but not specifically for adolescents.<sup>34-43</sup> Many studies evaluated didactic counselling or group education sessions but did not assess whether knowledge improvement impacted health care uptake.<sup>34-37</sup> An intervention in Ghana however, used more novel methods such as video and role plays coupled with community mobilisation to increase service demand, which included increased uptake of antenatal and perinatal services.<sup>39</sup> Another intervention, a promotional campaign aimed at increasing uptake of intermittent preventative treatment (IPTp) for malaria in pregnancy, found lower IPTp uptake in adolescent primigravidae compared to adult primigravidae (47% vs 62%) despite their higher risk.<sup>40</sup> Pregnant adolescents faced numerous age-specific barriers to care, such as strong cultural norms to keep first pregnancies private, which often led to delayed presentation for antenatal care and thus IPTp. Overall, we found very limited evidence on the effectiveness of efforts to inform adolescents and other stakeholders about skilled maternal care on their actual access to, and uptake of, health care.

Studies that evaluated interventions responding to adolescents' identified health needs were all from Brazil and qualitative; many sought to create spaces where adolescents could freely express their health needs.<sup>44-46</sup> These adolescent-inclusive interventions naturally engaged individual girls, but families and wider communities were rarely involved. One exception was a qualitative study linked to the Teenage Mother's project,<sup>47</sup> where parents of unmarried teenage mothers were actively involved and participated in counselling and reconciliation with their daughters. As a result, parents became more supportive of their daughters, particularly in continuing education. This was also the only study that tackled stigma,<sup>47</sup> and was one of only two studies that purposively incorporated cultural norms and preferences into intervention development.<sup>40,47</sup>

### *Governance*

The Teenage Mother's Project<sup>47</sup> was also the only project that engaged community leaders, with the aim of creating more supportive environments for unmarried adolescent mothers. No project sought to enhance intersectoral action.

### *Platforms*

Interventions on improving the organisation and accessibility of health services for pregnant adolescents and their neonates were also limited. Five studies, mainly from Latin America, evaluated group-based care, using qualitative or mixed methods.<sup>34-37,47</sup> Group sessions enhanced therapeutic relationships and led to shared dialogue and expression of needs and anxieties,<sup>36</sup> with potential to provide a peer group identity, otherwise absent.<sup>47</sup> "In the groups we talk to each other [...] we feel at ease [...] I don't feel embarrassed to express my views (14-year-old girl)."<sup>34</sup> In a nutrition intervention in Brazil, adolescents

preferred group sessions where their concerns could dominate.<sup>35</sup> Home visits by community health workers were also a promising platform. Although community health workers' ability to engage pregnant adolescents was not explored in most interventions,<sup>35,39,40</sup> three qualitative studies from Brazil were exceptions.<sup>42,43 45</sup> For either platform; group care or community health workers, it appears that the skill of the agent to engage adolescents was critical to the effectiveness of the platform.<sup>37,45,46,48</sup> However, no study provided data on how this impacted care uptake or outcomes.

### *Health workforce*

Only one project included adolescent-friendly workforce training but within a broader youth sexual reproductive health program that also included pregnant adolescents.<sup>39</sup> We found no study evaluating adolescent-friendly training for maternity staff.

### *Tools, Medicines and Supplements*

Over a third of higher-quality studies looked at multiple micronutrient supplements (MMN) or fortified foods. Most of these were delivered without tailoring supplement provision for adolescents, despite pregnant adolescents in LMIC likely being at higher nutritional risk than adults.<sup>49</sup>

Studies linked to the JiViTA-3 trial in Bangladesh<sup>50</sup> and the SUMMIT trial in Indonesia<sup>51</sup> sub-analysed the effects of MMN compared to Iron Folic Acid (IFA) on birth outcomes for pregnant adolescents. Findings differed, but so did the proportion and number of pregnant adolescents in each study (28%, n=12 277 in JiViTA-3 and 14%, n=4313 in SUMMIT). JiViTA-3 found no evidence of an overall effect of MMN on infant mortality (relative risk (RR) 0.95, 95% confidence interval (CI) 0.86–1.06) with no apparent effect modification by age (multiplicative risk scale, p=0.84), whilst the SUMMIT trial did point to an overall reduction in early infant mortality (90 days postpartum, RR 0.82 95% CI 0.70–0.95), but this was not seen in adolescents. Both JiViTA-3 and SUMMIT weighed heavily in a meta-analysis of 17 trials<sup>52</sup> that explored modifying factors for micronutrient supplementation effects on birth outcomes. No evidence of effect modification by maternal age was seen for any outcome examined (see table 2).

All of the above trials compared MMN to IFA, yet a trial of weekly periconceptual iron supplementation in nulliparous females (91% adolescents) in rural Burkina Faso<sup>53</sup> found iron supplementation to be potentially harmful, with little benefit. Although malaria risk was similar with iron folic supplementation compared to folic acid (ANC1 parasitemia, prevalence ratio (PR) 0.97, 95% CI 0.79–1.18), and risk of iron deficiency did not appear to be reduced (risk ratio (RR) 0.84 95% CI 0.46–1.54),<sup>53</sup> there was evidence of an increase in preterm births (RR 2.22 95% CI 1.39–3.61)<sup>54</sup> and potentially on gastrointestinal side effects (RR 1.29 95% CI 0.93–1.79).<sup>53</sup>

Findings from trials of fortified food and lipid-based nutrition supplementation (LNS) were mixed. There was evidence of reduction in neonatal stunting following LNS supplementation during pregnancy in the Ran-Ding nutrition study in Bangladesh (RR 0.83 95% CI 0.71–0.97),<sup>42</sup> with a greater reduction among infants born to adolescent mothers. In rural Malawi, a trial of fortified and supplement food preparation<sup>55</sup> found that despite adolescents receiving more supplementation, and having better nutritional indicators, their neonates had lower length for age compared to adults (1.2cm shorter in younger adolescents (p<0.001)). Only one study explored adherence to nutritional supplementation in pregnant adolescents and found marriage in adolescents to negatively impact adherence due to restricted mobility, increased domestic work, and the influence of husbands.<sup>56</sup>

Overall, MMN compared to IFA may improve some birth outcomes in pregnant adolescents, and existing studies suggest a need for age-sensitive programming.

There was no intervention identified that set up systems for disaggregated data collection.

## **Process of Care**

### *Competent care and systems and positive user experience*

Only six studies were not at high risk of bias in this domain. Two interventions directly addressed rights awareness and autonomy among pregnant adolescents and the community<sup>44,47</sup> but did not address rights within a health setting. Heidemann et al,<sup>44</sup> for example, led the only intervention that engaged adolescents as active partners in their own care through Freirean ‘culture circles’ and encouraged reflection on their own autonomy within a community setting. Only one intervention adopted a clear patient feedback mechanism, drawing on participatory methods.<sup>47</sup> No interventions sought to improve competent care and processes specifically for pregnant adolescents.

Varqa et al<sup>57</sup> was the only high-quality study that explored appropriate testing, treatment and counselling. Using narrative methods, they explored power imbalances that potentially affect girls’ abilities to disclose HIV status and take appropriate action in two pilot Prevention of Mother to Child Transmission (PMTCT) of HIV programmes. There was however no further intervention to tackle these challenges.

Continuity of care during pregnancy was considered by only one intervention, the Government of India’s Janani Suraksha Yojana (JSY; translated as safe motherhood scheme).<sup>38</sup> As part of the scheme, community health workers sought to ensure continuity of care and increase coverage of key practices. The Ananya project, also from India, enhanced reproductive, maternal and newborn health continuum of care (RMNH CoC)<sup>43</sup> but found reduced intervention effects for women who married as minors (see table 2).

## **Quality Impacts**

### *Economic benefit*

Two schemes looked at the effects of conditional cash transfers among pregnant adolescents: India’s JSY cash incentives for institutional deliveries<sup>38</sup> and Mexico’s Oportunidades programme,<sup>41</sup> a broader long term poverty reduction program with gender and age-specific health, education and nutrition conditions. Both had positive effects. Adolescents had a greater uptake of JSY compared to women aged 30-34 years (OR 1.57 95% CI 1.43–1.71), with decreased uptake as maternal age increased.<sup>38</sup> In the Oportunidades programme, adolescents with longer exposure to the programme were more likely to choose skilled delivery compared to adolescents from areas that were incorporated later into the programme (88% vs. 18%) with a smaller effects seen in 20-24-year-olds (41% vs. 3%) and none in 25-35-year-olds.<sup>41</sup> This was despite delivery choice not being a condition of the programme. This offers some evidence that financial incentives have greater effect in pregnant adolescents, and possibly more so with prolonged exposure.

### *Confidence in the system*

Four qualitative studies evaluated interventions that sought to build pregnant adolescents’ trust through well-facilitated, respectful dialogue. Three created this space through peer groups<sup>34,36,44</sup> and one

through nurse-led home visits.<sup>48</sup> No intervention sought to increase trust in hospital services or medical staff.

Only five interventions sought to increase care uptake.<sup>38,39,41,43,45</sup> The only one focussed on pregnant adolescents explored the role of community health agents in Family Health teams to increase uptake of care by pregnant adolescents, evaluated through qualitative methods.<sup>45</sup> Here again, clinical information and assessments were less helpful than building trusting relationships with pregnant adolescents.

#### *Better health:*

Very few studies assessed the impact of an intervention on actual health outcomes. Most, as mentioned above, were nutritional studies that reported birth outcomes. All were extracted from large studies that performed sub-analysis of data for adolescents. Furthermore, no intervention sought to improve health outcomes amongst adolescents or their newborns through improving birth preparedness, expanding basic and comprehensive obstetric emergency care or providing safe abortion care.

### **Critical gaps and missed opportunities**

Across the high-quality health system framework for pregnant adolescents in LMIC we found very little evidence for health interventions, and in some areas nothing at all. We found no studies related to adolescent-friendly training for maternity staff, enhancing privacy, or addressing critical outcomes such as maternal mortality, violence or substance abuse. There were only two studies on mental health, both at high risk of bias.<sup>30,58</sup> Except for two nutritional supplementation trials,<sup>59,60</sup> there was no high-quality quantitative evidence specifically related to adolescent and newborn pregnancy care, and almost nothing on improving delivery, abortion or postnatal care including newborn care for adolescents. We found no studies that explicitly aimed to tackle broader determinants of health such as gender norms, social class divisions or racial discrimination, though many studies acknowledged<sup>34,36,40,44,47</sup> or even analysed for their effect<sup>38,41,43</sup> and sought to improve equitable inclusion and participation.<sup>34,44,46-48</sup> Most studies were at high risk of bias and did not assess the impact of the intervention on health outcomes.

We found very few studies that recognised the specific challenges and developmental needs of pregnant adolescents compared to adults.<sup>61</sup> Some findings suggested that general improvements in health systems and maternity care, such as increasing provision of ITP-p<sup>40</sup> may not translate into better outcomes for adolescents without age-specific considerations.<sup>40,55,56</sup> Critically, we found no study that viewed adolescent mothers as agents of change within their communities.

Most of the maternal health literature we found neglected pregnant adolescents, potentially missing findings of public health importance. Only 14 studies sub-analysed for effects in adolescents. In contrast, we identified and excluded over 800 maternal health interventional studies that either did not recruit adolescents or did not sub-analyse for effects in them. Although small numbers can hinder meaningful sub-analysis, we found that in regions where adolescent pregnancy rates are high, sub-analysis can be useful if done well. For example, in the Rang-Din LNS-PLS supplementation trial,<sup>42</sup> researchers found a greater reduction in stunting among neonates born to adolescent mothers. This led them to conduct further analyses, and to conclude that LNS-PLS supplementation only reduced preterm birth and LBW in food insecure adolescents,<sup>49</sup> a finding of public health importance.

### **Steps ahead**



Poorer outcomes in pregnant adolescents and their neonates in LMIC are well documented but have been overwhelmingly used to support and justify a primarily preventative approach. Despite decades of focus, with both Millennium Development<sup>5</sup> and Sustainable Development Goals<sup>6</sup> including adolescent birth rates, reductions have been variable, with many sub-Saharan African countries continuing to have adolescent birth rates above 100 births per 1000 adolescents.<sup>4</sup> In low-income countries, where there is a burgeoning adolescent population, the percentage of all births that are in adolescents has remained unchanged over the past 30 years, at 15%.<sup>62</sup> Although prevention is critical, we are left ill-equipped to meet the challenges facing millions of adolescent mothers and their children.

We propose several initial steps, some simple but others that require a shift in mindset in both maternal and adolescent health care. Given the lack of evidence, the focus is on advancing research (see recommendations panel).

### **Developing adolescent inclusive maternal health care**

Researchers and practitioners in adolescent and maternal health and sexual and reproductive health have an important opportunity to work more coherently together across a broader framework for high-quality health systems.

One challenge to overcome is the recognition of adolescents as an important sub-group in maternal health research and programming. Without data, we cannot assume that interventions work similarly for women across the reproductive age spectrum, as a number of studies indicate.<sup>38,40-42,55,56,61</sup> There is a need for maternal health researchers to recognise the importance of firstly recruiting and then analysing for effects in adolescents, particularly in settings where they constitute over 20% of all births. With input from adolescent health researchers, studies can include adolescent-relevant maternal health outcomes, such as those related to growth and maturation, and consider financial or cultural barriers to care. Of note is the need for disaggregated data, and for maternal health studies to use standard age categories and corresponding terminology,<sup>63</sup> including the particularly neglected 10–14-year-old age group. That is, recognise adolescents as adolescents, rather than young women. This alone will enable more potentially relevant studies to be identified.

We did not find any studies where maternal health delivery was informed by an adolescent-friendly approach. This is a promising space for future interventions. There is much to gain for all women from a synergistic collaboration between the movement for respectful maternity care<sup>64,65</sup> and adolescent health, that draws together learning from both fields on participatory, non-judgemental care and promotes autonomy. Critically, incorporating adolescent-friendly methods into maternal health care implies responding to the voices of pregnant girls in programming and recognising them as valuable partners, reinforcing principles of respectful maternity care. Collaboration will also ensure developmentally appropriate considerations are made when working towards positive maternity experiences for adolescents within general maternal care.<sup>65</sup>

A fundamental aspect of adolescent health care is recognising adolescents as potential sources of innovation.<sup>66</sup> This has been untapped in pregnant adolescents and may lead to more creative and responsive maternal health approaches in general. The two conditional cash transfer programmes reviewed for example, had greater impact among adolescents than adults,<sup>38,41</sup> with pregnant adolescents appearing more amenable to behaviour change than women.

## **Advancing adolescent focussed maternal health care**

Developing more adolescent inclusive maternal health services is alone unlikely to respond adequately to the many gaps we identified in high-quality care for pregnant adolescents. For example, positive communication with pregnant adolescents might entail recognising their specific need for peer support groups, and their decreased preference for didactic educational methods compared to adults.<sup>61</sup> Many pregnant adolescents often lack autonomy<sup>67</sup> and may be heavily influenced by other family members.<sup>3</sup> Unlike adults, interventions may need to include the adolescent's family, such as her mother or mother-in-law.<sup>47</sup> Well-facilitated group meetings<sup>34,44</sup> and home visits by adolescent-friendly staff<sup>45,48</sup> may be beneficial as complementary platforms for care. More research is required, but this needs to be context-specific to determine who is best placed to provide supportive adolescent maternity care without draining already limited resources. Questions also remain around how to optimise responsive clinical care and communication with pregnant adolescents that is cognisant of their developmental needs as adolescents, as well as the additional needs related to motherhood, including newborn care responsibilities and engagement with fathers.

## **Recognising the complexity of health programming for pregnant adolescents**

Pregnant adolescents are difficult to identify, reach and engage. Many are out of school and isolated, lose the support of peer groups and school-based health interventions, and face social stigma, particularly if unmarried.<sup>8</sup> Notwithstanding the importance of quality care for pregnant adolescents, their wider needs, like other marginalised groups, cannot be addressed only through short-term, vertical interventions, but require attention to barriers rooted in underlying social and economic determinants of health. This will require more investment in diverse, locally-led and long-term responsive programming, with recognition of its complexities by all stakeholders.

## **Limitations and Caveats**

Our review, although comprehensive across multiple health outcomes and databases, has limitations. Interventions could have been missed, as not all articles were independently screened by two reviewers. However, no potential intervention was missed from the 5,464 articles reviewed by two people in the first step of screening. Our focus was to determine the state of evidence, but a high-quality study does not necessarily equate to a high-quality intervention. Several good, but poorly evaluated interventions were relegated to the appendix. The qualitative synthesis method used, although suited for mapping evidence, has the known limitation of relying on a degree of judgement which impacts transparency.<sup>33</sup> Although the Lancet Commission's health-system framework<sup>16</sup> was the most comprehensive we found, it does not explicitly incorporate gender and developmental perspectives, which are important determinants of how health service systems are structured and resourced for pregnant adolescents. Additionally, although connecting foundations and processes of care with outcomes is implicit in the framework (figure 1), the evidence we found was so sparse that we were unable to make inferences on key pathways. This will need to be done as evidence strengthens. Finally, our attempt to synthesise interventions across all LMIC belies the diversity of both adolescent pregnancy experiences and LMIC. We hope that as literature expands in this area, studies and reviews will address context-specific needs and influences, such as early marriage.

## **Conclusion**

There is currently insufficient evidence to inform quality policy and programmes for the estimated 21 million girls<sup>68</sup> who become pregnant each year in LMIC. A lack of evidence-based action denies the potential development of these girls and their children, with generational impacts.<sup>69</sup> Yet there are immediate steps to be taken to address at least some of these gaps. Adolescence should be a period of immense growth and possibility. Treating pregnant adolescents as adults denies them the recognition and subsequent responsive programming that is afforded to their fellow agemates. We advocate that the same vocal concern, commitment and effort that has driven global pregnancy prevention programmes be applied to pregnant girls, rectifying their longstanding policy and programmatic neglect.

4214 words

## **Panel: Methods**

### **Search strategy and selection criteria**

We undertook a mixed methods systematic review following PRISMA guidelines. We chose a mixed methods review to ensure we covered all forms of evidence on interventions. The search strategy (appendix pp1–3) was created with help from a librarian, refined after a pilot search and tailored for each database. We searched 16 databases for publications issued between 1 January 2000 and 30 May 2020. We included search terms for young adults, as adolescents were often referred to as young women. No language restriction was applied. We searched reference lists of relevant systematic reviews, as well as grey literature published by relevant UN bodies, international NGOs, and aid agencies. We contacted relevant experts and organisations for further references. We included interventions offered during pregnancy, delivery or the postnatal period up to 42 days post-delivery, including abortion, as well as neonatal care that assessed any health-related outcome among adolescent girls and their neonates residing in LMIC (as defined by the World Bank at the time of the study).<sup>70</sup>

Pregnant adolescents were defined as girls aged 10 to 19 years inclusive, at any period of gestation. We included all studies that evaluated interventions, with some restrictions. Quantitative studies required at least a before and after comparison or a comparator group; descriptive accounts were excluded. Studies were also included if a majority of participants (>50%) were adolescents. We excluded interventions that only focused on pregnancy prevention, including preventing a second pregnancy.

We screened articles in three stages to capture studies evaluating general maternal and neonatal interventions that performed sub-analysis of data for adolescents and designed data extraction sheets for quantitative and qualitative studies (appendix p 4, pp 7–12). We assessed risk of bias (ROB) using the ROB-2 tool for randomised controlled trials,<sup>71</sup> ROBINS-I for non-randomised interventional studies,<sup>72</sup> AMSTAR-2 for the meta-analysis<sup>73</sup> and the CASP checklist for qualitative studies.<sup>74</sup>

We did not exclude studies with a high ROB, but synthesised findings from studies with low to medium risk and described other studies in the appendix. Whilst screening abstracts, we also tagged relevant observational studies describing barriers to care for pregnant adolescents to aid our interpretation of

findings. The study protocol is available online at PROSPERO:  
([https://www.crd.york.ac.uk/prospERO/display\\_record.php?ID=CRD42018099754](https://www.crd.york.ac.uk/prospERO/display_record.php?ID=CRD42018099754)).

### **Synthesis of evidence**

Once studies had been identified according to the systematic review criteria, we drew on a convergent approach to synthesise the qualitative and quantitative evidence together.<sup>32</sup> This entailed transforming all quantitative data into categories and themes (appendix pp 29-31). Given our aim was to provide an update on the state of evidence, as opposed to generate hypotheses or guidelines, we adopted the qualitative synthesis method of textual narrative synthesis. This method is used to describe the scope and diversity of existing research and the strength of evidence.<sup>33</sup> It requires three steps. Firstly, studies are grouped according to sub-groups, which were the sub-components in our adapted framework for high-quality health care for pregnant adolescents. We adopted an inclusive approach, adding the study if it any way addressed the sub-component. Thus, many studies fell across more than one sub-component. We ran a check on how these studies were grouped (appendix pp 32-35). Second, commentaries were produced summarising the studies' relation to the sub-group. Thirdly, if data permitted, we produced sub-group synthesis and conclusions. It is accepted that where there is heterogeneity and lack of data, conclusions cannot always be drawn.

### **Contributors**

FS, GP and AP conceptualised the study and devised the protocol. FS developed the search strategy and did the literature search. FS, SR and HQ screened titles and abstracts. FS and AP screened full texts, with GP and JC providing additional statistical interpretation if needed. FS, SR and MNC extracted data. FS and AP assessed risk of bias. FS and GP adapted the high-quality health system framework for pregnant adolescents. FS analysed and mapped the data. FS, GP and AP interpreted the mapping. FS wrote the first draft of the manuscript, with GP, AP, JC and SS providing inputs on subsequent drafts. All authors reviewed and approved the final manuscript.

### **Declaration of interests**

All authors declare they have no competing interests. FS was supported by an NHMRC Postgraduate Scholarship (GNT 1150879) and Clifford Family Scholarship. GP, SS and FS are researchers in the NHMRC-funded Centre of Research Excellence in Driving Global Investment in Adolescent Health (GNT 1171981). GP was supported by an NHMRC Investigator Grant (GNT 1196999). No authors were precluded from accessing data in the study. The corresponding author had full access to all the data in the study and final responsibility for the decision to submit for publication. The views expressed in this Health Policy paper are those of the authors alone and do not represent the policies or views of the affiliated institutions.

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