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# THE "DISTAL DETERMINANTS" OF FERTILITY

# IDENTIFYING UNDERLYING CONSTRUCTS AND

# EXAMINING RACE-ETHNIC VARIATION

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**Identifying Underlying Constructs and Examining Race-Ethnic Variation**

***Abstract:*** The proximate causes of unintended fertility are clear. But the more distal factors that predict unprotected sex among those who do not want to conceive, and the uneven distribution of this behavior across race-ethnicity, are not well understood. In this paper, we propose that attitudinal indicators and reproductive knowledge measures that have been shown to be individually associated with unintended fertility can be drawn together under the umbrella concepts of *fertility motivation* and *reproductive knowledge* and may be useful in explaining race-ethnic variation in reproductive behaviors. We test this approach by applying multi-group confirmatory factor analysis drawing on data from the National Longitudinal Survey of Adolescent to Adult Health. For both *fertility motivation* and *reproductive knowledge*, a three-construct factorial pattern best fit the data, but the structure of the patterns varied across race-ethnic groups. The results suggest that the factors identified for the full sample function differently across race-ethnicity and should not be used to explain race-ethnic variation in behavior.

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Despite modest declines in recent years, unintended fertility in the U.S. remains high: in 2011, 45% of pregnancies were categorized as unintended, with prevalence substantially higher among economically disadvantaged women and race-ethnic minorities (Finer & Zolna, 2016). Given the negative linkage between unintended fertility and the well-being of children, parents, and families (Boden, Fergusson, & Horwood, 2015; Gipson, Koenig, & Hindin, 2008; Guzzo & Hayford, 2012, 2014; Herd, Higgins, Sicinski, & Merkurieva, 2016; Kost & Lindberg, 2015; Lindberg, Maddow-Zimet, Kost, & Lincoln, 2015; McCrory & McNally, 2013), variation across groups likely both reflects and exacerbates persistent social and economic disparities.

Many surveys measure different elements of reproductive and contraceptive knowledge and attitudes toward childbearing, and a wide range of individual items and ad-hoc scales have been shown to be associated with sexual and contraceptive behavior and unintended fertility (e.g., Craig, Dehlendorf, Borrero, Harper, & Rocca, 2014; Garfield et al., 2016; Guzzo & Hayford, 2012; Hayford & Guzzo, 2013; Ryan, Franzetta, & Manlove, 2007). It has been proposed that differences in some of these elements may explain persistent disparities in unintended fertility in the United States. However, little effort has been made to synthesize these findings across different populations or to construct consistent measures. Researchers often use different indicators across analyses and data sources, limiting both the comparability of findings and their implications for policy and programmatic interventions. In addition, because the psychometric properties of specific items and constructs have not been established, it is not clear whether variation across sub-groups is *real* (for instance, some groups actually have more or less motivation to avoid a pregnancy) or *apparent* due to measurement issues (for instance, various groups of people respond differently to similar questions).

The goals of this paper are twofold. First, we propose a unifying framework for understanding reproductive and contraceptive knowledge and attitudes and we seek to establish how individual survey questions about sex, contraception, and pregnancy tap into larger underlying concepts representing *reproductive knowledge* and *fertility motivation*. Second, given evidence of race-ethnic variation in reproductive attitudes and behavior, we seek to determine whether the associations between survey items and their relationship to underlying latent constructs are similar across race-ethnic-nativity groups. The National Longitudinal Study of Adolescent to Adult Health (Add Health) provides a unique opportunity to address these goals, as it has a rich set of individual knowledge and attitudinal measures. Further, the large sample size and race-ethnic diversity of Add Health allows us to test whether, if such constructs exist, they represent the same constructs across different racial-ethnic groups.

*Proximate and Distal Determinants of Unintended Fertility*

The mechanisms that contribute to high levels of unintended fertility – and variation in unintended fertility by race-ethnicity – remain unclear, despite the large body of work on its correlates and consequences. From a demographic perspective, the birth of a child is the final result of a series of transitions and behaviors – having sex without effective contraception, getting pregnant, and carrying a pregnancy to term – and fertility research is often guided, at least implicitly, by a focus on these mechanisms. These mechanisms are known as the *proximate determinants* of fertility – factors affecting exposure to pregnancy (i.e., sex), factors affecting conception (primarily contraceptive use but also breastfeeding), and factors affecting the likelihood of a live birth (primarily abortion but also miscarriage) (Bongaarts, 1978). According to the proximate determinants framework, then, race-ethnic differences in unintended fertility must be driven by differences in either sex, contraception, or abortion (or some combination of the three pathways).

The proximate determinants framework has been widely used in demographic and sociological research on fertility levels, change, and differentials. Most recently, it has been explicitly applied to developing country contexts, but this framework is also useful in the United States, with its wide variation in childbearing behaviors and shifts over time (Sweeney & Raley, 2014). However, we suggest that the utility of the proximate determinants framework would be improved if we could identify the factors that lead to differences in behavior. For instance, Lindberg, Santelli, and Desai (2016) report that recent declines in teen childbearing were primarily attributable to increased contraceptive use rather than changes in sexual activity, yet it is unclear why contraceptive use changed. At the aggregate level, improved access played a role, but at the individual level, it is likely teens increasingly used contraception due to shifts in their knowledge and attitudes toward sex, contraception, and childbearing. Thus, understanding unintended fertility requires identifying not just which mechanisms explain variation in prevalence, but *why* the proximate determinants vary.

Sex, contraception, and abortion are socially patterned and socially meaningful behaviors and, as such, are shaped by social structures and socially determined beliefs. In this paper, we present a first step toward understanding these social determinants by introducing the concept of *distal determinants* as precursors to the proximate determinants. We draw on another classic demographic theory, one that has also traditionally been applied to developing countries – Coale's notion of "ready, willing, and able." Coale (1973) described three preconditions for fertility decline: 1) childbearing must be in the calculus of choice ("ready"), 2) it must be advantageous to have fewer children ("willing"), and 3) the means to control childbearing must be available ("able"). Put more simply, in order to limit births – and, by extension, to prevent unintended fertility – people must understand how to control their fertility, have reasons to limit or space their childbearing, and have access to family planning.

In our distal determinants framework, we focus on the first two preconditions. We conceptualize the ability to limit fertility ("ready") as *reproductive knowledge* – whether individuals understand how pregnancy occurs and how to prevent pregnancy. *Reproductive knowledge* includes familiarity with contraceptive methods; knowledge of the use, relative effectiveness, and risk of side effects of different methods; and an understanding of basic reproductive biology, including the menstrual cycle and risks of conception. We conceptualize the desire to limit fertility ("willing") as *fertility motivation*. *Fertility motivation* encompasses positive and negative feelings about children; perceived individual and relationship costs and benefits of childbearing; social norms about childbearing, in general and in particular contexts; and attitudes about the social or moral acceptability of birth control. In this analysis, we set aside Coale's third precondition, the ability to control fertility. Contraception and abortion are, in theory, easily available in the United States. In practice, there are substantial financial, legal, and geographic barriers to accessing contraception (particularly long-lasting and highly effective methods such as the IUD and Depo-Provera) and abortion, and these barriers likely have a disproportionate impact on race-ethnic minorities. Barriers to access of contraception and abortion are in substantial part driven by structural and institutional factors such as laws regulating abortion, health insurance policies, and the placement of public family planning clinics. Reproductive knowledge and fertility motivation, in contrast, are primarily individual-level attitudes and beliefs. We focus here on these individual-level measures.

*Race-Ethnic Differences in Fertility Behavior, Attitudes, and Knowledge*

To date, research has indeed confirmed race-ethnic differences in the proximate determinants of fertility. For instance, black teens tend to have sex at slightly younger ages than white and Hispanic teens (Martinez, Copen, & Abma, 2011), which would lead to higher rates of teen fertility among blacks relative to other groups due to longer exposure to pregnancy. However, race-ethnic differences in sexual behavior have generally narrowed over time (Sweeney & Raley, 2014; Kim & Raley, 2015), and so differences in sexual behaviors and activity are unlikely to be a major driver of current differences in unintended childbearing. Abortion rates also vary by race-ethnicity, with rates highest among blacks, followed by Hispanics, and then whites (Jones & Kavanagh, 2011); higher abortion rates among minorities suggests that, if anything, differences in unintended *pregnancy* are larger than differences in unintended births. Approaching race-ethnic differences in unintended childbearing with the proximate determinants framework, then, points to differences in contraceptive behavior as the key factor (Sweeney & Raley, 2014), a hypothesis supported by a large literature documenting race-ethnic differences in the usage, consistency, and type of contraception used. Among women at risk of an unintended pregnancy (sexually active but reporting that they are not trying to get pregnant), only 83% of black women reported currently using any form of contraception, compared to 90% of Hispanic and 91% of white women (Jones, Mosher, & Daniels, 2012). Method type also varies – of those using contraception, 32% of white women use the pill compared to 18% of blacks and 20% of Hispanics. Blacks and Hispanics rely on barrier methods (such as condoms) more often, at 20% and 18% respectively, than whites (14%). The reasons behind these differentials, however, remain unclear, a gap which we suggest could be filled with an emphasis on the distal determinants. Variation across race-ethnicity in contraceptive use is likely driven by differences in the motivation to avoid having a child and/or differences in understanding how reproduction and contraception work, necessitating a focus on these motivational and knowledge characteristics.

There is certainly evidence of race-ethnic variation in both knowledge and attitudes. For instance, studies have documented misperceptions and concerns about the reproductive process and contraception (Aarons & Jenkins, 2002; Gilliam et al., 2009; Guzzo & Hayford, 2012; Shedlin et al., 2013; Witt, McEvers, & Kelly, 2013). Other work suggests that black women actually have *less* favorable attitudes toward nonmarital pregnancy than whites after controlling for socioeconomic and demographic factors (Hayford & Guzzo, 2013), though they perceive more positive consequences of pregnancy as well (Barber, Yarger, & Gatny, 2013). While this work is suggestive that differences in knowledge and motivation may contribute to differences in contraceptive use, there are several limitations to this research. Much of it is qualitative, cross-sectional, and/or focuses *only* on specific race-ethnic groups, making it difficult to generalize results, determine the extent to which variation occurs across groups, or understand how knowledge and motivation may relate to differences in behavior. Further, the existing research that has used nationally representative data to document race-ethnic differences in knowledge has tended to examine individual indicators of knowledge (e.g., Barber, Yarger, & Gatny, 2013; Borrero et al., 2013; Craig et al., 2014; Hayford & Guzzo, 2013) rather than conceptualize them as part of a multidimensional set of factors. This is an important oversight, as understanding how individual items fit together to form a broader construct might help us better identify which factors play into different aspects of reproductive behavior. For instance, a more positive orientation toward early, nonmarital, and/or unintended childbearing may reduce the consistency of contraceptive use whereas misperceptions about how contraception works may influence the type of method used. As such, our goal is to step back from behaviors themselves to instead consider the attitudinal determinants of behaviors.

*Measurement Invariance across Race-Ethnicity*

The utility of a distal determinants framework for explaining race-ethnic variation in attitudes about childbearing and knowledge of reproduction relies upon a potentially consequential assumption: that these concepts are measured in an equivalent fashion (Moors, 2004), referred to as *measurement invariance*. However, we cannot assume measurement invariance exists given the lack of directed attention to a) the development of valid instruments overall, and b) explicit attention to possible measurement differences across race-ethnicity. There is reason to suspect that instruments may work differently across race-ethnic groups given variation in instruments used in other fields; for instance, research suggests that the constructs that comprise depression are not related identically across race-ethnic groups (Perreira, Deeb-Sossa, Harris, & Bollen, 2005; Norton, 2007).

Measurement invariance refers to a psychometric property of measurement that the same construct is being measured by the scale items across different groups. It is based on an approach to measurement that assumes that correlations between responses to questions on a survey are driven by the association between individual items and one or more underlying but unmeasured constructs (e.g., motivation to prevent pregnancy or knowledge about reproduction). A measurement model demonstrates measurement invariance if the relationships among and between the survey items and the latent variables are the same across groups. In this study, we focus on testing two core facets of measurement invariance, configural invariance and metric invariance. Configural invariance occurs when different groups have the same dimensionality of measurement (i.e., the same number of latent factors) and scale items load onto the same factors for different groups. Metric invariance means that the magnitude of these factor loadings are the same across different groups. When both the pattern and the magnitudes of all factor loadings are the same across groups, it implies that scale items are measuring identical constructs across groups. Partial invariance, in which the model structure is the same but only some factor loadings are identical across groups, is also possible. In general, if at least half of the factor loadings are the same across groups, the scale items are considered to be measuring the same constructs across groups (Reise, Widaman, and Pugh, 1993). After establishing configural and metric invariance, it is also possible to further test whether scale items have the same means, variances, and covariances across groups. In this analysis, we focus on establishing the basic elements of measurement invariance.

**Data and Method**

The study uses data from the Wave I in-home interview data of the National Longitudinal Study of Adolescent to Adult Health (Add Health). Add Health is a nationally representative sample of adolescents in the United States designed to understand the biological, behavioral, and social changes adolescents experience as they transition into young adulthood. The target population of Add Health was adolescents in grades 7-12 (ages 12-19) in the United States in 1995. Respondents were re-interviewed in 1996, 2001-2002, and 2007-2008.

Add Health used a stratified two-stage sampling method. At the first stage, the sampling frames of the target population of schools were stratified by region, urbanization, school size, school type, and race composition. At the second stage, a random sample of students was drawn from these selected schools and was administered an in-home interview (n=20,743), with several groups of students being oversampled, including twins and siblings of twins; non-related adolescents residing together; disabled minority students; blacks from well-educated families;

and minority students who are Chinese, Cubans, and Puerto Ricans. The Add Health data include a large number of Mexican-Americans (over 1,500) and significant numbers of adolescents who identified as immigrants or reported a foreign-born parent. We identified five race-ethnic groups among the sample selected for the in-home interview: whites, blacks, Hispanics, Asians, and members of ‘other’ race-ethnic groups. We further disaggregated the Hispanic category by nativity status but were unable to do so for other race-ethnic groups due to smaller sample sizes. This produced a total of six race-ethnic-nativity groups (referred to as race-ethnic groups for brevity).

Only respondents aged 15 and older were asked questions about sex, reproduction, and contraception, reducing the sample size to 15,072. We further exclude 1,237 respondents with missing values on the weight variables (over-samples of key groups). For the *fertility motivation* related questions, 85 respondents had missing responses on all key items (discussed below). The final analytic sample is 13,750 respondents for the *fertility motivation* analyses. For the *reproductive knowledge* related questions, 158 respondents had missing responses on all key items. The final analytic sample is 13,677 for the *reproductive knowledge* analyses.

Because there were – and are – no standard items to measure *fertility motivation* or *reproductive knowledge*, we searched for possible items among the 39 different modules of the survey, identifying items from three different modules (pregnancy risk perceptions, motivations for birth control, and motivation to engage in risky behaviors). We identified 17 questions that potentially reflect *fertility motivation* and 12 items that potentially reflect *reproductive knowledge*. *Fertility motivation* items were recoded so that higher scores reflect less favorable attitudes toward pregnancy and more favorable attitudes toward birth control whereas lower scores reflect more favorable attitudes toward pregnancy and less favorable attitudes toward birth control. *Reproductive knowledge* questions were measured as true or false and coded so that 1 indicates the correct answer and 0 indicates the incorrect answer to the question. Three of the *reproductive knowledge* questions (i.e., rhythm, condom1, and withdra1) were recoded as dichotomous variables where strongly agree and agree are coded as 1 and neutral, disagree, and strongly disagree coded as 0. Tables 1 and 2 lists the wordings and response categories of these items, along with the weighted means, standard deviations and percentages for the full sample and by race-ethnicity.

- Table 1 here -

- Table 2 here -

*Analytic Strategy*

Variable coding was conducted in Stata 13, and all EFA and CFA analyses were run using M*plus* 7 software and were weighted to account for the complex survey design. We used both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Devellis, 2012) to identify underlying factors. We began with EFA to determine the number of latent factors underlying *fertility motivation* and *reproductive knowledge* for the full sample. We conducted an EFA with maximum likelihood estimation with standard errors and orthogonal rotation. We compared model fit across 1-, 2-, 3-, and 4-factor models using two goodness-of-fit criteria, Root Mean Squared Error of Approximation (RSMEA) and Comparative Fit Index (CFI), and conducted a chi-square test of model fit to determine significant differences in the improvement of model fit between the various models (Hu and Bentler, 1999). RSMEA values of .01, .05, and .08 are indicators of excellent, good, and mediocre fit, respectively (Brown and Cudeck, 1992; MacCallum. Brown and Sugawara, 1996). In this analysis, we used a cutoff value of .05 or lower to indicate a good-fitting model. The CFI ranges from 0 (poor fit) to 1 (perfect fit), and values of a .95 or higher are considered to provide evidence for an excellent fitting model (Hu and Bentler, 1999). From the EFA, we identified the factor loading magnitude of each item and the number of latent factors. We then used single-group confirmatory factor analysis (CFA) to confirm the patterns identified in the EFA. CFA uses the same goodness of fit statistics as EFA to determine a good fitting model (RSMEA < .05; CFI > .95). This was an iterative process in which we moved back and forth testing models between EFA and CFA, beginning with all possible identified items (17 for *fertility motivation* and 12 for *reproductive knowledge)* and removing items as necessary to achieve acceptable model fit.

After using single-group CFA to test the best fitting factorial pattern from the EFA analysis, we moved on to multi-group CFA to test measurement invariance across race-ethnic-nativity groups. We conducted multi-group CFA to test whether the factor loadings and factor covariances remained invariant across race-ethnicity; that is, whether there was configural and metric invariance. Invariant factor loadings for race-ethnic groups indicate that these items measure the same constructs. Invariant factor covariances for race-ethnic groups indicate these latent factors are related to each other the same way across race-ethnicity. Invariant factor loadings and factor covariances provide support for the notion that these items measure the same constructs across race-ethnic categories.

For the multi-group CFA for race-ethnic groups, we began by constraining all factor loadings to be the same, then proceeded across a series of models to allow the factor loading for each individual item (other than the base factor, identified as highest-loading item within each factor from the full sample CFA) to vary for race-ethnic groups to test invariance of the factor loadings. Using Satorra-Bentler scaled chi-square difference tests (Bryant & Satorra, 2012), we then identified progressively better-fitting models based on whether allowing the factor loading to vary freely improved model fit. Using the best-fitting model from the factor invariance analyses as our base model (in which correlations between factors were allowed to vary freely), we then tested invariance of the factor correlations (i.e., covariances) by constraining the correlation between each set of factors to be the same across race-ethnic-ethnic groups to test whether this improved model fit (again using Satorra-Bentler scaled chi-square difference tests). We repeated this intensive and iterative process across race-ethnic groups until we arrived at the final model, which allowed us to determine whether we had full, partial, or no invariance across race-ethnic groups.

We begin by presenting the differences across race-ethnic groups in the individual items (Tables 1 & 2). We then present our EFA and CFA analyses first for *fertility motivation*, then for *reproductive knowledge*. For each analysis, there is a brief discussion of the exploratory factor analysis (EFA) and confirmatory factor analysis (single-group CFA) before presenting the results focused on measurement invariance (multi-group CFA) by race.

**Results**

*Descriptive Results for Fertility Motivation*

Table 1 shows the mean of the items used in the *fertility motivation* factor analyses for the overall sample and separately by race. The means of items measuring *fertility motivation* ranged between 2.4 and 4.3 for the full sample; recall that higher scores mean less favorable attitudes toward childbearing and more favorable attitudes toward contraception. This suggests that the sample, as a whole, had fairly negative views toward teenage childbearing and were accepting of contraceptive use. Looking at these items by race-ethnicity, we see that there is indeed large variation across groups. Whites, Asians, and members of ‘other’ race-ethnic groups generally have more negative attitudes toward adolescent fertility and more favorable attitudes toward contraceptive use than blacks, foreign-born Hispanics, and native-born Hispanics. Whether these items contribute to the same underlying constructs across race-ethnicity, however, remains to be seen, and so we turn to factor analyses.

*Fertility Motivation Exploratory Factor Analysis (EFA)*

We used exploratory factor analysis (EFA) to determine what construct or constructs these items measured. Table 3 shows the EFA comparing the model fit of our *fertility motivation* distal determinant for the full sample of Add Health after we identified, through the iterative process mentioned earlier, the items that produced an acceptable model. In this process, we removed four items ("abortstrs1," "marrywrg1," "easybc," and "looksex") that did not fit into any factorial structure. We then tested equivalent 1-, 2-, 3-, and, 4-factor models using the remaining items. Each factor model was compared to the previous model (i.e., 1-factor to 2-factor, 2-factor to 3-factor, and 3-factor to 4-factor) using a chi-square difference test to determine improvement of model fit ($x^2$ difference tests p <.001). As shown in Table 3, the results of the Chi-square difference tests showed that the 2-factor model significantly fit better than the 1-factor (p =.000) and that the 3-factor model fit data significantly better than the 2-factor model (p = .000). It is worth noting that although a 4-factor model did show a significant improvement in model fit relative to a 3-factor model, the 4-factor model had too few items (i.e., less than two) loading on individual factors to create an adequate factor. Therefore, we determined a 3-factor model fit the data best and that these 13 *fertility motivation* items measure three latent constructs for the full sample. From Table 4, we can observe relatively high factor loadings and items significantly grouped together by latent construct. After examining the magnitudes of factor loadings for each of the items, we decided that three items ("sexonce," "prgworst," and "notbad") loaded on the first factor, six items ("moral," "bcbother," "hardbc," "muchplan," "pleasure," and "expensiv") loaded on the second factor, and four items ("pregfast," "quitsch," "embrsfam," and "embrsme") loaded on the third factor.

- Table 1 here -

- Table 2 here -

The first factor, which we term *attitudes toward pregnancy,* appears to tap into how respondents feel about a hypothetical pregnancy – both its likelihood of occurring and their general feeling about such a pregnancy. The second factor, which we term *birth control attitudes,* taps into the respondent's overall orientation towards contraception, which we interpret as how difficult or 'costly' (on a social and relational basis) it is to take steps to avoid pregnancy. The final factor, which we term *life course consequences,* seems to tap into how a hypothetical pregnancy would impact specific aspects of the respondent's life.

*Fertility Motivation Confirmatory Factor Analysis (CFA)*

After deciding what these three factors mean and which items load on which factor, we used single-group CFA with the full sample to test the 3-factor model found in the EFA. The factorial pattern is depicted in Figure 1. The single-group CFA revealed a good fitting 3-factor model (CFI = 0.971, RSMEA = 0.027) and the factor loadings on these constructs were all significantly different from 0, indicating that these items are indicative of these constructs. In addition, the factor covariances among these three constructs were all significantly different from 0, suggesting that these three constructs may represent three sub-dimensions of the larger construct, *fertility motivation*. Therefore, the findings of the single-group CFA suggest that when the whole sample is examined, the correlations among the 13 items of fertility motivation can be adequately explained by three constructs: *attitudes toward pregnancy*, *birth control attitudes*, and *life course consequences*. Each of these constructs is measured by a unique set of questions and these constructs appear to represent three sub-dimensions of *fertility motivation*.

- Figure 1 here -

*Fertility Motivation Multi-group CFA*

Although the findings of the single-group CFA shows that the three-factor model fits the data from the full sample, it remains unclear whether this structure effectively describes the correlation among items and underlying factors within each race-ethnic group – that is, whether there is measurement invariance. To address this question, we applied a series of multi-group CFA analyses to test if factor loadings and covariances of the 3-factor model were invariant across all six race-ethnic groups (i.e., whether there was configural and metric invariance). Models did not converge initially among Asians, native-born Hispanics, and the 'other' race-ethnic group. Non-convergence can be caused by relatively small sample size within particular race-ethnic groups, heterogeneity within groups (for instance, the Asian group comprises substantial variation by country of origin, and the 'other' race-ethnic group is also heterogeneous), or problems with specific items. To determine if particular items were causing convergence issues, we removed each item individually and reran the multi-group CFA each time. In doing so, we determined that the item "embrsme" was creating convergence issues for native-born Hispanics. When we removed this item, we were able to successfully run the *fertility motivation* model across whites, blacks, foreign-born Hispanics, and native-born Hispanics groups in the multi-group CFA analysis. To confirm that a factorial structure without this item was still an acceptable model, we reran the initial EFA and CFA with the full sample (results not shown) without the "embrsme" item and did indeed find that this was a good fitting model (CFA = .969). However, we were unable to find an acceptable model that would allow us to include

Asians and the ‘other’ group in the multi-group CFA. Nonetheless, this intensive and iterative process of testing for measurement invariance allowed us to identify an acceptable multi-group CFA model across white, black, foreign-born Hispanic, and native-born Hispanic groups, summarized in Figure 2.

- Figure 2 here –

The results revealed several important findings. First, in the factor *attitudes toward pregnancy*, the factor loadings of “prgworst” are invariant across all four groups (.94), while those of “sexonce” are invariant for white and native-born Hispanic only. This finding suggests that for whites and native-born Hispanics, the three items (“sexonce,” “prgworst,” and “notbad”) measure the same construct because the factor loadings of these three items are the same (.14, .94, 1.0) for these two groups. Although the factor loadings of “sexonce” for blacks (.28) and foreign-born Hispanics (.52) are different than those for whites and native-born Hispanics (.14), more than half the items have invariant factor loadings across these four race-ethnic groups. Thus, according to the criteria of partial invariances (Reise et al., 1993), these items generally measure the same construct, *attitudes toward pregnancy*, across the four race-ethnic groups.

Second, the pattern of factor loading for *birth control attitudes* is fairly complex across these groups. Specifically, only for the item “moral” do we have invariant loadings across all four groups (.61); factor loadings for the other four items (i.e., “bcbother,” “hardbc,” “pleasure,” and “expensiv”) were only partially invariant for whites and native-born Hispanics. Given the criteria of partial invariance (Reise et al. 1993), we conclude that these items generally measure the same construct, *birth control attitudes*, for whites and native-born Hispanics only.

Third, in the factor *life course consequences,* factor loadings of “pregfast” are invariant across all four groups (.73), while those of “quitsch” are invariant only for whites, blacks, and native-born Hispanics (.50). This finding suggests that for white, black, and native-born Hispanics, the three items (“pregfast,” “quitsch,” and “embrsfam”) measure the same construct because the factor loadings of these three items are the same for these three groups. Although the factor loading of “quitsch” varies for foreign-born Hispanics (.22) relative to the other groups, these items generally measure the same construct, *life course consequences*, across these four race-ethnic groups.

The findings on the factor loadings on these three factors indicate that factors *attitudes toward pregnancy* and *life course consequences* generally have the same meanings across these four groups, so we further tested if factor covariances between them were the same across groups. By contrast, the factor loadings on *birth control attitudes* are invariant for whites and native-born Hispanics only. Thus, we only tested if this factor has the same correlations with the other two factors for whites and native-born Hispanics. The results show that the factor covariances between *attitudes toward pregnancy* and *life course consequences* across are invariant (.41) across these four groups. The factor covariance between *attitudes toward pregnancy* and *birth control attitudes* are invariant for only whites and native-born Hispanics (.14). However, the covariances between *birth control attitudes* and *life course consequences* are completely variant (there are no shared covariances) between whites and native-born Hispanics.

Overall, these results suggest a very complex factorial pattern of items measuring *fertility motivation* across race-ethnic groups. Specifically, when we look at the items measuring *attitudes toward pregnancy*, *birth control attitudes*, *life course consequences*, the items measuring the first and the third factors are generally invariant across the four groups. However, the items measuring the second factor are invariant only for whites and native-born Hispanics. When these three factors are viewed as three sub-dimensions of a higher-order construct, *fertility* *motivation*, however, we found that the associations of these constructs were not the same across the four groups because *birth control attitudes* seems to have an identical meaning for whites and native-born Hispanics only and even for these two groups, the association between *birth control attitudes* and *life course consequences* is differs.

*Descriptive Results for Reproductive knowledge*

In Table 2, the proportion of the analytic sample who correctly answered the items used in the *reproductive knowledge* analyses are shown for the full sample and also by race-ethnicity. In the full sample the proportion of respondents answering the questions correctly ranges widely, from 26.8% to 89.1%. Further, as with *fertility motivation*, there is substantial variation across groups in the proportion providing correct responses to the various items. Again, though, whether these items contribute to an underlying factorial structure in the same fashion across race-ethnicity remains to be seen.

*Reproductive Knowledge Exploratory Factor Analysis (EFA)*

Table 5 shows the EFA comparing the model fit of *reproductive knowledge* for the full sample of Add Health. As with *fertility motivation*, we removed any items that, through an iterative process, we identified as contributing to unacceptable model fit because they did not fit into any factorial structure; here, we removed only one item, "pullout." With the remaining items, we tested equivalent 1-, 2-, 3-, and, 4-factor models. Each factor model was compared to the previous model (i.e., 1-factor to 2-factor, 2-factor to 3-factor, and 3-factor to 4-factor) using a chi-square difference test to determine improvement of model fit. It is important to note that a 4-factor model only marginally improved model fit (p = .1) but, again, resulted in a factor with too few items. Therefore, we determined a 3-factor model fit the data best ($x^2$ difference tests p <.001). From Table 6, we can observe items significantly grouped together by latent construct.

After examining the magnitudes of factor loadings for each of the items, we decided that four items ("ovulate," "bfperiod," "duperiod," and "spermdie") were loaded on the first factor, four items ("withdraw," "fittight," "vaseline," and "unroll") were loaded on the second factor, and three items ("rhythm," "condom1," and "withdra1") were loaded on the third factor.

The first factor, which we term *biology knowledge,* appears to tap into respondents' knowledge of the physiological aspects of reproduction. The second factor, which we term *condom knowledge,* taps into the respondent's overall knowledge of condoms and how to effectively use them. The final factor, which we term *birth control confidence* seems to tap into how confident individuals feel about their general knowledge of some contraceptive methods. All factor loadings are significant at $p<.001$, and all factors were significantly correlated with each other, indicating that there are three inter-related factors that we argue are reflective of *reproductive knowledge*.

- Table 5 here -

- Table 6 here -

*Reproductive Knowledge Confirmatory Factor Analysis (CFA)*

Next, we used single-group CFA to test the 3-factor model found in the *reproductive knowledge* EFA analysis. The single-group CFA revealed a good fitting 3-factor model (CFI = 0.965, RSMEA = 0.015) with the full sample. This factorial pattern is depicted in Figure 3. In addition, the factor loadings and covariances were all significantly different from 0. Given this, the finding of the single-group CFA suggests that when the full sample is examined, the correlations among the 11 items of *reproductive knowledge* can be adequately explained by these three constructs: *biology knowledge*, *condom knowledge*, and *birth control confidence*. Each of these constructs is measured by a unique set of questions and appear to represent three sub-dimensions of *reproductive knowledge*.

- Figure 3 here -

*Reproductive Knowledge Multi-group (CFA)*

We then tested for measurement invariance of the factor structure identified in the *reproductive knowledge* CFA across race-ethnicity. This required testing for equivalence of factor loadings and correlations across race-ethnicity (i.e., configural and metric invariance). As with *fertility motivation*, initial models did not converge for the native-born Hispanic, Asian, and 'other' groups. We again tried removing each individual item from the analyses to see if one of the items caused convergence issues. Unlike the earlier analyses in which we identified a specific item as causing convergence issues, we did not identify a particular item as the primary cause of non-convergence for *reproductive knowledge* among these groups. Given this, we believe that these items do not contribute to any latent *reproductive knowledge* constructs for native-born Hispanics, Asians and the 'other' race-ethnic group. However, we were able to proceed with the multi-group CFA across whites, blacks, and foreign-born Hispanic groups.

- Figure 4 here –

The results revealed several important findings. First, we found that the item factor loadings ("bfperiod," "duperiod," "spermdie," "ovulate") for factor *biology knowledge* were completely invariant for whites, blacks, and foreign-born Hispanics (.58, 1.0, .33, .32), suggesting that these items measure the same construct, *biology knowledge*, across whites, blacks, and foreign-born Hispanics. Second, items measuring the factor *condom knowledge* ("withdraw," "fittight," "vaseline," "unroll") had the same factor loadings for whites and foreign-born Hispanics (.50, 82, 69, 1.0), suggesting a metric invariant model for these two race-ethnic groups. However, we found only a partial invariance model for blacks because the factor loading for the item "withdraw" (.18) differs from the other groups. Despite this, given the criteria of partial invariance (Reise et al. 1993), we conclude that these items generally measure the same construct, *condom knowledge*, across all the race-ethnic groups.

Third, for the factor *birth control confidence,* the factor loadings of "rhythm" were invariant for whites and foreign-born Hispanics (.79) but not for blacks (.92). In addition, for the item "condom1," we have invariance between two groups (whites and blacks, at .71) but not for foreign-born Hispanics (.94). These findings indicate that when all the items are considered together, we only found a partial invariant model (i.e., items generally measuring the same construct) when we make the comparisons between: 1) whites and blacks and 2) whites and foreign-born Hispanics.

The findings for the factor loadings for these three factors indicate that *biology knowledge* and *condom knowledge* have the same meanings across these three race-ethnic groups, so we tested the covariances between across all three groups. In contrast, the factor loadings for *birth control confidence* were only invariant when making comparisons between whites and blacks and between whites and native-born Hispanics, so we only tested the comparisons between these groups and the other factors. Our findings revealed complete invariance in the covariances when comparing blacks and whites (.22, .07, .04). Given this finding, and the results of either complete invariance (*biology knowledge*) or partial invariance (*condom knowledge* and *birth control confidence*) in the factor loadings, we are able to conclude that for white and black race-ethnic groups these items measure the same factors and that these three factors are viewed as three sub-dimension of a higher-order construct, *reproductive knowledge*. Conversely, there is complete variance when comparing the factor covariances between foreign-born Hispanics and whites, suggesting that while these items may measure the same constructs across these two groups, these items do not necessarily measure the same sub-dimensions of the higher-order construct of *reproductive knowledge.*

**Discussion**

In this paper, we sought to test whether the individual items typically used to measure knowledge of and attitudes toward sex, contraception, and childbearing tap into larger underlying constructs. We argued that reproductive behaviors and childbearing can be studied with our proposed concept of distal determinants, and we theorized there are two distinct components: *reproductive knowledge* and *fertility motivation*. Further, we expect that these components are themselves multidimensional. As a first step towards our proposed distal determinants model, we used a large, nationally representative survey of adolescents with a rich set of items to examine what constructs underlie these two components. Our results suggest that there are three factors for *fertility motivation*: (1) a factor that taps into global attitudes toward pregnancy and pregnancy risk; (2) a factor that assesses the potential costs of using contraception to avoid pregnancy; and (3) a factor that reflects perceptions of what would change if a pregnancy occurred. Similarly, our results suggest that there are three factors for *reproductive knowledge*: (1) a factor that indicates awareness of the biology of reproduction; (2) a factor that taps into knowledge about condoms; and (3) a factor that captures individual confidence about contraceptive knowledge.

Our secondary goal was to examine whether these factors are measured similarly and are similarly correlated for different race-ethnic groups. It has been suggested that higher levels of unintended fertility among race-ethnic minorities may reflect differences in motivation to avoid a pregnancy (Hayford & Guzzo, 2013) or less familiarity with contraceptive methods (Craig et al., 2014), but it cannot be assumed that these factors function similarly across race-ethnicity given that other widely used instruments, such as depression scales, differ across race-ethnicity (Perreira, Deeb-Sossa, Harris, & Bollen, 2005). For an instrument or factor to have the same conceptual interpretation across groups, the relationships of the observed variables and the underlying factor must be completely identical or highly similar across groups (Lubke, Dolan, Kelderman, & Mellenbergh, 2003); that is, they must have at least partial, if not full, measurement invariance. Otherwise, in the absence of measurement invariance, comparisons across race-ethnic groups are problematic because between-group differences might be measurement artifacts rather than true differences in the levels of a particular construct (Gregorich, 2006; Vanderberg & Lance, 2000).

As such, we tested for measurement invariance of the sub-dimensions of both *fertility motivation* and *reproductive knowledge* identified in the full sample analyses. The results suggest that the psychometric properties of these factor structures do indeed vary across race-ethnicity. We could not find an acceptable model to test for Asians and people of 'other' race-ethnic groups for either dimension, nor could we find an acceptable model for *reproductive knowledge* for native-born Hispanics. For *fertility motivation,* we found partial invariance of the factor loadings across all four race-ethnic groups for *attitudes toward pregnancy* and *life course consequences* but only partial invariance between whites and native-born Hispanics for *birth control attitudes.* Further, although we had identical factor covariances between *attitudes toward pregnancy* and *life course consequences* across groups, we did not have similar variances between these constructs and *birth control attitudes* across groups. Overall, then, we cannot use the identified factors to examine race-ethnic variation in *fertility motivation* without considering the different measurement properties. Similarly, for *reproductive knowledge,* the underlying pattern of correlations among items was different enough for native-born Hispanics, Asians, and the residual 'other' race ethnic group that a good-fitting measurement model could not be established for these groups. For non-Hispanic whites, foreign-born Hispanics, and blacks, factor loadings for two factors, *biology knowledge* and *condom knowledge*, were the same across groups. For the third factor, *birth control confidence,* some loadings were shared across all three groups, while loadings for other items were shared for only two groups, resulting in partial metric invariance. Analyzing covariance between factors showed a fully invariant model for whites and blacks but not for foreign-born Hispanic respondents.

Taken together, these results show that the associations between multiple measures of knowledge and attitudes about sex, contraception, and pregnancy can be explained by links to a set of unmeasured latent constructs which can be reasonably interpreted as representing *reproductive knowledge* and *fertility motivation*. However, the patterns of associations are not the same across all race-ethnic groups. Caution should be used when analyzing these survey items to compare levels of knowledge and motivation across different groups or the association between these constructs for different groups. For instance, only the *reproductive knowledge* factors could be used to analyze race-ethnic differences and, even then, only between blacks and whites. Perhaps more importantly, these findings also suggest we cannot necessarily expect these factors to relate to key reproductive outcomes in the same fashion across race-ethnicity.

In planned future analyses, we will continue to test the consistency and stability of measures of *reproductive knowledge* and *fertility motivation* by attempting to replicate this analysis for other datasets and by considering other possible axes of variation, for instance age and gender. We will also more explicitly test the association between these distal determinants of fertility, more proximate determinants such as sexual and contraceptive behaviors, and unintended fertility.

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**Table 1. Items and measure names (in parentheses) used in factor analyses of fertility motivation, along with weighted item means and standard deviations using The National Longitudinal Survey of Adolescence to Adult Health (Add Health), respondents aged 15 and older at Wave I**

| Question[A] | Full Sample | White | Black | Foreign-born Hispanic | Native-born Hispanic | Asian | Other |
|---|---|---|---|---|---|---|---|
| | Mean, SD | Mean, SD | Mean, SD | Mean, SD | Mean, SD | Mean, SD | Mean, SD |
| Imagine that sometime soon you were to have sexual intercourse with someone just once, but were unable to use any method of birth control for some reason. What is the chance that you would get (If R is male, add: your partner) pregnant? *(sexonce)* | 3.21 (0.976) | 3.23 (0.826) | 3.13 (1.191) | 2.95 (1.443) | 3.21 (1.229) | 3.25 (1.387) | 3.21 (1.114) |
| Getting (If R is male, add: someone) pregnant at this time in your life is one of the worst things that could happen to you.[RC] *(prgworst)* | 4.31 (1.007) | 4.41 (0.811) | 4.05 (1.297) | 4.07 (1.358) | 4.17 (1.446) | 4.38 (1.426) | 4.28 (1.169) |
| It wouldn't be all that bad if you got (IF R is male,add: someone) pregnant at this time in your life. *(notbad)* | 4.20 (1.006) | 4.32 (0.814) | 3.85 (1.276) | 3.77 (1.446) | 4.07 (1.353) | 4.35 (1.253) | 4.17 (1.162) |
| Using birth control is morally wrong.[RC] *(moral)* | 4.12 (1.053) | 4.21 (0.885) | 4.05 (1.237) | 3.64 (1.420) | 3.97 (1.436) | 3.82 (1.595) | 4.09 (1.232) |
| In general, birth control is too much of a hassle to use.[RC] *(bcbother)* | 4.03 (1.160) | 4.15 (0.961) | 3.81 (1.448) | 3.31 (1.510) | 3.91 (1.498) | 3.82 (1.663) | 4.06 (1.298) |
| It takes too much planning ahead of time to have birth control on hand when you're going to have sex.[RC] *(muchplan)* | 3.92 (1.108) | 4.03 (0.931) | 3.82 (1.337) | 3.21 (1.433) | 3.72 (1.439) | 3.63 (1.574) | 3.88 (1.208) |
| It {IS/WOULD BE} too hard to get a {GIRL/BOY} to use birth control with you. *(hardbc)* | 3.87 (1.069) | 3.94 (1.039) | 3.82 (1.132) | 3.48 (1.057) | 3.48 (1.057) | 3.52 (1.062) | 3.89 (1.113) |
| For you, using birth control {interferes/would interfere} with sexual enjoyment.[RC] *(pleasure)* | 3.76 (1.148) | 3.80 (1.002) | 3.78 (1.330) | 3.34 (1.368) | 3.65 (1.471) | 3.58 (1.491) | 3.74 (1.302) |
| In general, birth control is too expensive to buy.[RC] *(expensiv)* | 3.88 (1.091) | 3.94 (0.950) | 3.86 (1.259) | 3.51 (1.326) | 3.74 (1.378) | 3.74 (1.508) | 3.67 (1.27) |
| If you got (If R is male, add: someone) pregnant, you would be forced to grow up too fast. *(pregfast)* | 3.85 (1.155) | 3.97 (0.957) | 3.44 (1.484) | 3.66 (1.385) | 3.81 (1.469) | 3.91 (1.487) | 3.73 (1.371) |
| If you got (If R is male, add: someone) pregnant, you would have to quit school. *(quitsch)* | 2.40 (1.164) | 2.44 (1.013) | 2.05 (1.205) | 2.79 (1.542) | 2.42 (1.480) | 2.89 (1.830) | 2.51 (1.354) |
| If you got (If R is male, add: someone) pregnant, it would be embarrassing for your family. *(embrsfam)* | 3.64 (1.289) | 3.79 (1.079) | 3.05 (1.500) | 3.41 (1.603) | 3.41 (1.711) | 4.29 (1.430) | 3.76 (1.427) |
| If you got pregnant (If R is male, add: someone), it would be embarrassing for you. *(embrsme)* | 3.62 (1.356) | 3.81 (1.290) | 3.08 (1.411) | 3.22 (1.383) | 3.22 (1.383) | 4.04 (1.150) | 3.67 (1.341) |
| It is easy for you to get birth control (*easybc*) | 3.63 (1.229) | 3.66 (1.226) | 3.79 (1.269) | 3.31 (1.234) | 3.49 (1.238) | 3.11 (1.081) | 3.62 (1.149) |
| If you got pregnant, you might marry the wrong person, just to get married (*marry*) | 3.06 (1.311) | 3.02 (1.294) | 3.51 (1.327) | 3.20 (1.299) | 3.11 (1.274) | 2.52 (1.275) | 2.88 (1.428) |
| If you got pregnant, you would have to decide whether or not to have the baby, and that would be stressful and difficult. (*abort*) | 3.88 (1.249) | 3.92 (1.294) | 3.62 (1.331) | 3.48 (1.294) | 3.85 (1.226) | 4.12 (1.025) | 4.01 (1.203) |
| If you used birth control, your friends might think that you were looking for sex (*looksex*) | 3.49 (1.202) | 3.57 (1.186) | 3.37 (1.290) | 3.08 (1.146) | 3.247 (1.179) | 3.18 (1.115) | 3.43 (1.269) |
| **N** | 13,750 | 7,123 | 2,824 | 718 | 1,817 | 971 | 297 |

[A] All items measured on a scale of 1 (strongly agree) to 5 (strongly disagree) except *sexonce,* which is measured on a scale of 1 (almost no chance) to 5 (almost certain).

[RC] Reverse coded so that higher scores indicate more favorable attitudes toward contraception and less favorable attitudes toward pregnancy.

**Table 2. Items and measure names (in parentheses) used in factor analyses of reproductive knowledge, along with weighted proportions with correct answers using The National Longitudinal Survey of Adolescence to Adult Health (Add Health), respondents aged 15 and older at Wave I**

| | Full Sample | White | Black | Foreign-born Hispanic | Native-born Hispanic | Asian | Other |
|---|---|---|---|---|---|---|---|
| | % correct | | | | | | |
| Most women's periods are regular, that is, they ovulate or are fertile fourteen days after their periods begin.[A] *(ovulate)* | 26.80% | 25.94% | 27.98% | 28.57% | 28.30% | 29.77% | 28.52% |
| The most likely time for a woman to get pregnant is right before her period starts. [A] *(bfperiod)* | 42.20% | 41.67% | 42.54% | 43.67% | 44.11% | 42.13% | 49.65% |
| In general, a woman is most likely to get pregnant if she has sex during her period, as compared with other times of the month. [A] *(duperiod)* | 60.20% | 62.65% | 51.39% | 55.18% | 56.98% | 56.97% | 58.48% |
| When a women has sexual intercourse, almost all sperm die inside her body after about six hours. [A] *(spermdie)* | 59.70% | 57.19% | 64.59% | 57.38% | 61.49% | 65.40% | 63.96% |
| Even if the man pulls out before he ejaculates, even if ejaculation occurs outside of the woman’s body, it is still possible for the woman to become pregnant. [A] *(withdraw)* | 80.40% | 83.87% | 73.18% | 69.91% | 78.14% | 82.76% | 79.79% |
| When putting on a condom, it is important to have it fit tightly, leaving no space at the tip. [A] *(fittight)* | 57.00% | 59.24% | 57.42% | 49.63% | 57.57% | 51.14% | 59.66% |
| Vaseline can be used with condoms, and they work just as well. [A] *(vaseline)* | 68.60% | 68.68% | 71.29% | 57.12% | 66.80% | 66.15% | 73.90% |
| As long at the condom fit over the tip of the penis, it doesn't matter how far down it is unrolled. [A] *(unroll)* | 89.20% | 91.03% | 86.20% | 74.51% | 84.43% | 80.15% | 83.69% |
| You are quite knowledgeable about the rhythm method of birth control and when it is a “safe” time during the month for a woman to have sex and not get pregnant. [B] *(rhythm)* | 57.30% | 56.95% | 64.40% | 52.31% | 57.37% | 49.05% | 53.10% |
| You are quite knowledgeable about how to use a condom correctly. [B] *(condom1)* | 88.10% | 88.06% | 90.23% | 74.82% | 86.09% | 80.25% | 86.69% |
| You are quite knowledgeable about the withdrawal method of birth control. [B] *(withdra1)* | 69.30% | 67.96% | 75.35% | 66.04% | 70.94% | 60.95% | 65.86% |
| When using a condom, the man should pull out of the woman right after he has ejaculated [A]*(pullout )* | 74.39% | 75.02% | 75.40% | 65.88% | 74.21% | 63.48% | 79.53% |
| **N** | 13,677 | 7,098 | 2,799 | 709 | 1,811 | 966 | 294 |

[A] Measured as true and false and coded so that 1 equals the correct answer, and 0 equals the incorrect answer with the exception of rhythm, condom1, and withdra1 which were recoded as 1 = agree and 0=disagree.

[B] Originally meeasured on a scale of 1 (strongly agree) to 5 (strongly disagree). Recoded as a dichotomous variable: 1 (strongly agree and agree) and 0 (neutral, disagree, and strongly disagree)

**Table 3. Exploratory Factor Analysis (EFA) *Fertility Motivation* using Add Health: Comparing Model Fit**

| | DF | CFI | RMSEA | Chi-Square Test of Model Fit | Chi-Square Test for Difference Testing |
|---|---|---|---|---|---|
| *Full Sample* | | | | | |
| One-Factor Model | 65 | 0.531 | 0.107 | 10222.43 | --- |
| Two-Factor Model | 53 | 0.938 | 0.043 | 1387.406 | p = .000[1] |
| **Three-Factor Model** | **42** | **0.990** | **0.019** | **260.631** | **p = .000[2]** |
| Four-Factor Model | Too Few Items load on Factors | | | | |

[1] Significant differences between one-factor and two-factor model

[2] Significant differences between two-factor and three-factor model

**Table 4. Factor Loadings from Exploratory Factor Analysis (EFA) for Three-Factor Model of *Fertility Motivation* in Add Health**

| Factor 1: *Attitudes toward Pregnancy* | 1 | 2 | 3 |
|---|---|---|---|
| Imagine that sometime soon you were to have sexual intercourse with someone just once, but were unable to use any method of birth control for some reason. What is the chance that you would get (If R is male, add: your partner) pregnant? *(sexonce)* | .167* | | |
| Getting (If R is male, add: someone) pregnant at this time in your life is one of the worst things that could happen to you.[RC] *(prgworst)* | .795* | | |
| It wouldn't be all that bad if you got (IF R is male,add: someone) pregnant at this time in your life. *(notbad)* | .673* | | |
| Factor 2: *Birth Control Attitudes* | | | |
| Using birth control is morally wrong.[RC] *(moral)* | | .515* | |
| In general, birth control is too much of a hassle to use.[RC] *(bcbother)* | | .685* | |
| It takes too much planning ahead of time to have birth control on hand when you're going to have sex.[RC] *(muchplan)* | | .797* | |
| It {IS/WOULD BE} too hard to get a {GIRL/BOY} to use birth control with you. *(hardbc)* | | .682* | |
| For you, using birth control {interferes/would interfere} with sexual enjoyment.[RC] *(pleasure)* | | .647* | |
| In general, birth control is too expensive to buy.[RC] *(expensiv)* | | .683* | |
| Factor 3: *Life Course Consequences* | | | |
| If you got (If R is male, add: someone) pregnant, you would be forced to grow up too fast. *(pregfast)* | | | .325* |
| If you got (If R is male, add: someone) pregnant, you would have to quit school. *(quitsch)* | | | .332* |
| If you got (If R is male, add: someone) pregnant, it would be embarrassing for your family. *(embrsfam)* | | | .895* |
| If you got pregnant (If R is male, add: someone), it would be embarrassing for you. *(embrsme)* | | | .884* |

*p < .05

**Table 5. Exploratory Factor Analysis (EFA) Reproductive Knowledge using Add Health: Comparing Model Fit**

| | DF | CFI | RMSEA | Chi-Square Test of Model Fit | Chi-Square Test for Difference Testing |
|---|---|---|---|---|---|
| *Full Sample* | | | | | |
| One-Factor Model | 44 | 0.036 | 0.788 | 827.977* | --- |
| Two-Factor Model | 34 | 0.015 | .971 | 142.702* | p = .000[1] |
| **Three-Factor Model** | **25** | **.009** | **.993** | **51.025*** | **p = .000[2]** |
| Four-Factor Model | 17 | .006 | .997 | 26.590 | p = .100[3] |

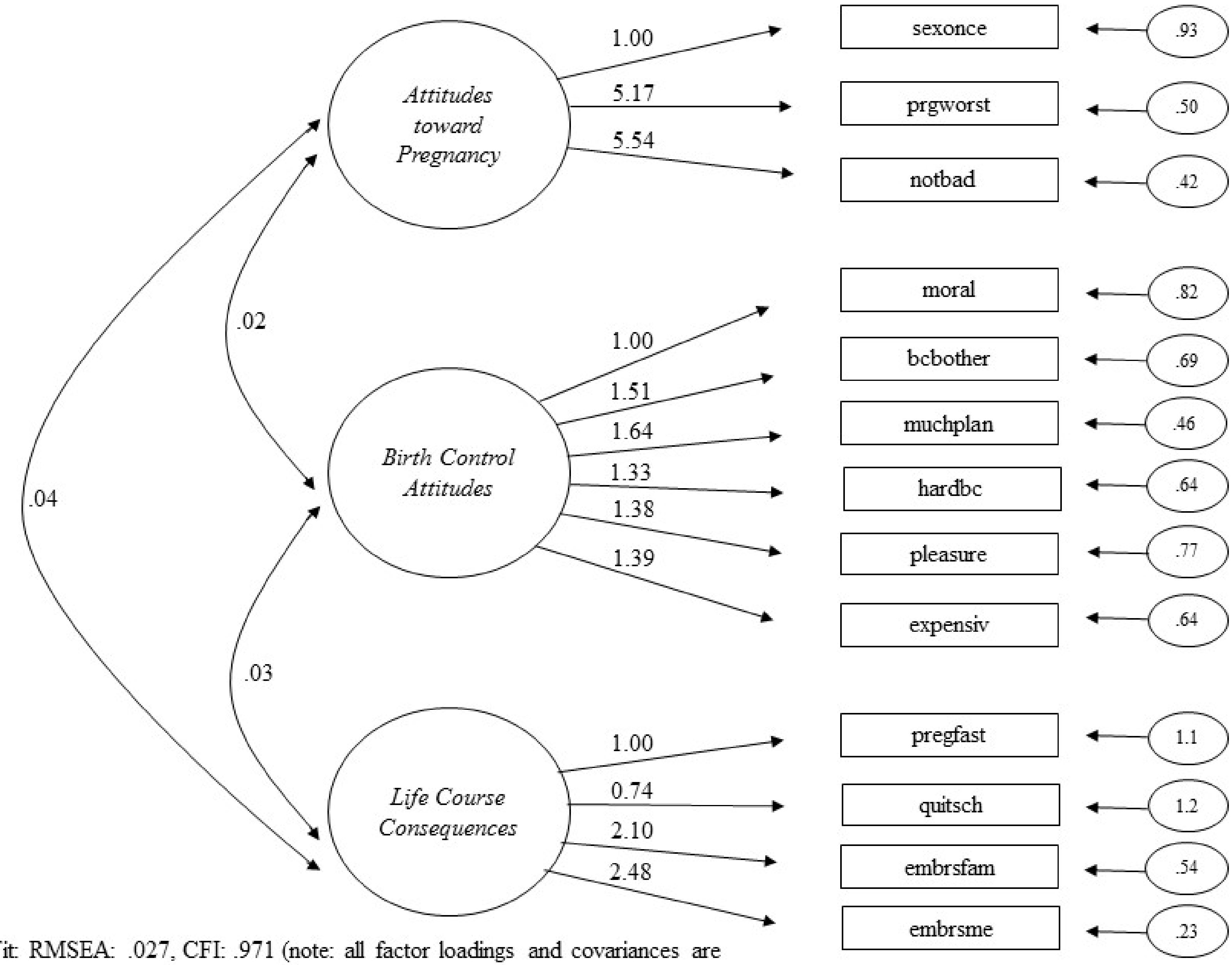
[1] Significant differences between one-factor and two-factor model
[2] Significant differences between two-factor and three-factor model
[3]Not significant improvement in model fit

**Table 6. Factor loadings from Exploratory Factor Analysis (EFA) for three-factor model of Reproductive Knowledge in Add Health**

| *Factor 1: Biology Knowledge* | 1 | 2 | 3 |
|---|---|---|---|
| Most women's periods are regular, that is, they ovulate or are fertile fourteen days after their periods begin. *(ovulate)* | 0.066* | | |
| The most likely time for a woman to get pregnant is right before her period starts. *(bfperiod)* | 0.729* | | |
| In general, a woman is most likely to get pregnant if she has sex during her period, as compared with other times of the month. *(duperiod)* | 0.281* | | |
| When a women has sexual intercourse, almost all sperm die inside her body after about six hours. *(spermdie)* | 0.069* | | |
| *Factor 2: Condom Knowledge* | | | |
| Even if the man pulls out before he ejaculates, even if ejaculation occurs outside of the woman's body, it is still possible for the woman to become pregnant. *(withdraw)* | | .281* | |
| When putting on a condom, it is important to have it fit tightly, leaving no space at the tip. *(fittight)* | | .528* | |
| Vaseline can be used with condoms, and they work just as well. *(vaseline)* | | .428* | |
| As long at the condom fit over the tip of the penis, it doesn't matter how far down it is unrolled. *(unroll)* | | .569* | |
| *Factor 3: Birth Control Confidence* | | | |
| You are quite knowledgeable about the rhythm method of birth control and when it is a "safe" time during the month for a woman to have sex and not get pregnant. *(rhythm)* | | | .770* |
| You are quite knowledgeable about how to use a condom correctly. *(condom1)* | | | .664* |
| You are quite knowledgeable about the withdrawal method of birth control. *(withdra1)* | | | .950* |

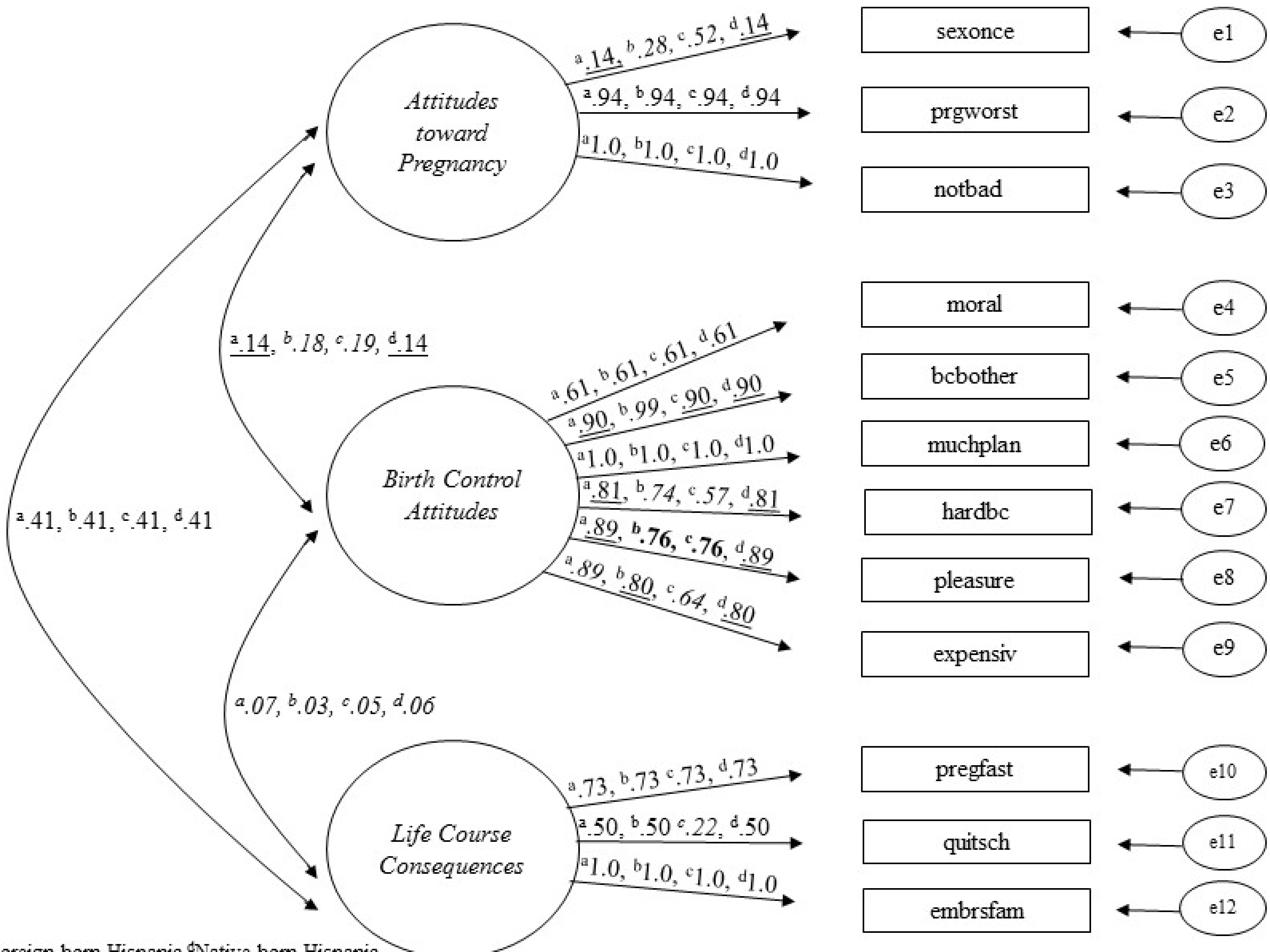
*p < .05

**Figure 1: Factorial model of fertility motivation from CFA using the full sample**




Model Fit: RMSEA: .027, CFI: .971 (note: all factor loadings and covariances are significant, $p < .001$)

**Figure 2: Measurement invariance testing used to find the factorial model of fertility motivation by race**



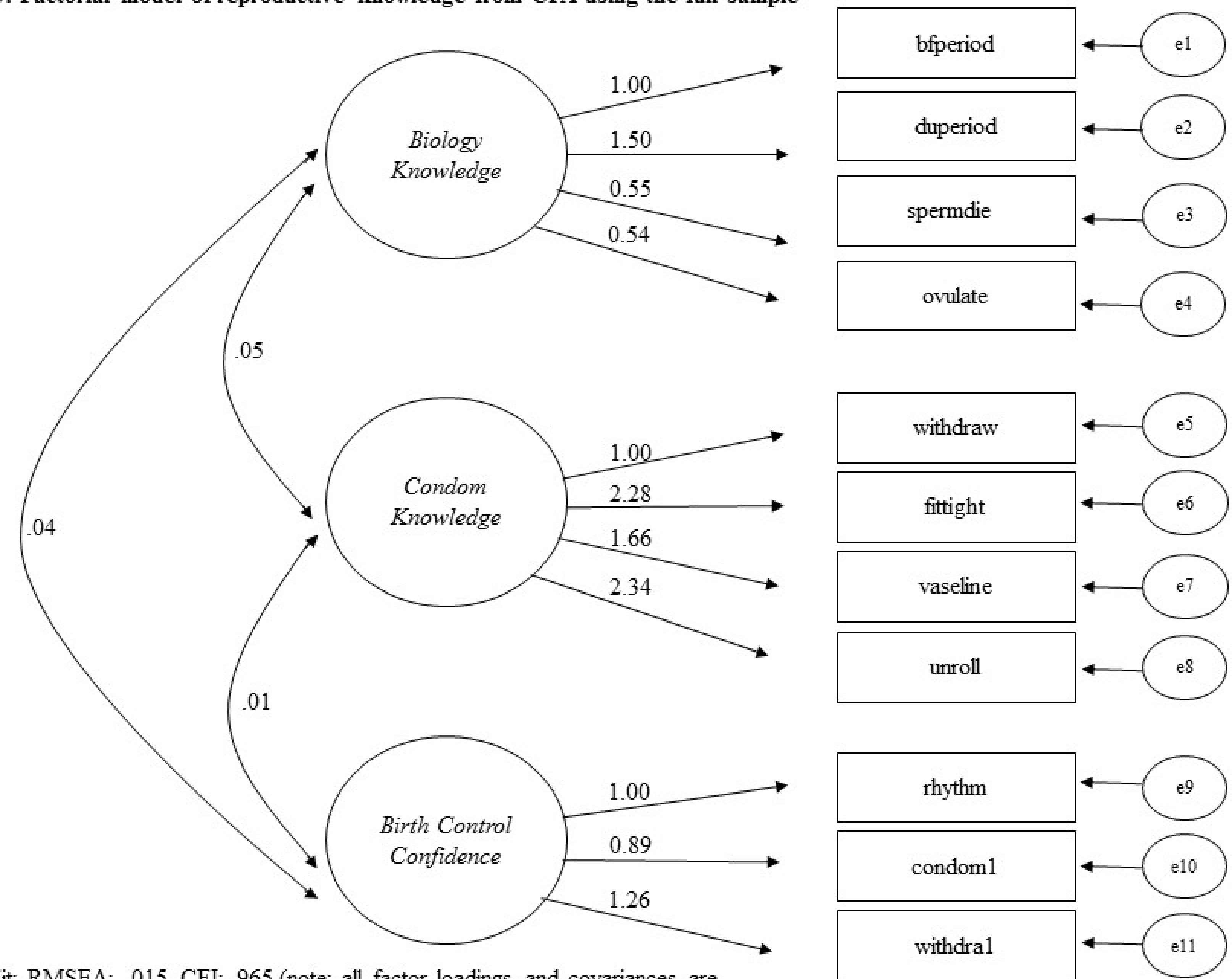

[a]White, [b]Black [c]Foreign-born Hispanic, [d]Native-born Hispanic

Underline/**Bold**: two/three racial-ethnic groups share factor loading/covariance/variance

*Italic:* no shared factor loading/variance with other race/ethnic groups

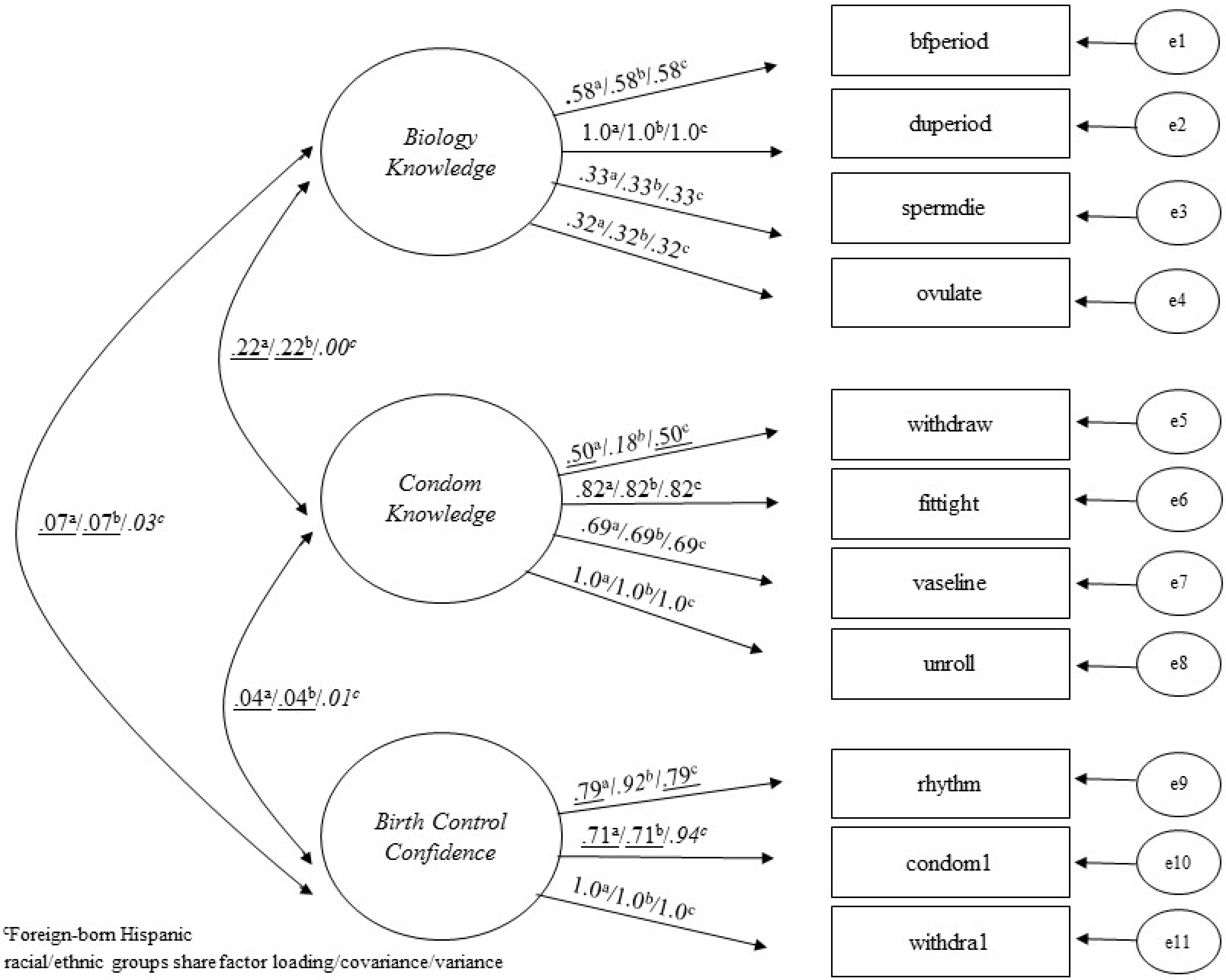
Model Fit: RMSEA .028, CFI .949

**Figure 3: Factorial model of reproductive knowledge from CFA using the full sample**




Model Fit: RMSEA: .015, CFI: .965 (note: all factor loadings and covariances are significant, $p < .001$)

**Figure 4: Measurement invariance testing used to find the factorial model of reproductive knowledge by race**




[a]White, [b]Black [c]Foreign-born Hispanic

Underline: two racial/ethnic groups share factor loading/covariance/variance

*Italic:* no shared factor loading/variance with other race/ethnic groups

Model Fit: RMSEA .016, CFI .946