# The development of adolescent agency and implications for reproductive choice among girls in Zambia

Katharine J. McCarthy [a,b,*], Katarzyna Wyka [b], Diana Romero [b], Karen Austrian [c], Heidi E. Jones [b]

[a] *Icahn School of Medicine at Mount Sinai, Department of Population Health Science, New York, NY, USA*
[b] *City University of New York (CUNY) School of Public Health and Health Policy, New York, NY, USA*
[c] *Population Council, Nairobi, Kenya*

## ARTICLE INFO

## ABSTRACT

*Background:* A substantial proportion of adolescent girls in Zambia lack the ability to decide their reproductive future. We examined the role of agency in early and unwanted adolescent childbearing.
*Methods:* Using latent transition analysis, we characterized a multi-dimensional profile of adolescent agency annually over a four-year period. We investigated the influence of early life access to resources and time-varying predictors (school retention, violence, early marriage and unwanted/mistimed pregnancy and childbearing) on agency profile membership as well as transitions in agency status over time.
*Results:* Four agency profiles were identified, with differences by age cohort (10–14 years vs. 15–19 years). Three profiles identified in both age cohorts were: *Low-moderate agency*, *Self-assured gender conformers*, and *High agency*. Unique to younger girls was the *Gender conscious, low belief in abilities* status, while among older girls was the *Self-assured selective gender conscious* status. While younger girls were likely to transition to the highest agency status over time, high agency membership declined among older girls. Early life resources were associated with augmented agency while exposure to negative events, particularly early marriage, were associated with detraction from high agency status. Girls who expressed high self-efficacy but gender-conforming values were most at risk of early marriage and unwanted/mistimed pregnancy while *High agency* girls were at comparatively low risk.
*Conclusions:* Results show agency is dynamic but less mutable with increasing age. Early adolescent strategies which address inequitable gender norms and limit early marriage, may guard against losses to agency which contribute to unwanted fertility outcomes.

## 1. Introduction

The agency to decide one's reproductive future is paramount, yet an estimated 80% of pregnancies to unmarried adolescents ages 15–19 in Zambia surveyed in the 2013–14 Demographic Health Survey were unwanted or mistimed - a rate nearly identical to that measured almost a decade prior (Central Statistical Office (CSO) Zambia, University of Zambia, & Macro International, 2009; 2015). Among Zambian girls, early childbearing increases rapidly with age, from six percent at age 15–53% among adolescents age 19 (Central Statistical Office (CSO) Zambia, University of Zambia, & Macro International, 2009). Contraceptive use, in contrast, remains low: only 18% of sexually active

unmarried 15–19 year old girls and 36% of married girls report currently using a modern contraceptive method (Central Statistical Office (CSO) Zambia et al., 2009).

Unwanted pregnancy and early childbearing pose health concerns as complications from pregnancy and childbearing remain a leading cause of death among girls aged 15–19 globally (Mokdad et al., 2016; Patton et al., 2009). Maternal mortality is high in Zambia, with an estimated 247 maternal deaths per 100,000 live births in 2015 (Kassebaum et al., 2016). Adolescents are at particular risk: analysis of the 2010 Population and Housing Census found that the pregnancy-related mortality ratio among girls aged 15–19 years was 80% higher than among those aged 20–24 (Banda, Fylkesnes, & Sandøy, 2015). Further, while abortion is

\* Corresponding author. Blavatnik Women's Health Research Institute, Icahn School of Medicine at Mount Sinai, 1770 Madison Avenue, Floor 2, New York, NY, 10035, Kenya.
*E-mail address:* Katharine.mccarthy@mountsinai.org (K.J. McCarthy).

legal in Zambia, high morbidity and mortality attributable to unsafe abortion services due to restrictive law elements, limited access and stigmatized use of safe services have significant implications for unwanted pregnancy (Banda, 2015; Haaland et al., 2019; Owolabi, Cresswell, Vwalika, Osrin, & Filippi, 2017).

A critical resource in achieving desired reproductive outcomes is agency – the ability to set goals aligned with values, perceive oneself as able to act on the goal, and then act towards achieving the goal (Donald, Koolwal, Annan, Falb, & Goldstein, 2017; Kabeer, 1999; Kishor & Subaiya, 2008). The role of agency in reproductive choice draws on a substantial literature including feminist empowerment theory, developmental economics and social cognitive theory (Alkire, 2008; Bandura, 2001, 2005; Donald et al., 2017; ICRW and Measure Evaluation, 2018). Three common features of agency across disciplines were summarized in a 2017 multidimensional framework as: (1) motivational autonomy, or the ability of individuals to conceptualize goals, free from coercion or social pressures, and plan to pursue them, (2) confidence in one's ability to achieve goals, and (3) the power to act towards one's own goals (either directly or indirectly through others) (Donald et al., 2017). Cross-sectional data suggest that women and girls who report high levels of agency (e.g., gender equitable attitudes, freedom of movement or household decision-making) have higher contraceptive use (Al Riyami, Afifi, & Mabry, 2004; Do & Kurimoto, 2012; Govindasamy & Malhotra, 1996; James-Hawkins, Peters, VanderEnde, Bardin, & Yount, 2016), longer birth intervals (Upadhyay et al., 2014; Upadhyay & Karasek, 2012), and fewer births (Upadhyay et al., 2014), even after controlling for potential confounders such as partner characteristics.

Complicating understanding of the role of agency in attaining desired sexual and reproductive health outcomes, however, is limitations in its measurement (Ibrahim & Alkire, 2007). Despite acknowledgment as multidimensional, previous quantitative studies have typically measured agency through single dimensions such as decision-making autonomy or freedom of movement only (Do & Kurimoto, 2012; James-Hawkins et al., 2016; Upadhyay et al., 2014; Upadhyay & Karasek, 2012). For some types of measures (e.g., intentionality/goal setting), validation studies have predominantly taken place in high income countries or have not specifically examined adolescents (Donald et al., 2017). Studies examining the association between agency and reproductive outcomes have largely not disaggregated findings by adolescent age group (Do & Kurimoto, 2012; James-Hawkins et al., 2016; Upadhyay et al., 2014; Upadhyay & Karasek, 2012). Therefore, it remains unclear whether current conceptualizations of agency are empirically supported among adolescents or whether distinct combinations of agency attributes exist or have relevance for reproductive health programming.

Further, evidence suggests agency is dynamic, rather than static, during adolescence (Revollo, José, & Portela, 2019), yet little prospective evidence of the relationship between agency and reproductive health outcomes among adolescence exists. During adolescence expansions in agency may occur through cognitive development (Choudhury, Blakemore, & Charman, 2006; Nelson et al., 2019) as well opportunities in higher education and employment associated with emerging adulthood (Sawyer et al., 2012), however for some the onset of puberty and corresponding reproductive maturation may signal the loss of agency needed to ensure reproductive choice. Such constraints stem, in part, from the intensification of harmful gender norms and changes in social roles triggered by the onset of puberty contributing to widening female disadvantage in educational attainment (Psaki, McCarthy, & Mensch, 2018), sexual violence and child marriage (Central Statistical Office (CSO) Zambia et al., 2009). For example, 5% of girls reported ever experiencing sexual violence before age 18 while 31% of girls were married before age 18 (Central Statistical Office (CSO) Zambia et al., 2009). Such exposures are associated with diminished social networks and educational opportunities girls need to gain skills and knowledge to delay desired pregnancy (Hallman, Kenworthy, Diers, Swan, & Devnarain, 2015), with negative implications for agency. These data suggest

that, for some, agency may decline rather than expand with adolescence, potentially placing adolescents at risk of loss of reproductive autonomy. Despite this, no known study has described changes in a multidimensional profile of agency over the course of adolescence, precluding the ability to understand temporality and the degree to which loss of agency may precipitate an unwanted/mistimed reproductive event. As levels of adolescent pregnancy and childbearing have remained relatively stagnant over the past decade, a more complete understanding of agency and the mechanisms that lead to unwanted/mistimed adolescent pregnancy is needed to inform and tailor programs.

To address these gaps, we implemented secondary analysis of longitudinal data to characterize a multidimensional profile of agency over the course of adolescence and to explore the directionality of relationship between agency and early/unwanted reproductive health events among adolescent girls in Zambia. Data are drawn from the Adolescent Girls Empowerment Program (AGEP), a cluster randomized trial between 2013 and 2017. Guided by a multidimensional conceptual framework of agency (Donald et al., 2017), we assessed the extent to which unique agency profiles comprised of the three critical dimensions are represented among adolescent girls in Zambia over time. We also investigated the influence of an individual's access to resources on the likelihood of their baseline agency status membership as well as how significant life events (school attendance, marriage, transitioning to sexual activity, exposure to violence, pregnancy and childbearing) alters agency group membership over time.

## 2. Methods

### 2.1. Study sample and design

AGEP was a multi–sectoral asset-building program for adolescent girls aged 10–19 that assessed the theory that access to social, health and economic assets would reduce vulnerabilities that lead to unwanted/ mistimed pregnancy, as well as other negative life experiences such as gender-based violence, sexually transmitted infection (STI)/HIV acquisition, and child marriage (marriage < age 18). The study used a cluster randomized controlled trial design to assess immediate and long-term effects on reproductive and sexual health outcomes, as described elsewhere (Hewett et al., 2017). In brief, AGEP was implemented in five rural and five urban sites in four Zambian provinces: Central, Copperbelt, Lusaka and North-Western. The intervention arms were: 1) weekly mentor-led girls' groups only which included short trainings on topics such as health, finances and life skills; 2) girls' groups plus health voucher (coupons redeemable for basic wellness exams and sexual and reproductive health services at public and private providers); 3) girls' groups, health vouchers and girl friendly savings accounts (no fee and which required very low minimum balance) and 4) no intervention (control arm). The AGEP intervention lasted two years in each site. Data were collected annually over the four-year time period (time 1-time 4). Because the intervention did not significantly influence gender equitable views, self-efficacy, experiences of violence, child marriage, or sexual and reproductive health outcomes at intervention end (Austrian, Soler-Hampejsek, Hewett, Jackson-Hachonda, & Behrman, 2018), we analyzed the data as a longitudinal cohort study and controlled for intervention arm in analyses.

The AGEP program targeted a selective sample of girls characterized by high vulnerability. A vulnerability index was created by predicting being behind in school by marital status, childbearing, and school enrollment using ordinary least squares regression (Hewett et al., 2017). The estimated residual from this regression, was ordered from most to least vulnerable and used to select 1,200 to 1,400 of the most vulnerable girls per site who were unmarried and between the ages of 10–19 years for participation (Hewett et al., 2017). Sampled girls represented 38% and 85% of the most vulnerable girls in urban and rural areas, respectively (Hewett et al., 2017). At time 1 (baseline) 5,235 girls (N = 2,701 ages 10–14; N=2,534 ages 15–19) were interviewed (88% of sampled

girls). By time 4, 83% (N=4,363) of girls interviewed at baseline remained in the study.

## 2.2. Measures

The current study was secondary analysis of the AGEP study with no *a priori* measures of agency. We identified survey questions which corresponded to the three domains of agency: motivational autonomy, perceived sense of control and ability, and participation in decision-making processes to achieve goals. The following criteria were used to identify a parsimonious list of agency indicators: conceptual relevance, variation in response (neither near universal endorsement nor disagreement), percentage of missing data, and the degree of correlation vs. uniqueness of each indicator, as assessed by pairwise correlation and factor loadings following exploratory factor analysis.

### 2.2.1. Agency indicators

Seven categorical indicators of agency were identified. The *motivational autonomy dimension* was represented by three indicators of respondent views on gender norms. Gender views were used as a proxy for motivational autonomy under a Western/feminist assumption that greater rejection of traditional gender norms represented lower internalized social pressure to act in accordance with gender norms and higher autonomous decision-making. To reflect the degree of *perceived control and ability to act* in pursuit of one's goals, respondent agreement with three self-efficacy indicators was used. Finally, a proxy measure for *the power to participate in decision-making* relevant to enacting one's goals was represented by one item which asked respondents to choose between two statements: "*What happens to me is my own doing*" vs. "*Sometimes I feel that I don't have enough control over the direction my life is taking.*" All responses were dichotomized so that '1' indicated higher agency (i.e., greater motivational autonomy, self-efficacy or perceived control) and '0' indicated lower agency.

### 2.2.2. Predictors of baseline agency status membership

Indicators of respondent resources and support were explored as predictors of baseline agency profile membership and included: urban versus rural residence, current school attendance, number of grades of schooling completed, number of friends (ranging from zero to ten or more), parental co-residence and household wealth quintile. Household wealth quintile was constructed using principal components analysis of a list of 18 household assets (e.g., electricity, toilet, television) (Filmer & Pritchett, 1999).

### 2.2.3. Predictors of transitions between agency profiles

We explored time-varying predictors hypothesized to affect transitions between agency profiles over time. At each of the four time points, respondents were asked whether they attended school during the current year and the highest grade completed. Questions regarding marital status, sexual behavior, reproductive outcomes and violence were asked to respondents aged 15 and older. These included whether the respondent had ever or in the past 12 months been: married or living together as married (by design all respondents were unmarried at baseline), experienced sexual violence (been forced by anyone to have sexual intercourse or to perform any other sexual acts) or been pregnant or given birth. Ever pregnant girls were asked whether at the time they became pregnant, they wanted to become pregnant, wanted to wait until later or did not want to have any (more) children, which was used to construct an indicator of unwanted/mistimed pregnancy.

### 2.2.4. Outcomes of agency profile membership

To inform the direction of influence, unwanted/mistimed pregnancy and birth were also explored as outcomes of agency profile status. We examined differences in the observed proportion of girls who avoided all early or unwanted reproductive health outcomes until study endline (time 4) by observed agency profile membership at the time prior. We also report differences by age, marital status, and transition to sexual activity to provide insight into the sequence of events that leads to pregnancy and birth.

## 2.3. Analysis

Latent transition analysis (LTA) was used to identify distinct profiles of adolescent agency and patterns of change over time (Lanza & Bray, 2013). LTA is a type of finite mixture modeling that identifies otherwise unobserved groupings of individuals based on their response profile to a set of discrete empirical observations (Lanza & Bray, 2013). First, the best-fitting model was identified by imposing 2–6 latent statuses across the four time points (Table A1). Competing model fit was assessed using the $G^2$ statistic, information criteria (AIC, BIC, CAIC and a-BIC), entropy $R^2$, solution stability, as well as the replicability of the optimal solution across time. Model fit was weighed against model interpretability, the uniqueness of latent classes, and latent class size (prevalence >3–5%) (Collins & Lanza, 2016; Lanza, Patrick, & Maggs, 2010).

Second, measurement invariance over time was assessed. While the $G^2$ statistic suggested varying item response probabilities over time ($\Delta G^2$=698, $\Delta df$=84, p<0.001), the BIC (Table A2) and graphical inspection of item response probabilities showed consistent interpretation of agency profiles over time, despite minor fluctuations. Hence, measurement invariance over time was imposed. The final four LTA-based agency profiles were validated by a series of cross-sectional latent class analysis (LCA) models at each time point to confirm model identification.

Third, to align findings with age segregation typically used in adolescent programming (Sawyer et al., 2012) and because questions related to violence, pregnancy and childbearing were only asked to girls aged 15 and older, we explored whether the latent structure of agency identified differed among younger (ages 10–14) and older (ages 15–19) adolescents. A two-group model (Table A2) suggested that item response probabilities (i.e., agency profiles) varied by age cohort, hence the analyses were age cohort-specific.

Fourth, to identify factors predictive of agency group membership at time 1, as well as changes to agency over time, time-stable and time-varying predictors were individually incorporated into the two-group four profile LTA model using logistic regression (Lanza et al., 2014). The odds of profile membership (high agency relative to all other lower agencies) or transition between agency profiles over time were assessed using the likelihood ratio $\chi^2$ test. Time-varying analysis was performed among girls aged 15–19 as younger girls were not asked questions related to violence, pregnancy, and childbearing. The substantial increase in time-varying predictors of interest over the study period (Table 1) suggests the length of observation (four annual time points) was adequate to capture meaningful change in agency over time. All models controlled for AGEP intervention arm as well as baseline levels of each covariate.

Finally, to provide insight into the directionality of the relationship between agency and reproductive health outcomes, the proportion of girls aged 15–19 at time 1 who never experienced an early or unwanted/mistimed reproductive health event at end of study observation (time 4) was examined by agency status membership at the time prior.

To assess the potential effects of bias due to differential attrition and AGEP intervention participation, sensitivity analyses included complete cases analysis (i.e., among girls followed until time 4), and control-group only analysis. Results of these sensitivity analyses suggested results were largely consistent (see Appendix).

## 3. Results

### 3.1. Participant characteristics

The baseline sample consisted of 5,235 vulnerable unmarried adolescent girls ages 10–19. Mean age was 14.3 (SD 2.7) years at

**Table 1**

Descriptive statistics for adolescent girls aged 10–19 at baseline in Zambia (AGEP study, N=5235), by study round.

| | Time 1 | | Time 2 | | Time 3 | | Time 4 | |
|---|---|---|---|---|---|---|---|---|
| | N=5,235 | | N=4,693 | | N=4,633 | | N=4,363 | |
| | % | N | % | N | % | N | % | N |
| **Age (Mean, SD)** | 14.3 (2.7) | 5,235 | 15.2 (2.7) | 4,693 | 16.2 (2.7) | 4,633 | 17.2 (2.7) | 4,363 |
| **Urban rural** | | | | | | | | |
| Urban | 56.6 | 2961 | 56.8 | 2666 | 57.3 | 2655 | 57.4 | 2505 |
| Rural | 43.4 | 2273 | 43.2 | 2025 | 42.7 | 1976 | 42.6 | 1856 |
| Total | 100.0 | 5234 | 100.0 | 4691 | 100.0 | 4631 | 100.0 | 4361 |
| **Tribe** | | | | | | | | |
| Bemba | 35.6 | 1863 | NA | | NA | | NA | |
| Nyanja | 15.2 | 798 | | | | | | |
| Kaonde | 7.1 | 372 | | | | | | |
| Tonga | 8.7 | 456 | | | | | | |
| Other | 30.7 | 1606 | | | | | | |
| Multiple | 2.7 | 140 | | | | | | |
| Total | 100.0 | 5235 | | | | | | |
| **Mother is alive** | | | | | | | | |
| No | 12.7 | 667 | 16.0 | 746 | 17.7 | 818 | 18.3 | 800 |
| Yes | 87.3 | 4568 | 84.0 | 3919 | 82.3 | 3815 | 81.7 | 3563 |
| Total | 100.0 | 5235 | 100.0 | 4665 | 100.0 | 4633 | 100.0 | 4363 |
| Missing | | | 0.6 | 28 | | 0 | | 0 |
| **Father is alive** | | | | | | | | |
| No | 24.4 | 1278 | 28.9 | 1327 | 32.5 | 1505 | 4.8 | 1485 |
| Yes | 75.6 | 3957 | 71.1 | 3270 | 67.5 | 3128 | 95.2 | 2850 |
| Total | 100.0 | 5235 | 100.0 | 4597 | 100.0 | 4633 | 100.0 | 4335 |
| Missing | | 0 | 2.0 | 96 | | 0 | 0.6 | 28 |
| **Co-resides with biological mother** | | | | | | | | |
| No | 35.4 | 1853 | NA | | NA | | NA | |
| Yes | 64.6 | 3379 | | | | | | |
| Total | 100.0 | 5232 | | | | | | |
| Missing | | 3 | | | | | | |
| **Co-resides with biological father** | | | | | | | | |
| No | 53.8 | 2815 | NA | | NA | | NA | |
| Yes | 48.2 | 2420 | | | | | | |
| Total | 100.0 | 5235 | | | | | | |
| Missing | | 0 | | | | | | |
| **Number of friends (Mean, SD)** | 3.71 (2.61) | | 3.80 (2.49) | | 3.39 (2.38) | | 3.59 (2.46) | |
| Total | | 5213 | | 4692 | | 4632 | | 4363 |
| Missing | 0.4 | 22 | 0.0 | 1 | 0 | 1 | 0.0 | 0 |
| **Ever married/lived together as if married** | | | | | | | | |
| No | 100.0 | 5232 | 94.5 | 4435 | 88.6 | 4101 | 82.3 | 3589 |
| Yes | 0.0 | 0 | 5.5 | 258 | 11.4 | 530 | 17.7 | 774 |
| Total | 100.0 | 5232 | 100 | 4693 | 100 | 4631 | 100 | 4363 |
| Missing | 0.00 | 0 | 0.00 | 0 | 0.04 | 2 | 0.00 | 0 |
| **Highest level of school attended** | | | | | | | | |
| No school | 2.3 | 120 | 1.6 | 76 | 1.1 | 49 | 0.8 | 37 |
| Primary | 71.0 | 3718 | 62.5 | 2930 | 56.9 | 2638 | 51.4 | 2242 |
| Secondary | 26.6 | 1395 | 35.9 | 1686 | 41.9 | 1940 | 47.7 | 2079 |
| Higher cert/degree | 0.0 | 2 | 0.1 | 1 | 0.1 | 6 | 0.1 | 5 |
| Total | 100.0 | 5235 | 100.0 | 4693 | 100.0 | 4633 | 100.0 | 4363 |
| Missing | | 0 | | 0 | | 0 | | 0 |
| **Currently in school (attended current year)** | | | | | | | | |
| No | 21.0 | 1099 | 29.3 | 1375 | 37.1 | 1719 | 45.7 | 1992 |
| Yes | 79.0 | 4136 | 70.7 | 3318 | 62.9 | 2914 | 54.3 | 2371 |
| Total | 100.0 | 5235 | 100.0 | 4693 | 100.0 | 4633 | 100.0 | 4363 |
| Missing | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| **Household wealth quintile** | | | | | | | | |
| Lowest | 20.0 | 1016 | 20.0 | 905 | 20.2 | 907 | 20.0 | 861 |
| Lower middle | 20.1 | 1023 | 20.2 | 915 | 20.1 | 904 | 20.2 | 871 |
| Middle | 19.9 | 1009 | 19.8 | 893 | 19.8 | 891 | 19.8 | 851 |
| Upper middle | 20.0 | 1016 | 20.0 | 904 | 20.4 | 918 | 20.4 | 878 |
| Highest | 20.0 | 1016 | 20.0 | 904 | 19.6 | 881 | 19.6 | 844 |
| Total | 100.0 | 5080 | 100.0 | 4521 | 100.0 | 4501 | 100.0 | 4305 |
| Missing | 3.0 | 155 | 3.7 | 172 | 2.8 | 132 | 1.3 | 58 |
| **Ever sexual violence[a]** | | | | | | | | |
| No | 79.2 | 1977 | 71.2 | 1944 | 66.5 | 2135 | 62.8 | 2146 |
| Yes | 20.8 | 520 | 28.8 | 785 | 33.5 | 1075 | 37.2 | 1272 |
| Total | 100.0 | 2497 | 100.0 | 2729 | 100.0 | 3210 | 100.0 | 3418 |
| Missing | 0.1 | 37 | 0.4 | 11 | 0.2 | 7 | 0.1 | 2 |
| **Ever unwanted/mistimed pregnancy[a]** | | | | | | | | |
| No | 88.8 | 2215 | 83.3 | 2245 | 77.5 | 2472 | 71.7 | 2445 |
| Yes | 11.2 | 278 | 16.7 | 451 | 22.5 | 719 | 28.3 | 964 |
| Total | 100.0 | 2493 | 100.0 | 2696 | 100.0 | 3191 | 100.0 | 3409 |
| Missing | 1.6 | 41 | 1.6 | 44 | 0.8 | 26 | 0.3 | 11 |

**Table 1** (*continued*)

| | Time 1 | | Time 2 | | Time 3 | | Time 4 | |
|---|---|---|---|---|---|---|---|---|
| | N=5,235 | | N=4,693 | | N=4,633 | | N=4,363 | |
| | % | N | % | N | % | N | % | N |
| **Ever given birth**[a] | | | | | | | | |
| No | 88.9 | 2245 | 82.8 | 2268 | 74.5 | 2396 | 68.1 | 2329 |
| Yes | 11.1 | 281 | 17.2 | 472 | 25.5 | 820 | 31.9 | 1091 |
| Total | 100.0 | 2526 | 100.0 | 2740 | 100.0 | 3216 | 100.0 | 3420 |
| Missing | 0.3 | 8 | 0.0 | 0 | 0.0 | 1 | 0.0 | 0 |

[a] Items asked to girls ages 15–19 and older only.

baseline and 17.2 (SD 2.7) by time 4 (Table 1). Study retention was approximately 90% at times 2 and 3 and 84% at time 4. Girls lost to follow-up by time 4 were less likely to co-reside with their biological mother (OR 0.61 (95% CI 0.52, 0.70)) or father (OR 0.78 (95% CI 0.67, 0.91)), be from the Nyanja tribe (OR 0.74 (95% CI 0.75, 0.95)), and were less likely to have a greater number of friends (OR 0.94 (95% CI 0.91, 0.97)) or be attending school at baseline (OR 0.62 (95% CI 0.52, 0.74)).

### 3.2. Latent transition model of agency by age cohort

Four agency profiles were identified in each age cohort (Table 2). The item-response probabilities suggested the following three interpretative labels common in both cohorts: *Low-moderate agency, Self-assured gender conformers,* and *High agency. Low-moderate agency* members possessed low self-efficacy, held relatively gender inequitable views, and had the lowest perceived influence on the direction their life was taking. Notably, older-aged girls in this profile held relatively more traditional gender beliefs, particularly regarding schooling for girls. *Self-assured gender conformer* members were characterized by high self-efficacy and relatively gender inequitable views. *High agency* members, in contrast, had both high self-efficacy and gender equitable views. Unique to the younger cohort were girls characterized as *Gender conscious, low belief in abilities* – girls characterized by gender equitable beliefs but low perceived self-efficacy. Finally, unique to the older cohort were *Self-assured, selective gender conscious* members. This agency profile was characterized by high self-efficacy but variable gender views. In particular, there was high endorsement of education for girls, but low/moderate endorsement of female control over family finances or decision-making regarding childbearing.

### 3.3. Probabilities of transitioning between adolescent agency profiles, by age cohort

Examination of transition probabilities suggests that agency membership is relatively transient. Among both the younger and older cohorts, membership to *Low-moderate agency* declined between times 1 and 4 (more than 1.6-fold among younger girls and 2.5-fold among older girls). In contrast, in both cohorts, membership to *Self-assured gender conformer* increased with time (by 2.2-fold and 1.4-fold among younger and older girls, respectively). Differential effects were observed among *High agency* members depending on cohort: while *High agency* group membership increased over time among girls in the younger cohort (from 33.9% at time 1–48.0% at time 4), it slightly decreased among girls in the older cohort from 26.5% at time 1–23.0% at time 4 (Table 2).

Most movement between profiles occurred between times 1 and 2, irrespective of age cohort. On average, less than half of girls in the younger cohort remained in the same agency profile between time points. With increasing age, however, girls were more likely to retain their same agency membership over time. For example, among the older cohort, approximately 80% of the *Self-assured, selective gender conscious* and *Self-assured gender conformer* groups retained the same status between times 3 and 4.

Further, among both cohorts, movement from the highest to lowest agency profile was unlikely: less than 10% of *High agency* girls at times 2

and 3 transitioned to *Low-moderate* agency at the subsequent time interval. In contrast, among the younger cohort, a quarter or more of *Low-moderate agency* members moved to *High agency* profile during the same time interval. Among the older cohort, the greatest movement, nearly one-third of girls at each time interval, was between the *High agency* to the *Self-assured, selective gender conscious agency* profile.

### 3.4. Predictors of adolescent agency profile membership at time 1

Several factors indicative of greater access to resources ("protective assets") were identified as significant predictors of time 1 agency profile membership (Table 3). Residing in an urban (vs. rural) area, greater household wealth and higher grade attainment each increased the odds of *High agency* membership between 1.1 and 1.4-fold across age cohorts. Current school attendance was also a positive, although non-significant predictor of *High agency* membership. Neither having either parent alive, parental co-residence nor number of friends significantly increased the likelihood of *High agency* group membership.

### 3.5. Time-varying predictors of adolescent agency profile (girls aged 15–19)

#### 3.5.1. School retention, onset of sexual activity and marriage

Current school attendance and marital status were significant predictors of transitions in agency profile over time among the 15- to 19-year-old cohort, conditional on membership at the time prior (Table 4). Remaining in school was generally associated with increased odds of remaining or transitioning to the *High agency* profile, particularly in later adolescence (Table 5). Between times 1 and 2 *High agency* girls who currently attended school had nearly twice the odds of retaining *High agency* at the subsequent time interval; this effect was amplified to seven-fold between times 3 and 4. Becoming and staying married had a negative influence on the likelihood of *High agency* membership, irrespective of stage of adolescence. Becoming married between times 1 and 2 was associated with very low odds (OR 0.03) of transitioning from *Low-moderate* agency to *High agency* during the same interval.

While not statistically significant, transitioning to sexual activity generally decreased the likelihood of transitioning to *High agency* at each subsequent time interval. *High* agency girls who transitioned to sexual activity earlier in adolescence were less likely to remain *High agency* at the subsequent time interval (time 1–2, OR 0.70; time 2–3, OR 0.38). In contrast, *High agency* girls who transitioned to sexual activity later in adolescence were more likely to remain *High agency* (time 3–4, OR 1.30).

#### 3.5.2. Sexual violence, unwanted/mistimed pregnancy, and childbearing

Childbearing was a significant predictor of transitions in agency profiles among older girls, while neither sexual violence nor unwanted/mistimed pregnancy reached significance (Table 4). Experience with sexual violence in the past 12 months was associated with a substantial, though non-significant, decrease in the likelihood of transitioning from *Low-moderate* to *High agency* throughout adolescence (Table 5). Unwanted/mistimed pregnancy and childbearing had differential effects on agency transitions, depending on agency profile and stage of adolescence (Table 5). In earlier adolescence recent unwanted/mistimed

**Table 2**

Four status latent transition model of adolescent girl's agency by baseline age cohort (AGEP study, Zambia, Time 1–4, N=5235).

| Girls aged 10–14 at baseline | Latent statuses and prevalence | | | |
|---|---|---|---|---|
| | Low-moderate agency | Gender conscious, low belief in abilities | Self-assured gender conformers | High agency |
| Time 1 | 0.230 | 0.285 | 0.146 | 0.339 |
| Time 2 | 0.213 | 0.182 | 0.182 | 0.423 |
| Time 3 | 0.233 | 0.084 | 0.235 | 0.448 |
| Time 4 | 0.138 | 0.058 | 0.324 | 0.480 |
| **Girls aged 15–19 at baseline** | Low-moderate agency | Self-assured, selective gender conscious | Self-assured gender conformer | High agency |
| Time 1 | 0.330 | 0.213 | 0.191 | 0.265 |
| Time 2 | 0.281 | 0.300 | 0.216 | 0.204 |
| Time 3 | 0.150 | 0.350 | 0.257 | 0.243 |
| Time 4 | 0.127 | 0.385 | 0.259 | 0.230 |
| **Agency indicators** | **Item response probabilities (Proportion responding "Yes")** | | | |
| **Girls aged 10–14 at baseline** | Low-moderate agency | Gender conscious, low belief in abilities | Self-assured gender conformers | High agency |
| 1. I can always manage to solve difficult problems if try hard enough | 0.316 | *0.162* | **0.876** | **0.760** |
| 2. If someone against me, I can still find ways to get what I want | 0.383 | *0.170* | **0.855** | **0.763** |
| 3. Because of the help I can get, I know how to manage unexpected situations | 0.552 | 0.295 | **0.743** | 0.680 |
| 4. What happens to me is my own doing vs. Sometimes I feel I don't have enough control over direction my life is taking | 0.386 | 0.488 | 0.451 | 0.475 |
| 5. Fathers in the family should decide on how family money is spent – [Disagree] | 0.279 | 0.698 | 0.281 | 0.693 |
| 6. When a family cannot afford to send all children to school, it is better to send boy -– [Disagree] | 0.601 | **0.911** | 0.543 | **0.909** |
| 7. When a husband and wife disagree about the number of children to have, the husband's opinion matters more – [Disagree] | 0.223 | **0.807** | 0.257 | **0.766** |
| **Girls aged 15–19 at baseline** | Low-moderate agency | Self-assured, selective gender conscious | Self-assured gender conformer | High agency |
| 1. I can always manage to solve difficult problems if try hard enough | 0.308 | **0.870** | **0.800** | **0.848** |
| | 0.273 | **0.870** | **0.822** | **0.889** |

**Table 2** (*continued*)

| Girls aged 10–14 at baseline | Latent statuses and prevalence | | | |
|---|---|---|---|---|
| | Low-moderate agency | Gender conscious, low belief in abilities | Self-assured gender conformers | High agency |
| 2. If someone against me, I can still find ways to get what I want | | | | |
| 3. Because of the help I can get, I know how to manage unexpected situations | 0.477 | **0.762** | **0.775** | **0.794** |
| 4. What happens to me is my own doing vs. Sometimes I feel that I don't have enough control over the direction my life is taking | 0.438 | 0.437 | 0.483 | 0.561 |
| 5. Fathers in the family should decide on how family money is spent – [Disagree] | 0.530 | 0.515 | 0.306 | **0.828** |
| 6. When a family cannot afford to send all children to school, it is better to send boy -– [Disagree] | **0.771** | **0.900** | 0.300 | **0.937** |
| 7. When a husband and wife disagree about the number of children to have, the husband's opinion matters more – [Disagree] | 0.545 | 0.343 | *0.192* | **1.000** |
| | **Transition (tau) probabilities** | | | |
| **Girls aged 10–14 at baseline** | Low-moderate agency | Gender conscious, low belief in abilities | Self-assured gender conformers | High agency |
| **Transitions from time 1 (rows) to time 2 (columns):** | | | | |
| Low-moderate agency | **0.339** | 0.189 | 0.208 | 0.264 |
| Gender conscious, low belief in abilities | 0.130 | **0.285** | 0.185 | 0.401 |
| Self-assured gender conformers | 0.218 | 0.107 | **0.205** | 0.469 |
| High agency | 0.195 | 0.125 | 0.150 | **0.530** |
| **Transitions from time 2 (rows) to time 3 (columns):** | | | | |
| Low-moderate agency | **0.382** | 0.119 | 0.152 | 0.347 |
| Gender conscious, low belief in abilities | 0.377 | **0.209** | 0.087 | 0.327 |
| Self-assured gender conformers | 0.221 | 0.035 | **0.475** | 0.269 |
| High agency | 0.101 | 0.033 | 0.239 | **0.627** |
| **Transitions from time 3 (rows) to time 4 (columns):** | | | | |
| Low-moderate agency | **0.430** | 0.049 | 0.288 | 0.233 |
| Gender conscious, low belief in abilities | 0.215 | **0.324** | 0.147 | 0.314 |

**Table 2** (*continued*)

| Girls aged 10–14 at baseline | Latent statuses and prevalence | | | |
|---|---|---|---|---|
| | Low-moderate agency | Gender conscious, low belief in abilities | Self-assured gender conformers | High agency |
| Self-assured gender conformers | 0.000 | 0.023 | **0.682** | 0.295 |
| High agency | 0.045 | 0.030 | 0.188 | **0.737** |
| **Girls aged 15–19 at baseline** | Low-moderate agency | Self-assured, selective gender conscious | Self-assured gender conformer | High agency |
| **Transitions from time 1 (rows) to time 2 (columns):** | | | | |
| Low-moderate agency | **0.443** | 0.218 | 0.138 | 0.201 |
| Self-assured, selective gender conscious | 0.180 | **0.598** | 0.000 | 0.222 |
| Self-assured gender conformers | 0.175 | 0.116 | **0.634** | 0.075 |
| High agency | 0.235 | 0.294 | 0.185 | **0.286** |
| **Transitions from time 2 (rows) to time 3 (columns):** | | | | |
| Low-moderate agency | **0.465** | 0.205 | 0.175 | 0.155 |
| Self-assured, selective gender conscious | 0.000 | **0.770** | 0.000 | 0.230 |
| Self-assured gender conformers | 0.043 | 0.002 | **0.802** | 0.153 |
| High agency | 0.053 | 0.302 | 0.170 | **0.476** |
| **Transitions from time 3 (rows) to time 4 (columns):** | | | | |
| Low-moderate agency | **0.591** | 0.228 | 0.107 | 0.075 |
| Self-assured, selective gender conscious | 0.000 | **0.787** | 0.000 | 0.213 |
| Self-assured gender conformers | 0.081 | 0.000 | **0.820** | 0.099 |
| High agency | 0.070 | 0.308 | 0.133 | **0.489** |

*Notes*: Bolded text in *rho* parameters indicates item response probabilities highly characteristic of latent class (>0.75), while those in italics represents agency attributes not reflective of the latent class (<0.25).
Bolded items in *tau* parameters reflect likelihood of remaining in the same latent status between $T_i$ and $T_{i+1}$.

pregnancy reduced the odds of transitioning from all lower agency profiles to *High agency* membership. Among *Low-moderate* agency girls at time 1, for example, unwanted/mistimed pregnancy in the last 12 months reduced the odds of *High* agency membership at time 2 (OR, 0.78). Recent childbearing, on the other hand, increased the odds of transitioning from *Low-moderate* to *High agency* membership across adolescence (times 1–2, OR 1.27, times 3–4, OR 11.55). A somewhat reverse trend was observed among *High agency* members, where recent childbearing reduced the odds of remaining *High agency* at each time interval (times 1–2, OR 0.60; times 3–4, OR 0.65).

### 3.5.3. Agency profile as a predictor of early or unwanted sexual and reproductive health events

Table 6 displays the proportion of girls who remained unmarried or never experienced unwanted/mistimed pregnancy or birth by end of observation by agency profile membership at the time prior. Across outcomes, *High agency* members were most likely to report remaining unmarried or never experiencing unwanted/mistimed pregnancy or birth by endline. In contrast, *Self-assured gender conformers* were most

**Table 3**
Protective assets as predictors of membership in Time 1 latent statuses of adolescent agency by age cohort in a four profile latent transition model conditional on age cohort (AGEP study, Zambia).

| | High agency vs. all lower statuses combined (N=5235) | | | |
|---|---|---|---|---|
| | Odds Ratio: girls ages 10–14 at baseline | Odds Ratio: girls ages 15–19 at baseline | Likelihood Ratio Test Statistic[a] | P-value |
| Urban vs rural residence | 1.41 | 1.08 | 8.3 | 0.016 |
| Mother alive | 1.20 | 1.10 | 1.1 | 0.570 |
| Father alive | 0.88 | 0.83 | 2.9 | 0.240 |
| Co-resides with mother | 1.20 | 0.98 | 2.0 | 0.366 |
| Co-resides with father | 1.01 | 0.88 | 1.0 | 0.607 |
| Household wealth quintile | 1.09 | 1.15 | 14.3 | 0.001 |
| Grade attainment (0–12) | 1.38 | 1.34 | 134.3 | <0.001 |
| Current school attendance | 1.16 | 1.20 | 2.5 | 0.288 |
| Number of friends (0–10+) | 1.01 | 0.99 | 0.4 | 0.816 |

[a] Hypothesis tests for predictors of time 1 (baseline) agency status membership performed using likelihood ratio test with 2 degrees of freedom for all tests following a X distribution.

**Table 4**
Hypothesis tests for time-varying predictors of transitions between four latent statuses of adolescent agency among cohort of girls aged 15–19 at baseline using binary logistic regression (AGEP study, Zambia, Rounds 1–4)[a].

| | Girls aged 15–19 at baseline (N=2534) | | | |
|---|---|---|---|---|
| | N | Delta Likelihood Ratio Statistic[b] | df | p-value |
| Current school attendance | 1926 | 53.4 | 12 | <0.001 |
| Transition to sexual activity within past 12 months | 1924 | 18.1 | 12 | 0.113 |
| Ever married | 1925 | 49.1 | 12 | <0.001 |
| Sexual violence past 12 months | 1883 | 12.5 | 12 | 0.406 |
| Unwanted/mistimed pregnancy, past 12 months | 1854 | 11.1 | 12 | 0.520 |
| Birth in past 12 months | 1926 | 24.7 | 12 | 0.016 |
| Ever birth | 1926 | 30.4 | 12 | 0.002 |

[a] Model also adjust for time-stable predictors of baseline agency status: program study arm assignment, age at baseline, and baseline exposure of each predictor.
[b] Difference in likelihood ratio statistic for models with and without the covariate of interest.

likely to be married, have transitioned to sexual activity, and were most at risk of early or unwanted/mistimed pregnancy and birth, relative to all other profiles.

## 4. Discussion

This study characterized longitudinal patterns in the development of agency over the course of adolescence in Zambia to provide insight into pathways that lead to early and unwanted adolescent pregnancy. Findings suggest that agency is multidimensional, age and context-dependent, potentially influenced by both adolescents' early life access to resources, as well as time-varying predictors – particularly early marriage. Results support a generally negative, bi-directional relationship between high agency status and experiences of early or unwanted reproductive health events. While exploratory, results also suggest that

**Table 5**

Odds ratios reflecting the effects of school retention, onset of sexual activity and marriage on transitions in agency status among adolescent girls aged 15 to 19 at baseline in Zambia (AGEP study, times 1–4).

| | Latent statuses among all girls aged 15–19 at baseline (Times 1–4) | | | |
|---|---|---|---|---|
| | **Low-moderate agency** | **Self-assured gender conformers** | **Self-assured, selective gender conscious** | **High agency** |
| *Covariates [a]* | *Odds Ratio for transition from reference status at time 1 to high agency status at time 2* | | | |
| Current school attendance | 1.90 | 8.18 | 0.15 | 1.87 |
| Transition to sexual activity past 12 months | 1.12 | 0.05 | 1.01 | 0.70 |
| Ever married | 0.03 | 0.08 | 1.19 | 0.91 |
| Sexual violence past 12 months | 0.49 | 1.86 | 0.33 | 0.80 |
| Unwanted/ mistimed pregnancy past 12 months | 0.78 | 0.12 | 0.50 | 1.39 |
| Birth past 12 months | 1.27 | 0.06 | 0.23 | 0.60 |
| Ever given birth | 1.29 | 0.44 | 0.75 | 0.69 |
| **Time 2 to 3** | *Odds Ratio for transition from reference status at time 2 to high agency status at time 3* | | | |
| Current school attendance | 1.63 | 1.48 | 0.29 | 3.65 |
| Transition to sexual activity past 12 months | 1.14 | 0.25 | 0.32 | 0.38 |
| Ever married | 0.32 | 0.21 | 0.69 | 0.42 |
| Sexual violence past 12 months | 0.66 | 1.33 | 0.24 | 0.66 |
| Unwanted/ mistimed pregnancy past 12 months | 0.35 | 0.25 | 0.93 | 0.65 |
| Birth past 12 months | 1.25 | 0.04 | 1.12 | 0.86 |
| Ever given birth | 0.77 | 0.18 | 1.36 | 0.49 |
| **Time 3 to 4** | *Transition from reference status at time 3 to high agency status at time 4* | | | |
| Current school attendance | 1.82 | 1.49 | 0.12 | 7.21 |
| Transition to sexual activity within past 12 months | 0.59 | 0.18 | 0.52 | 1.30 |
| Ever married | 0.58 | 0.61 | 0.64 | 0.52 |
| Sexual violence within past 12 months | 0.33 | 1.99 | 0.47 | 0.42 |
| Unwanted/ mistimed pregnancy past 12 months | 0.55 | 7.55 | 1.02 | 0.86 |
| Birth within past 12 months | 11.55 | 0.57 | 0.09 | 0.65 |
| Ever given birth | 0.91 | 2.67 | 0.50 | 0.42 |

*Note:* time points are annual.

[a] All models also control for baseline study arm assignment, and covariate at time 1 – apart from marriage (all girls unmarried at time 1). Current school attendance controls for highest level of education at baseline.

*High agency* status was protective against early and unwanted reproductive health events during adolescence while profiles characterized by high self-efficacy yet adherence to traditional gender values were most at risk.

Several trends in the developmental course of agency during

**Table 6**

Proportion of girls aged 15–19 at baseline who never experienced marriage or an early/unwanted sexual and reproductive health event at end of observation by agency status membership at time prior (AGEP study, Zambia).

| | Agency status at time 3 among all girls aged 15–19 at baseline (N=2,534) | | | | |
|---|---|---|---|---|---|
| Marriage and SRH outcomes by time 4 | Low-moderate agency | Self-assured gender conformer | Self-assured, selective gender conscious | High agency | |
| | % | % | % | % | N[a] |
| Mean age | 18.3 | 18.6 | 18.5 | 18.6 | 2534 |
| Never had sex | 19.7 | 10.6 | 21.0 | 22.3 | 385 |
| Never married | 66.2 | 54.8 | 74.6 | 77.2 | 1437 |
| Never unwanted/ mistimed pregnancy | 66.1 | 51.6 | 62.5 | 66.2 | 1271 |
| Never birth | 57.9 | 39.6 | 60.4 | 62.5 | 1151 |

[a] Sample size for responses of "No" for selected outcomes.

adolescence are apparent. First, the structure and prevalence of identified profiles varied among younger (ages 10–14 at baseline) and older (ages 15–19 at baseline) girls, supporting the multidimensional and dynamic nature of agency. While the agency profile *Gender conscious, low belief in abilities*– suggestive of motivational autonomy but low self-efficacy– comprised more than a quarter (28.5%) of the sample at time 1, membership declined to near zero by time 4 such that this profile was not identified in the older age cohort. Rather, the two highest prevalence agency profiles identified among older girls at end of observation were both characterized by mixed or gender inequitable views but high self-efficacy. These results suggest that traditional gender values (indicative of internalized social pressure to act in accordance with gender roles rather than independent values) become more entrenched with increasing age among girls in Zambia. It could also imply a 'middle ground' posture for girls to take wherein they garner some confidence from their self-assuredness while not challenging gender norms, which might expose them to potential challenges. Regardless, the increase in prevalence of these two agency profiles over adolescence is of public health significance as these profiles were most likely to experience unwanted/mistimed pregnancy by end of observation. That girls were less likely to move between agency classes during later adolescence also suggests that Zambian programs seeking to improve agency in reproductive decision-making may be better suited targeting girls earlier in adolescence, when agency is more mutable. This aligns with findings from the Global Early Adolescent Study of 10–14 year olds from 15 countries, which found, for example, that many gender stereotypes (relevant for motivational autonomy) were engrained by young adolescence, suggesting the need for early intervention (Chandra-Mouli et al., 2017).

Among both age cohorts, there was a natural progression away from the lowest agency profile over time. However, *High agency* membership was substantially lower among older versus younger girls at time 4 (23.0% and 48.0%, respectively). A study of agency among adolescents ages 12 and 22 in Ethiopia, India, Peru and Vietnam also documented heterogeneous patterns of change in mean agency over time, also suggesting adolescent agency is likely to be dynamic but that developmental trends may be context specific (Revollo et al., 2019). In this sample of vulnerable adolescent girls in Zambia, it is possible that the lower prevalence of *High agency* status among older girls reflects the greater accumulation of life exposures, including negative events which detract from *High agency* status. School enrollment also declines with age among girls in Zambia (from 97.6% primary school enrollment to 52.7% for secondary school) (Psaki et al., 2018), suggesting potential diminished access to a protective influence. Younger girls, in contrast, may retain an 'idealism' untrammeled by negative life experiences and may

maintain the protective influence of early life resources.

The above hypothesis is supported in that predictive analyses identified several baseline factors indicative of greater access to resources enhanced the likelihood of *High agency* membership. Greater household wealth, higher grade attainment and urban (vs. rural) residence all positively predicted membership to the *High agency* profile relative to all lower profiles combined. Further, remaining in school increased the likelihood of retaining *High agency* status over time, an effect that was amplified with age. These findings are supported by analysis of population level data among women ages 15–49 in 55 developing countries, which found agency deprivations were associated with lower education and household wealth (Hanmer & Klugman, 2016). That higher agency profile was distinguished by greater access to resources lends support to empowerment theories of change which seek to restore or augment girls' agency by expanding access to resources and skills training as a mechanism to improve health and well-being (Bandiera et al., 2018; Hewett et al., 2017; Salam et al., 2016; Sandøy et al., 2016).

On the other hand, exposure to time-varying events such as adolescent marriage, violence and early or unwanted/mistimed pregnancy generally reduced the probability of remaining or transitioning to the *High agency* profile among girls ages 15–19 at baseline over the four-year study period. While there is some variation to this general pattern depending on agency status and stage of adolescence, becoming and staying married in particular maintained a strong negative influence on the likelihood of transitioning to or remaining *High agency* status throughout adolescence. The negative influence of early marriage on women's agency and psychological well-being have been demonstrated in other settings, including Uganda, Niger and Northern Ghana (De Groot et al., 2018; Edmeades, & Murithi, 2019; Sunder, 2019). A causal analysis among women in Uganda, for example, provides evidence that delaying child marriage leads to gains in educational attainment, mediated by agency (Sunder, 2019). A 34 country comparative analysis, including Zambia, also documented higher risk of physical and sexual violence associated with early marriage (Kidman, 2016), highlighting early marriage as a context which may increase exposure to harmful influences while lessening protective resources such as education, at the cost of agency.

Adolescent childbearing, on the other hand, had differential effects dependent on agency profile membership at the time prior. While among *High agency* girls childbearing detracted from agency, *Low/moderate agency* girls who recently gave birth had increased likelihood of transitioning to the *High agency* profile, suggesting childbearing can also be a source of agency among subsets of adolescents. It may be that, as a substantial proportion of *Low/moderate* agency girls were married, adolescent childbearing in the context of marriage is associated with gains in cultural status and positive perceptions associated with motherhood (Erfina, Widyawati, McKenna, Reisenhofer, & Ismail, 2019). In contrast, *High agency* girls were least likely to be married by end of observation and most likely to be in school. Considering qualitative evidence among adolescents in Zambia that childbearing outside of the context of marriage is generally perceived as negative among girls (Austrian, Soler-Hampejsek, Duby, & Hewett, 2019; Svanemyr, 2019), it may be that *High agency* girls experienced the greatest disruption to future aspirations. This aligns with a hypothesis by Mensch et al. which posits that school may be self-reinforcing such that with increasing grade attainment, girls may be more likely to envision a future less constrained by marriage and motherhood (Mensch et al., 2019). These findings add to the understanding of what processes lead to early and unwanted pregnancy and how the effects of adolescent childbearing vary across subpopulations.

Examination of the distribution of early or unwanted reproductive events at end of observation by agency status at the time prior provides evidence that the relationship between agency and fertility outcomes is bidirectional. *High agency* girls at time 3 were least likely to be married, experience unwanted pregnancy or adolescent childbearing by the end of observation relative to all lower agency statuses. In contrast, those

most at risk of these events were members of the *Self-assured gender conformer* status. That members of this group were characterized by low motivational autonomy (including regard for control over reproductive decision-making) and were most likely to experience unwanted/mistimed pregnancy, suggests that 'public-facing' values that conform with gender roles may conflict with individual fertility preferences at the cost of reproductive agency. Given that membership to the *Self-assured gender conformer* status was the second highest prevalence agency profile by end of observation (25.9%), for effective programming to address high rates of early or unwanted adolescent pregnancy, gender inequitable norms may need to be prioritized. These results also illustrate the interchangeable relationship between agency, life exposures and reproductive outcomes, which is often obscured in cross-sectional research and suggests the need for continued programmatic support across adolescence.

There are several limitations to this study. First, this was a secondary analysis and no *a priori* measures of agency were available; the proxy measures used may be incomplete representations of underlying agency constructs. Furthermore, key exposures including exposure to violence, marital status, sexual behavior and reproductive outcomes were only asked of girls ages 15 and older only. Time-varying effects should be interpreted as change in agency status among the 15 to19-year old cohort as these girls grow older during the four-year time span. Although the study maintained high retention (84% at time 4), differential attrition by agency status could introduce selection bias. Sensitivity analysis, however, suggests that findings did not appreciably differ among complete cases versus the full sample (Table A3). Further, while the AGEP program was not found to influence variables of interest at immediate and one-year follow-up (Austrian et al., 2018), there is a possibility of residual bias due to program participation. Adjustment for AGEP study arm assignment and a control group-only sensitivity analysis both suggest that major trends were consistent, lending credibility to findings (Table A4). Finally, this was a predictive analysis, identified predictors need further study to determine causality. Representativeness of the study sample must also be considered when extending findings to other contexts as this sample was selective of high vulnerability girls likely to be behind in grade for age with implications for agency.

Despite these limitations this study provides insight into hypothetical pathways that lead to early and unwanted adolescent childbearing. The detrimental influence of high rates of physical and sexual violence against girls as well as high prevalence of adolescent marriage in Zambia may explain why *High agency* status is substantially lower among older relative to younger girls (Central Statistical Office Zambia et al., 2015). Further, the association between lower agency status and early and unwanted pregnancy provides insight as to why, despite efforts such as the AGEP intervention, adolescent rates of early and unwanted pregnancy have remained relatively stagnant over the past decades. Findings suggest that to guard against reduced agency, which is associated with unwanted fertility outcomes, successful intervention strategies will likely have to focus on at least four elements. Hypothesized targets include intervening on inequitable gender norms, increased access to protective resources, limited exposures to events such as violence and early marriage, and engaging girls earlier in adolescence (when agency is more mutable and before the influence of negative exposures on agency have accumulated).

## 5. Conclusion

This study characterizes longitudinal transitions in agency status over the course of adolescence among a cohort of vulnerable girls in Zambia. Findings provide empirical support for theoretical conceptualizations of agency as a dynamic, multidimensional construct in adolescence. We find agency is influenced by both access to resources which enhance agency as well as by time-varying life events, particularly early marriage, which detracts from agency status over time. Results also demonstrate that the natural development of agency is not necessarily

linear, but these relationships vary by the specific dimension of agency and stage of adolescence. Distinct combinations of agency attributes, such as high self-efficacy yet traditional gender norms in later adolescence were most at risk of unwanted pregnancy and early childbearing, while having collectively 'high' agency status across dimensions was found to be protective. Given the different public health implications of distinct agency profiles, future research should adopt multidimensional measures of agency inclusive of its critical dimensions: *motivational autonomy, confidence in ability to achieve goals* and *the power to make strategic choices*. Additional cross-context research is warranted to explore the ways in which these forms of agency manifest may vary to ensure they are salient to local aspects of adolescent life.

## Author contributions

**Katharine J McCarthy**: Formal analysis, Writing Original Draft, Writing- Review & Editing, Visualization. **Katarazyna Wyka:** Conceptualization, Methodology, Writing – Review & Editing, Supervision. **Diana Romero**: Writing – Review & Editing, Supervision **Karen Austrian:** Resources, Writing- Review & Editing.

**Heidi Jones:** Conceptualization, Writing – Review & Editing, Supervision.

## Declaration of competing interests

The authors have no affiliations or involvement with any organizations or individuals that may bias or influence the conclusions of this work.

## Ethical statement

This research article uses secondary data which is publicly available: Austrian, Karen. 2018. "Adolescent Girls Empowerment Program (AGEP)," https://doi.org/10.7910/DVN/CFIUC6, Harvard Dataverse, V1. Due to the secondary nature of the de-identified data, ethical clearance was not required to be sought from the CUNY Graduate School of Public Health & Health Policy.

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. All authors have seen and approved the final version of the manuscript being submitted and meet ICMJE criteria for authorship.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2021.101011.

## References

Al Riyami, A., Afifi, M., & Mabry, R. M. (2004). Women's autonomy, education and employment in Oman and their influence on contraceptive use. *Reproductive Health Matters, 12*(23), 144–154.

Alkire, S. (2008). *Concepts and measures of agency*. OPHI Working Paper. No. 9.

Austrian, K., Soler-Hampejsek, E., Hewett, P. C., Jackson-Hachonda, N. A., & Behrman, J. R. (2018). *Adolescent girls empowerment programme: Endline technical report*. Lusaka ,Zambia.

Austrian, K., Soler-Hampejsek, E., Duby, Z., & Hewett, P. C. (2019). "When He asks for sex, you will never refuse": Transactional sex and adolescent pregnancy in Zambia. *Studies in Family Planning*. https://doi.org/10.1111/sifp.12100. sifp.12100.

Banda, P. C. (2015). Status of maternal mortality in Zambia: Use of routine data. *African Population Studies, 29*(2).

Banda, R., Fylkesnes, K., & Sandøy, I. F. (2015). Rural-urban differentials in pregnancy-related mortality in Zambia: Estimates using data collected in a census. *Population Health Metrics, 13*, 32. https://doi.org/10.1186/s12963-015-0066-9

Bandiera, O., Buehren, N., Burgess, R., Goldstein, M., Gulesci, S., Rasul, I., et al. (2018). *Women's empowerment in action: Evidence from a randomized control trial in africa*.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology, 52*(1), 1–26. https://doi.org/10.1146/annurev.psych.52.1.1

Bandura, A. (2005). Adolescents' development from an agentic perspective. In U. T. Pajares F (Ed.), *Self-efficacy beliefs of adolescents*.

Central Statistical Office (CSO) Zambia, Department of Population Studies, Tropical Diseases Research Centre, Z., University of Zambia, & Macro International. (2009). *Zambia demographic and health survey 2007*. Maryland: Calverton.

Central Statistical Office Zambia, Ministry of Health Zambia, University of Zambia Teaching Hospital Virology Laboratory, Department of Population Studies, Tropical Diseases Research Centre, Z., & ICF International. (2015). *Zambia demographic and health survey 2013-14*. Rockville, Maryland.

Chandra-Mouli, V., Plesons, M., Adebayo, E., Amin, A., Avni, M., Kraft, J. M., et al. (2017). Implications of the global early adolescent study's formative research findings for action and for research. *Journal of Adolescent Health, 61*(4), S5–S9. https://doi.org/10.1016/J.JADOHEALTH.2017.07.012

Choudhury, S., Blakemore, S.-J., & Charman, T. (2006). Social cognitive development during adolescence. *Social Cognitive and Affective Neuroscience, 1*(3), 165–174. https://doi.org/10.1093/scan/nsl024

Collins, L., & Lanza, S. (2016). *Latent class and latent transition analysis for applications in the social, behavioral, and health sciences*. Hoboken, NJ: Wiley.

De Groot, R., Kuunyem, M. Y., Palermo, T., Osei-Akoto, I., Adamba, C., Darko, J. K., et al. (2018). Child marriage and associated outcomes in northern Ghana: A cross-sectional study. *BMC Public Health, 18*(1). https://doi.org/10.1186/s12889-018-5166-6

Do, M., & Kurimoto, N. (2012). Women's empowerment and choice of contraceptive methods in selected African countries. *International Perspectives on Sexual and Reproductive Health, 38*. https://doi.org/10.1363/3802312 (01), 023–033.

Donald, A., Koolwal, G., Annan, J., Falb, K., & Goldstein, M. (2017). *Measuring women's agency*. The World Bank. https://doi.org/10.1596/1813-9450-8148

Erfina, E., Widyawati, W., McKenna, L., Reisenhofer, S., & Ismail, D. (2019). April 10). Adolescent mothers' experiences of the transition to motherhood: An integrative review. *International Journal of Nursing Sciences. Chinese Nursing Association*. https://doi.org/10.1016/j.ijnss.2019.03.013

Filmer, D., & Pritchett, L. (1999). The effect of household wealth on educational attainment: Evidence from 35 countries. *Population and Development Review, 25*(1), 85–120. https://doi.org/10.1111/j.1728-4457.1999.00085.x

Govindasamy, P., & Malhotra, A. (1996). Women's position and family planning in Egypt. *Studies in Family Planning, 27*(6), 328–340.

Haaland, M. E. S., Haukanes, H., Zulu, J. M., Moland, K. M., Michelo, C., Munakampe, M. N., et al. (2019). Shaping the abortion policy - competing discourses on the Zambian termination of pregnancy act. *International Journal for Equity in Health, 18*(1). https://doi.org/10.1186/s12939-018-0908-8

Hallman, K. K., Kenworthy, N. J., Diers, J., Swan, N., & Devnarain, B. (2015). The shrinking world of girls at puberty: Violence and gender-divergent access to the public sphere among adolescents in South Africa. *Global Public Health, 10*(3), 279–295. https://doi.org/10.1080/17441692.2014.964746

Hanmer, L., & Klugman, J. (2016). Exploring women's agency and empowerment in developing countries: Where do we stand?. https://doi.org/10.1080/13545701.2015.1091087.

Hewett, P. C., Austrian, K., Soler-Hampejsek, E., Behrman, J. R., Bozzani, F., & Jackson-Hachonda, N. A. (2017). Cluster randomized evaluation of adolescent girls empowerment programme (AGEP): Study protocol. *BMC Public Health, 17*(1), 386. https://doi.org/10.1186/s12889-017-4280-1

Ibrahim, S., & Alkire, S. (2007). *Agency and empowerment: A proposal for internationally comparable indicators*. Oxford.

ICRW and Measure Evaluation. (2018). *A conceptual framework for reproductive empowerment*. Washington DC.

James-Hawkins, L., Peters, C., VanderEnde, K., Bardin, L., & Yount, K. M. (2016). Women's agency and its relationship to current contraceptive use in lower- and middle-income countries: A systematic review of the literature. *Global Public Health*, 1–16. https://doi.org/10.1080/17441692.2016.1239270

Kabeer, N. (1999). Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change, 30*(3), 435–464. https://doi.org/10.1111/1467-7660.00125

Kassebaum, N. J., Barber, R. M., Bhutta, Z. A., Dandona, L., Gething, P. W., Hay, S. I., et al. (2016). Global, regional, and national levels of maternal mortality, 1990-2015:

A systematic analysis for the global burden of disease study 2015. *Lancet, 384*(9947), 980–1004. https://doi.org/10.1016/S0140-6736(16)31470-2

Kidman, R. (2016). Child marriage and intimate partner violence: A comparative study of 34 countries. *International Journal of Epidemiology, 46*(2), dyw225. https://doi.org/10.1093/ije/dyw225

Kishor, S., & Subaiya, L. (2008). *Understanding women's empowerment: A comparative analysis of demographic and health surveys (DHS) data.* Maryland: Calverton.

Lanza, S. T., & Bray, B. (2013). Transitions in drug use among high-risk women: An application of latent class and latent transition analysis. *Adv Appl Stat Sci, 31*(9), 1713–1723. https://doi.org/10.1109/TMI.2012.2196707.Separate

Lanza, S. T., Lemmon, D. R., Dziak, J. J., Huang, L., Schafer, J. L., & Collins, L. M. (2014). *Proc LCA & proc LTA users' guide version 1.2.5 beta* (pp. 1–43). The Methodology Center.

Lanza, S. T., Patrick, M. E., & Maggs, J. L. (2010). Latent transition analysis: Benefits of a latent variable approach to modeling transitions in substance use. *Journal of Drug Issues, 40*(1), 93–120.

Mensch, B. S., Grant, M. J., Soler-Hampejsek, E., Kelly, C. A., Chalasani, S., & Hewett, P. C. (2019). Does schooling protect sexual health? The association between three measures of education and STIs among adolescents in Malawi. *Population Studies, 1–21.* https://doi.org/10.1080/00324728.2019.1656282

Mokdad, A. H., Forouzanfar, M. H., Daoud, F., Mokdad, A. A., El Bcheraoui, C., Moradi-Lakeh, M., et al. (2016). Global burden of diseases, injuries, and risk factors for young people's health during 1990–2013: A systematic analysis for the global burden of disease study 2013. *The Lancet, 387*(10036), 2383–2401. https://doi.org/10.1016/S0140-6736(16)00648-6

Nelson, M. B., O'Neil, S. H., Wisnowski, J. L., Hart, D., Sawardekar, S., Rauh, V., et al. (2019). Maturation of brain microstructure and metabolism associates with increased capacity for self-regulation during the transition from childhood to adolescence. *Journal of Neuroscience.* https://doi.org/10.1523/JNEUROSCI.2422-18.2019, 2422–18.

Owolabi, O. O., Cresswell, J. A., Vwalika, B., Osrin, D., & Filippi, V. (2017). Incidence of abortion-related near-miss complications in Zambia: Cross-sectional study in central, Copperbelt and Lusaka provinces. *Contraception, 95*(2), 167–174. https://doi.org/10.1016/j.contraception.2016.08.014

Patton, G. C., Coffey, C., Sawyer, S. M., Viner, R. M., Haller, D. M., Bose, K., et al. (2009). Global patterns of mortality in young people: A systematic analysis of population health data. *Lancet, 374*(9693), 881–892. https://doi.org/10.1016/S0140-6736(09)60741-8

Psaki, S. R., McCarthy, K. J., & Mensch, B. S. (2018). Measuring gender equality in education: Lessons from trends in 43 countries. *Population and Development Review, 44*(1), 117–142. https://doi.org/10.1111/padr.12121

Revollo, P. E., José, M., & Portela, O. (2019). *Self-efficacy, agency and empowerment during adolescence and young adulthood in Ethiopia, India.* Working Pa: Peru and Vietnam.

Salam, R. A., Faqqah, A., Sajjad, N., Lassi, Z. S., Das, J. K., Kaufman, M., et al. (2016). Improving adolescent sexual and reproductive health: A systematic review of potential interventions. *Journal of Adolescent Health, 59*(4S), S11–S28. https://doi.org/10.1016/j.jadohealth.2016.05.022

Sandøy, I. F., Mudenda, M., Zulu, J., Munsaka, E., Blystad, A., Makasa, M. C., et al. (2016). Effectiveness of a girls' empowerment programme on early childbearing, marriage and school dropout among adolescent girls in rural Zambia: Study protocol for a cluster randomized trial. *Trials, 17*(1), 588. https://doi.org/10.1186/s13063-016-1682-9

Sawyer, S. M., Afifi, R. A., Bearinger, L. H., Blakemore, S.-J., Dick, B., Ezeh, A. C., et al. (2012). Adolescence: A foundation for future health. *Lancet, 379*(9826), 1630–1640. https://doi.org/10.1016/S0140-6736(12)60072-5

Sunder, N. (2019). Marriage age, social status, and intergenerational effects in Uganda. *Demography, 56*(6), 2123–2146. https://doi.org/10.1007/s13524-019-00829-8

Svanemyr, J. (2019). Adolescent pregnancy and social norms in Zambia. *Culture, health and sexuality.* https://doi.org/10.1080/13691058.2019.1621379

Upadhyay, U. D., Gipson, J. D., Withers, M., Lewis, S., Ciaraldi, E. J., Fraser, A., et al. (2014). Women's empowerment and fertility: A review of the literature. *Social Science & Medicine, 115*, 111–120. https://doi.org/10.1016/j.socscimed.2014.06.014

Upadhyay, U. D., & Karasek, D. (2012). Women's empowerment and ideal family size: An examination of DHS empowerment measures in sub-saharan africa. *International Perspectives on Sexual and Reproductive Health, 38*(2), 78–89. https://doi.org/10.1363/3807812