Published in final edited form as:
Popul Stud (Camb). 2013 March ; 67(1): 25–38. doi:10.1080/00324728.2012.738823.

The effects of ambivalent fertility desires on pregnancy risk in young women in Michigan, United States

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Abstract

Many different definitions of the construct of motivational ambivalence have appeared in the literature on reproductive health. Using a theoretical framework in which motivational ambivalence is defined as an interaction between positive and negative pregnancy desires, we propose two hypotheses. The first is that positive and negative pregnancy desires independently predict the risk of an unplanned pregnancy. The second is that ambivalence and three related constructs that are also based on the interaction between positive and negative desires are each important predictors of pregnancy risk. We use weekly journal data collected from a U.S. sample of 1,003 women aged 18–19 years and conduct hazard model analysis to test our hypotheses. Using both dummy and continuous predictors, we report results that confirm both hypotheses. The proposed interaction framework has demonstrated validity, compares favorably with previously reported alternative approaches, and incorporates a set of constructs that have potential importance for further research directed at the prevention of unplanned pregnancy.

Keywords

positive pregnancy desires; negative pregnancy desires; ambivalent motivation; indifferent motivation; pronatal motivation; antinatal motivation; pregnancy risk, unplanned pregnancy; adolescent pregnancy

The subject of 'mixed feelings' has provoked interest and debate for centuries. Socrates is reported to have pointed out that tragic plays provoke 'pleasure in the midst of tears' and many subsequent scholars have supported the contention that positively and negatively valenced emotions can be experienced simultaneously (Larsen and McGraw 2011). In a 1911 paper on schizophrenia, the psychiatrist Bleuler coined the term ‘ambivalence’, which he said reflected two opposing feelings toward the same target, and Freud subsequently incorporated the construct of ambivalence into his psychoanalytic theory, postulating that one of the two opposing feelings was typically repressed from consciousness (Freud 1959). In the field of family planning, Miller (1986) used the concept of ambivalence to refer to the struggle that women of reproductive age have between their positive and negative feelings about getting pregnant as well as their positive and negative feeling about their current contraceptive method. Zabin (1993) studied the extent to which adolescents wanted babies and concluded that ambivalence about their desire for a child, about their use of contraception, and in the perception of their partners’ childbearing desires was substantively important for their reproductive behaviour.

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In the last decade the number of studies utilizing the idea of ambivalence, especially those focusing on unplanned pregnancies among adolescents and youth, has expanded considerably. Although this testifies to the potential usefulness of the construct, a problem associated with this increased use is that ambivalence is defined in different ways in different studies. Thus a number of studies (Crosby 2002; Jaccard et al. 2003; Frost et al. 2004) have assessed the attitude toward pregnancy of women who were contracepting or at least not seeking pregnancy by using a bipolar scale, or its equivalent, in which the positive pole expressed a favorable attitude toward getting pregnant and the negative pole expressed an unfavorable attitude. In this group of studies ambivalence was attributed to those who endorsed the positive pole of the scale even while their situation was unfavorable to a pregnancy. Second, a number of studies (Schunmann and Glasier 2006; Schwarz et al.2007; Sipsma et al. 2011) have also used a bipolar scale or its equivalent to assess the attitude toward getting pregnant of a similar group of women, but in this case ambivalence was attributed to those whose attitude fell at the midpoint of the scale, and thus was neither favorable nor unfavorable. Third, some studies (Heil et al. 2011) have counted as ambivalent those women who said they 'didn’t know' or were 'unsure' in response to a pregnancy attitude question. And fourth, some studies (Zabin et al. 1993) have measured ambivalence as the degree of inconsistency of responses to multiple items that ask about attitudes toward having a baby or using contraception.

Recently, two additional ways of defining ambivalence have appeared in the literature, both based on the innovative design of response categories for questions related to childbearing. Sheeder and colleagues (2010) investigated the attitudes of 350 women toward getting pregnant. The attitude inventory compared two different response formats, but the one of interest here had three response categories for a question about how much the respondent would like to get pregnant now. These were: (i) I really do want to have a baby now; (ii) I go back and forth, so both are true for me; and (iii) I really do not want to get pregnant now. Category 2 was considered the ambivalent response. In the other innovative study, McQuillan and colleagues (2011) used data from a large national survey of women and some of their partners. Respondents were asked about their pregnancy intentions with the question: 'Currently, are you pregnant, trying to get pregnant, trying not to get pregnant, or are you okay either way?' Those who responded that they were 'okay either way' were considered ambivalent. The data analysis used attitudinal, life course, and demographic characteristics to predict pregnancy intentions, with the focus on the ambivalent group.

Each of these six ways of defining motivational ambivalence about childbearing makes some intuitive sense given our common, everyday understanding of what it means to feel ambivalent. However, this situation has two important drawbacks for the generation of a deeper understanding of the construct. One drawback is that multiple distinct definitions makes it almost impossible to compare studies using these different approaches because we can never be certain to what extent the study findings about ambivalence are a result of the phenomenon itself as opposed to the definition being used. The other drawback has to do with the common failure by investigators to delineate any explicit theory about why the chosen measurement approach can be said to represent ambivalence. Although these studies may be based on an implicit theory that appeals to our common sense, unless researchers make that theory explicit, our ability to evaluate the implications that any new research findings may have for the full meaning of the construct is substantially compromised. The current situation cries out for studies that use specific theoretical approaches to the ambivalence construct to generate and test hypotheses and, where possible, to make direct comparisons between the different approaches with respect both to the antecedents and the consequences of ambivalence.

In this paper we describe a theoretical framework that might be applied to motivational ambivalence about childbearing and report a test of the performance of the framework in predicting the occurrence of pregnancy in a population-based sample of unmarried US women aged 18 and 19 years. In the course of doing this we will present a set of motivational constructs that we have developed—including ambivalent, indifferent, pronatal, and antinatal motivation—and show how these constructs, and our theoretical framework more generally, help to integrate many of the diverse findings in the research literature described above.

Theoretical framework

Extensive psychological research supports the existence of two primary dimensions underlying the human experience of affect (Stanley and Meyer 2009). Cacioppo and colleagues (1999) have studied the affective components of attitudes, preferences, and behavioural expression. They argue that all organisms use two specialized evaluative channels that process information in parallel: one that derives appetite-related (positive) information and another that derives threat-related information. Each of these channels then governs a behavioural response, which is 'approach' in the case of positive information and 'withdrawal' in the case of negative information. However, despite the underlying existence of two independent unipolar affective dimensions (i.e., those that go from ‘none’ or ‘zero’ to a single high pole), situational constraints tend to restrict behavioural responses to either an approach or a withdrawal response. Similarly, in spite of two independent underlying dimensions of evaluation, mental guides for action such as attitudes or preferences may be more stable when organized in a single bipolar form that allows individuals (i) to choose one pole or the other and (ii) to resolve any cognitive dissonance by amplifying the positive features and diminishing the negative features of the chosen alternative and doing just the opposite for the alternative not chosen. Cacioppo and colleagues point out that the presence of separate positive and negative affective channels may lead to characteristic difficulties in thought and action. Specifically, if a particular object or goal strongly elicits both positive and negative affects from their respective systems, the result will be motivational ambivalence; and if that object or goal elicits both affect systems weakly, the result will be motivational indifference.

These ideas apply well to the motivational antecedents of fertility and fertility regulation. Miller (1994) has described the motivational sequence that leads to fertility behaviour as beginning with the traits that motivate people for childbearing, which then lead to the desires to have children, which in turn lead to the intentions to have children. He developed a measure of two broad childbearing motivational traits (1995), one positive and the other negative, and demonstrated in a sample of married men and women (1994) that they both predicted the next step in the motivational sequence, namely fertility desires, and to a lesser extent the step after that, namely fertility intentions. Relevantly to our discussion here, he found that these two motivational traits were largely uncorrelated with each other. These findings strongly suggest that the motivational state immediately downstream of motivational traits in the sequence, namely fertility desires, has separate positive and negative components that may operate independently. Traditionally the measurement of fertility desires has consisted of either a bipolar scale (e.g., from ‘Strong desire to have a child’ to ‘Strong desire not to have a child’) or a single positive unipolar scale (e.g., from ‘Strong desire to have a child’ to ‘No desire to have a child’). In the study reported here, in keeping with the distinction between positive and negative affect systems, we used two separate unipolar measures of childbearing desires, one positive and one negative, in order to test the predictive power of motivational ambivalence and related constructs.

The relationship between two unipolar measures of childbearing desires can be captured with a standard cross-tabulation. Figure 1 shows a graphic representation of such an interaction using two six-category pregnancy-desire variables, one positive (pronatal) and the other negative (antinatal). The six categories of the desire not to have a child increase in strength from left to right and are labelled across the top of the graph, while the six categories of the desire to have a child increase in strength from top to bottom and are labelled on the left side of the graph. Four quadrants are indicated on the graph and labelled according to the motivational implications of the combination of positive and negative desires that each one represents. Thus people who score high (4, 5, and 6) on negative childbearing desires and low (1, 2, and 3) on positive childbearing desires fall in the antinatal quadrant; those who score low on negative desires and high on positive desires fall in the pronatal quadrant; those who score high on both negative and positive desires fall in the ambivalent quadrant; and, those who score low on both negative and positive desires fall in the indifferent quadrant. Also shown are four 'pole cells', one in each quadrant, that represent the strongest expression of the type of motivational interaction represented by each quadrant. We discuss the different approaches we take to the creation of ambivalent, indifferent, pronatal, and antinatal motivation variables in the Methods section.

This theoretical framework led us to two broad hypotheses about the relationship between the motivational constructs discussed above and the risk of pregnancy. Our first hypothesis was that both positive and negative desires were valid predictors of pregnancy risk, with each one accounting for separate variation in that risk in a multivariate model. Our second hypothesis was that each of the four interaction variables—ambivalent, indifferent, pronatal, and antinatal desires—was a valid predictor of pregnancy risk, again with each one accounting for separate variation in that risk in a multivariate model.

Methods

Study design and sample

The Relationship Dynamics and Social Life (RDSL) study was a representative population-based sample of 1,003 women aged 18 to 19 residing in a single, preselected county in Michigan. This age group was selected because women aged 18 to 22 have the highest rates of unintended pregnancy. In part, the Michigan county in which we conducted our study was selected because it had a substantial proportion of both African American and white respondents, with both working class and middle class respondents in each group. In addition, the proximity of this county allowed us to maximize direct investigator involvement with the study population..

To be eligible, women had to be 18 or 19 and living in the Michigan county at the time of sampling, the only exception being women who were temporarily living outside the county to attend school, job training, etc. The sampling frame was the Michigan Department of State driver's license and Personal Identification Card (PID) database. Comparison of the driver's license and PID data by zip code with 2000-Census-based projections revealed 96 per cent agreement between the frame count and the projections for this population (Barber et al. 2010). Michigan falls around the national median on many measures that are key to the reproductive life course, such as cohabitation, marriage, age at first birth, completed family size, nonmarital childbearing, and teenage childbearing (Lesthaeghe and Neidert, 2006). Thus, while the RDSL sample is not nationally representative, it is representative of a state that is not a national outlier.

A 60-minute face-to-face baseline survey interview was conducted between March 2008 and July 2009. This gathered data on basic characteristics of respondents: important aspects of family background; demographic information; key attitudes, values, and beliefs; current and

past friendship and romantic relationships; education; and career trajectories. At the conclusion of this interview, all respondents were invited to participate in a weekly journal-based study, a mixed-mode (internet and telephone) survey that would track pregnancy status for 2.5 years. Each week respondents could choose to complete the journal either by logging into the study's secure website, or by calling a no-charge number and completing the journal with a live interviewer. In order to maximize the response rate, we took the following steps. Respondents were paid US$1 per week for completing the week's journal, with US$5 bonuses for completing five weekly journals in a row. Automated reminder email and/or text messages were sent to respondents weekly. If a respondent was late, study staff attempted to contact her first by telephone, and later by email and letter, in an effort to regain her participation. Respondents who became 60 or more days late were offered an increased incentive for completing the next week's journal. Small gifts (e.g., a pen, lip balm, compact, pencil) were also given to respondents to award continued participation.

Our incentive scheme, coupled with the cooperative nature of this age group and their interest in the subject matter, resulted in extremely high cooperation rates: a response rate of 83 per cent and a cooperation rate of 94 per cent for the baseline interviews. Over 99 per cent of respondents (N=992) who completed a baseline interview enrolled in the weekly journal part of the study.

In the RDSL journal study, respondents were asked about their behaviour since the last interview. If no interview had been conducted for more than14 days, data for that interval was treated as missing. For the overall sample we collected 58,594 journals out of a total of 128,960 possible person-weeks (992 respondents completing 130 weeks of the journal). The modal number of days between journals was 8. We limited the analyses reported here to data collected during all respondents' first 18 months of enrolment, excluding any weeks married or already pregnant. We also excluded women who completed some or all of the first three journals but then dropped out of the study, because three weeks was the look-back period from a pregnancy- risk week to a week when pregnancy desires had been previously reported (see the next to last paragraph in the Methods section). The group that remained after these three exclusions comprised 887 women who had completed 34,377 journals. Nineteen per cent of these women had missing data in at least one journal because no data had been collected for more than 14 days after the previous journal.

Measures

Core variables of pregnancy desires—Because of the late-teenage status of the RDSL respondent pool, our two core variables of positive and negative childbearing desires were measured with the following two questions about pregnancy desires:

> You know, getting pregnant and having a baby is a big event, one that has a lot of consequences. Most people your age have some positive and some negative feelings about getting pregnant and having a child. For this reason we are going to ask you first how much you want to get pregnant, using a scale from 0 to 5. Then we are going to ask you how much you want to avoid getting pregnant, using a scale from 0 to 5.
>
> First, how much do you want to get pregnant during the next month? Please give me a number between 0 and 5, where 0 means you don‘t at all want to get pregnant and 5 means you really want to get pregnant
>
> And next, how much do you want to avoid getting pregnant during the next month? Please give me a number between 0 and 5, where 0 means you don‘t at all want to avoid getting pregnant and 5 means you really want to avoid getting pregnant.

Variables based on different interactions between the core variables—We used interactions between the two core variables of pregnancy desires as building blocks for all the other motivational measures that were used in the analyses. There were a number of ways to create interaction variables using the framework represented in Figure 1. One approach was to calculate measures based on the difference between scores on positive and negative desires. We created a signed-difference variable by subtracting each respondent's negative desires score from her positive desires score. In addition we created an absolute-difference variable for each respondent by calculating the absolute value of her signed-difference score. These two difference measures are common approaches to studying the interaction between two variables. A signed difference may be used to indicate which of the two opposed measures is more highly valued. An absolute difference may be used to indicate the degree of conflict that exists between the two opposed measures regardless of the direction of conflict.

Another way to create interaction variables was to use the product of each respondent's scores on positive and negative desires. Using our two six-category core measures, we could create continuous product measures representing all four of the key constructs from our theoretical framework and with scores varying from 1 to 36. Depending upon which construct was being created, recoding of the positive or negative core measure was required with three of the four measures. Thus in order to create the continuous ambivalent measure, no recoding was required. This resulted in a high score of 36 (from 6 on negative desires×6 on positive desires) and a low score of 1 (from 1×1). For the other three continuous variables, we obtained the same 36-point scale by recoding as follows: for the continuous antinatal measure, we recoded positive desires so that 6 became 1, 5 became 2, and so on; for the continuous pronatal measure, we recoded negative desires that way; and for the continuous indifferent measure, we recoded both positive and negative desires that way.

It should be noted that scores on these four product variables are all weighted toward the high end as a result of the multiplication. For example, consider the scores along the diagonal of Figure 1 for the continuous ambivalent measure. The six product scores in those diagonal cells are 1, 4, 9, 16, 25, and 36. This series shows a progressive increase in the size of each interval between scores, giving a progressively greater weight to each higher score. Without this weighting, the ambivalence and indifferent continuous measures would more closely resemble reverse-coded equivalents, as would the pronatal and antinatal continuous measures.

Finally, another way to create interaction variables was to calculate dichotomous, quadrant-based combinations of the two core measures. Using this approach we created four dummy variables, each one based on all the cases falling in one of the four quadrants. We also created a dummy variable based on the pole cell of the antinatal quadrant because of the very large proportion of cases that clustered in that cell. We also lumped the remaining cases in that quadrant into a second dummy in order to test if the cases in the non-pole cells as a group behaved differently from the pole-cell cases in predictive models.

Pregnancy—Each week, in the journal, respondents were asked, 'Do you think there might be a chance that you are pregnant right now?' Respondents who answered 'yes' were asked, 'Has a pregnancy test indicated that you are pregnant?' Respondents who answered 'yes' to the question about the pregnancy test were coded '1' for pregnant.

Control variables—A large number of the background characteristics of respondents recorded at the baseline interview were included as controls in the analysis. Descriptive statistics for these measures are shown in Table 1. Race was included as a dichotomous indicator for African American versus non-African American. Two variables measured

education: whether the respondent was enrolled in school full-time (part-time enrollment and non-enrollment together were the reference category); and whether the respondent had graduated from high school. A respondent was coded as receiving public assistance if she reported current support from at least one of the following: (i) Women, Infants, and Children Program; (ii) Family Independence Program; (iii) cash welfare; or (iv) food stamps. The importance of religion was based on the question, “How important, if at all, is your religious faith to you? Would you say not important (1), somewhat important (2), very important (3), or more important than anything else (4)?”. A dichotomous measure indicated whether the respondent’s biological mother was less than 20 years old at her first birth. Family structure was based on the questions, 'While you were growing up, which of the following people did you live with?/Which of these people did you live with for the majority of the time when you were growing up?'. A dichotomous measure indicated whether the respondent’s mother’s education was less than high school. Parents’ income was measured through a series of dichotomous variables; the reference category was < = US$14,000. Previous sexual experiences were captured by four measures: a dichotomous indicator of whether the respondent was aged 16 years or less at first coitus (coded zero for respondents who had not yet had sexual intercourse); whether she had had two or more sexual partners; whether she had ever had sexual intercourse without birth control; and her number of previous pregnancies. We controlled for the respondents' current relationship status in two ways. First, a dichotomous measure indicated whether the respondent was cohabiting with her partner. In addition, any journals in which a respondent was pregnant were excluded from the analyses. Age was a continuous measure, in years. Time-to-pregnancy and time-to=pregnancy squared measured the length of the interval(s) a respondent had been at risk of pregnancy. Number of journals indicated the total number of observations a respondent had contributed to the data, thereby controlling for the effect of repeated measurement and the respondent’s level of participation in the study. Finally, it should be noted that we did not control for sexual or contraceptive behaviours because both are ways that women modulate the risk of pregnancy. We were not interested in controlling for risk but rather in how the motivational variables of our model affected the way our sample dealt with pregnancy risk.

Models of the hazard of pregnancy

We estimated two-level hazard models in order to analyse the effects of pregnancy desires on pregnancies nested within women. Because the data were precise to the week, we used discrete-time methods to estimate these models. Person-weeks of exposure were the unit of analysis. We examined all pregnancies reported by a respondent in the journal (i.e., 1st, 2nd, etc.), and included a time-varying control variable indicating the number of previous pregnancies. We considered women to be at risk of pregnancy during all weeks they reported that they were not currently pregnant. Consequently, journals in which a respondent was pregnant were excluded from the analyses after the initial report of the new pregnancy. Although using person-weeks of exposure to risk as the unit of analysis substantially increased the sample size, Petersen (1986; 1991) and Allison (1982; 1984) have shown that using discrete-time methods do not deflate the standard errors and thus provide appropriate tests of statistical significance. Furthermore, because the probability of becoming pregnant was so small within each week, the estimates obtained using discrete-time methods were similar to those that would be obtained using continuous methods.

Our time-varying variables of pregnancy desires were measured three weeks before the current week of pregnancy status in the hazard model, in order to measure these characteristics before the sexual intercourse that had resulted in the pregnancy. In other words, all time-varying covariates were lagged by three weeks. We adopted this strategy to guard against reciprocal causation, because a young woman’s recent discovery that she was pregnant may have affected her pregnancy desires. Of course, a couple’s sexual and

contraceptive behaviour may also have affected the woman's pregnancy desires, and thus our use of the time lag did not completely solve the reciprocal causation problem.

We estimated univariate hazard models predicting pregnancy by each of the core motivation measures and each of the motivation variables based on interactions between the two core measures. Separately we estimated multivariate hazard models predicting pregnancy by the two core measures together and by four of the six dummy quadrant-based variables together (in the latter case omitting the antinatal and pole-cell dummies, in order to avoid problems with collinearity). We anticipated that coefficients for the predictor variables would be stronger in the multivariate model because the presence of several closely related dummy variables in the model allowed each dummy to partial out some variance that reduced the explanatory power of each of the other dummies.

Results

During the period of study, 887 women rated their positive and negative pregnancy desires 34,377 times. Of these ratings, 91.5 per cent fell in the antinatal pole cell, 3 per cent fell in the remainder of the antinatal quadrant, and 2 per cent, 1 per cent, and 2.5 per cent fell respectively in the ambivalent, indifferent, and pronatal quadrants. Although a very large proportion of cases fell in the antinatal pole cell, the number of ratings falling outside that cell in the four quadrants is large enough to justify our hazard analyses. During the period of study, the 887 women reported the occurrence of 126 pregnancies, 12 of which were the second pregnancy reported during the study. Of the 108 pregnancies for which we have outcome information, 74 ended in a live birth, 1 ended in a still birth, 22 ended in a miscarriage, and 11 ended in an abortion.

Table 2 reports the descriptive statistics for all the motivation measures included in the hazard modelling. Each of these measures was tested alone in the prediction of pregnancy, while controlling for background variables; most were also tested in conjunction with one or more of the other motivational measures. The data for the two core measures show that the mean desire to become pregnant in our sample is quite low (1.20) on a scale from 1 to 6 and the mean desire to avoid pregnancy is quite high (5.79). The high negative value of the signed-difference variable indicates that the respondents preponderantly value the avoidance of pregnancy. The high positive value on the absolute-difference variable indicates that the sample respondents experienced relatively little conflict between the two core measures of motivation. The very high score for the antinatal continuous variable reflects the large proportion of respondents located in the antinatal quadrant. Similarly, the very high scores for the antinatal dummy and the antinatal pole-cell dummy reflect the large proportion of respondents located in the antinatal quadrant.

Table 3 reports separate hazard models for the core positive and negative pregnancy- desires measures that are central to our first hypothesis, as well as a model that includes both measures simultaneously. It also reports the two models based on their signed difference and their absolute difference. For the sake of brevity, the results for the control variables are not included in the Table. All of the coefficients in Table 3 are significant and have the expected valence. Greater positive desires predict a greater hazard of pregnancy and greater negative desires predict a lesser hazard, both separately and when together in a multivariate model. A higher score on the signed-difference measure, which reflects a greater value placed on positive desires relative to negative desires, predicts a greater hazard of pregnancy. Similarly, a higher score on the absolute-difference measure, which reflects a smaller discrepancy between positive and negative desires and thus potentially a greater net motivational uncertainty, predicts a lesser hazard of pregnancy.

Three summary statistics are reported for each model in Table 3. A larger Chi Square indicates a more significant model and a larger Pseudo R^2 indicates that more variance in the dependent variable (hazard of pregnancy) is accounted for by the model or, reported separately, by the motivational variables alone. The log likelihood statistic is always a negative number and indicates a better fit of the model as it decreases in magnitude (approaches zero). Because most pairs of models reported here are not nested (composed of the same variables, but with one model having one or more additional variables), a strict test of which of any two models has a better fit cannot be made in most cases. With that caveat in mind, several comparisons between the models in Table 3 are noteworthy: the positive-desires model appears to perform worse in terms of the Chi Square statistics than either the negative-desires model or the combined positive-and-negative-desires model; in the combined model both predictors are significant; the signed-difference model appears indistinguishable from the negative-desires and combined positive-and-negative-desires models in all three summary statistics; and the absolute-difference model appears to perform worse than all the other models shown in those statistics.

Table 4 reports the hazard analysis for the six measures that are central to our second hypothesis. It includes a model each for the ambivalent, indifferent, pronatal, and antinatal dummy variables and two models based on two components of the antinatal dummy variables, one with all the non-pole cells combined and one for the pole cell alone. Five of the six model coefficients are significant and all have the expected valence. The ambivalent, indifferent, and pronatal measures all strongly predict a greater hazard of pregnancy, and the antinatal and the antinatal pole measures strongly predict a lesser hazard. The antinatal non-pole measure predicts a greater hazard but fails to reach significance ($p = 0.26$). The final model in Table 4 is multivariate and includes the ambivalent, indifferent, and pronatal measures, as well as the one representing the non-pole portion of the antinatal quadrant. The same overall pattern of coefficient valence and significance is found in this model as in the individual dummy models, but in this case the antinatal non-pole dummy variable does achieve significance ($p = 0.02$) in the expected direction. As expected, the coefficients of all predictors in the multivariate model are appreciatively larger than their respective univariate model coefficients.

Among the single-variable models in Table 4, the Chi Square and Log Likelihood statistics for the pronatal model is modestly stronger than those for both the ambivalent and indifferent models but the statistics for all three models are considerably weaker than those for the antinatal model. The statistics for the non-significant antinatal non-pole cells dummy model are, of course, weakest of all. The final two models in the Table include one with a single dummy variable based on the antinatal pole-cell dummy, where the great majority of our respondents fall, and one with the four dummy variables together that constitute the single best test of our second hypothesis. These two models are generally comparable to the antinatal dummy model but have slightly superior summary statistics. For example, they have the highest Chi Square values of all models in Tables 3 or 4. In addition, the multivariate model has the lowest Log Likelihood value and the highest Pseudo R^2s observed in Tables 3 and 4.

The results for the continuous-variable models show that the four principal measures (ambivalent, indifferent, pronatal, and antinatal) have an average Chi Square value 2.7 higher than that for their four corresponding dummy variables and an average Log Likelihood value 1.4 lower. Although this indicates a slightly superior performance for the continuous variables, the pattern of results is so similar that we do not display these results in tabular form, partly for the sake of brevity and partly because with the continuous variables, we cannot test our second hypothesis through a combined analysis similar to that shown in the last column of Table 4. This is because it is impossible to create a continuous

antinatal variable equivalent to the non-pole dummy without recoding all cases in the pole cell and thereby completely changing its meaning and performance.

Discussion

The results provide good support for both of our hypotheses. Table 3 shows that positive and negative pregnancy desires predict the hazard of pregnancy both independently and when combined together in a multivariate analysis. It is often argued that a consistently strong motivation to avoid pregnancy is the single most important factor in preventing an unplanned pregnancy. Our findings do show that negative pregnancy desires perform somewhat better than positive desires, both by themselves and in a combined model, but the importance of positive pregnancy desires approaches that of negative desires and cannot be overlooked. Although both the signed-difference and absolute-difference models predict significantly, only the signed- difference model is comparable to the combined model in summary statistics.

Table 4 shows that each of the four interaction variables defined by our theoretical framework—ambivalent, indifferent, pronatal, and antinatal desires—predict the hazard of pregnancy both in a univariate and multivariate context. When the antinatal variable is divided into its pole and non-pole components as shown in Table 4, the antinatal non-pole dummy variable falls slightly short of significance primarily because the reference group includes antinatal pole-cell respondents as well as those who are pronatal, ambivalent, and indifferent. However, in the multivariate model it achieves significance, indicating that the antinatal non-pole-cells group is distinct from the antinatal pole-cell group and similar to the pronatal, ambivalent, and indifferent groups in the prediction of pregnancy. A useful way of thinking about this multivariate model is that any deviation from the antinatal pole cell—i.e., a score of less than 6 for negative desires or more than 1 (less than 6 after recoding) for positive desires, or both—indicates an increased risk of pregnancy. The log likelihood statistic for this model has the smallest magnitude of any model in our results, underscoring the important potential of our theoretical framework.

It should be noted that the antinatal pole-cell dummy has the next smallest log likelihood statistic of any model in our analyses and the largest Chi Square statistic, indicating that this far simpler model is statistically roughly equivalent to the multivariate dummy model. Further, because the ambivalent, indifferent, and pronatal dummy variables have coefficients of approximately equal strength and significance, one could simply conclude that any deviation from either the highest negatives desires or the lowest positive desires increases the risk of pregnancy. Although there may be advantages to this simpler approach, we are at too early a point in the research on this theoretical framework to anticipate fully what the disadvantages may be. Thus it may be that if we are measuring the motivational traits that underlie the desire for a pregnancy, rather than the desire itself, we will not find such a large preponderance of cases falling in the antinatal pole cell. For example, Miller et al. (2012) have found in a sample of young, urban African American women that the scores based on the interaction of Miller's (1995) positive and negative childbearing motivation scales were distributed primarily (60 per cent) in the pronatal quadrant and secondarily (30 per cent) in the ambivalent quadrant. Further, the study presented here examined the behaviour of a select group of women at a very specific point in their growth and development. It seems very likely that ambivalent motivations and the related phenomena described in our framework vary not only across sex but, of equal importance, across the roughly forty-year span of reproduction. A simpler approach taken at this point in our understanding would likely preclude finding the natural variations that occur in the interactions between the positive and negative motivational forces. Finally, it has to be kept in mind that even if it were found that any deviation from the antinatal pole cell increases risk at roughly the same

rate regardless of whether it is in the direction of ambivalence, indifference, or pronatalism, the psychological dynamics of those three directions would almost certainly differ considerably, as would the interventions that might be used against them in order to reduce the likelihood of an unwanted pregnancy. To grasp these differences fully, one has only to imagine trying to conduct family-planning counselling with someone from the ambivalent pole who was highly conflicted about the possible occurrence of a pregnancy, someone from the indifferent pole who was quite apathetic about it, or someone from the pronatal pole who was basically enthusiastic about it.

The amount of variance explained by all predictors in the better models of Table 4 approaches 15 per cent and the amount explained by the motivational predictors is around 4 per cent. Thus motivational variables explain about 27 per cent of the variance accounted for. Although this may seem like a rather small amount, we believe that it actually represents an important degree of success in prediction given the large number of potential sources of confounding. Among these are those that arise from the research method. Our predictions are prospective and not, as is the case in many studies, cross-sectional in time. This means that when we measure desires, the women do not know whether they are pregnant or will become pregnant soon. There is also measurement error. Survey questions in general and single-item measures in particular are always subject to the weakening effect of this consideration. Finally, there are the unmeasured interaction effects between the motivational variables and our control variables. A good example here would be the interaction between motivation and length of the at-risk interval. Both of these are highly significant predictors in our models and probably have an appreciable interaction effect as well.

There are also substantive sources of confounding. Many variables other than the woman's pregnancy desires contribute to the occurrence of an unplanned pregnancy. At the psychological level, there are two main behavioural pathways between the motivations we have measured and exposure to pregnancy risk, namely sexual and contraceptive behaviour. A large number of factors separate from childbearing motivations affect these two behavioural domains, including sexual attitudes, sexual desire, attitudes toward contraception, the effectiveness of the woman's contraceptive method, cognitive factors that influence how a method is used, and satisfaction with a method. At the biological level, any subfecundity in the woman, together with the operation of chance regarding the timing of intercourse during the menstrual cycle, may mean that behaviours that risk pregnancy do not actually result in a pregnancy. At the couple level, corresponding psychological and biological factors in the woman's partner are also operating to affect pregnancy risk. Finally, there are a number of situational contributors to the occurrence of risky sexual and contraceptive behaviour. When all these method-created and substantive considerations are taken into account, it is clear that many factors may dilute or obscure the relationship between a woman's childbearing desires and the occurrence of an unplanned pregnancy.

How does our model compare with the implicit models of the different approaches to measuring ambivalence discussed in the introduction? Among those using the positive polar definition, the implicit theory seems to be that ambivalence is reflected in the conflict between their pronatal motivations and their antinatal behaviour or situation. A drawback to this approach is that the two opposing valences that are characteristic of ambivalence are measured by constructs from the distinct domains of motivation, behaviour, and situation, creating a considerable challenge for the researcher. Among those using the midpoint definition, the implicit theory seems to be that those who respond at the midpoint of the motivational scale used in the study are experiencing both pronatal and antinatal motivations and therefore may be described as ambivalent. The drawback here is that the strengths of the two motivational valences are not directly measured and as a result there is no way of distinguishing between ambivalent and indifferent respondents. This may represent the best

alternative when using existing data bases where bipolar motivational scales are commonly used. It is to be hoped that separate measurement of the two motivational valences will increasingly become standard in future survey design.

Among those using the 'don’t know/unsure' definition, the implicit theory seems to be that uncertainty about personal childbearing goals is characteristic of those who are ambivalent. This assumption only applies when the strengths of the opposing valences are in close balance, and again it does not distinguish between ambivalence and indifference. However, recoding the 'don’t know' and the ‘unsure' responses to the scale midpoint may be a reasonable way to avoid missing data when using the midpoint approach. Among those studies using the degree of attitude inconsistency as a definition, the implicit theory seems to be that different responses to similar items signal ambivalence. However, inconsistency may simply reflect measurement error because different items in the scale do not reliably reflect the underlying construct.

The implicit theory of the 'I go back and forth' approach to definition seems to be that respondents who are simultaneously driven by strongly positive and strongly negative motivations would experience a see-sawing of their pregnancy goals, a description that is consistent with their falling in the ambivalent quadrant of our model. On the other hand, the implicit theory of the 'I am okay either way' approach seems to be that respondents who are simultaneously driven by weakly positive and weakly negative motivations would experience a lack of concern about the occurrence of pregnancy, a picture consistent with their falling in the indifferent quadrant of our model.

Considerable further research on ambivalence and related constructs needs to be done. Empirical relationships between the various definitions of ambivalence just discussed should be studied. An especially useful study would be to compare the reliability, validity, and predictive strength of these definitions using the same data base. We also need to reach out to the psychological and behavioural sciences for alternative definitions, even though this may complicate our task. For example, Thompson and colleagues (1995) have suggested a formula for calculating an ambivalence score for a romantic partner’s personal traits and Mikulincer and colleagues (2010) used this approach to study romantic-relationship ambivalence and attachment in anxious individuals. In order to examine how the definition of ambivalence suggested by these investigators related to our theoretical framework, we tested Mikulincer et al.’s suggested formula using the two 6-point positive and negative childbearing-desires scales depicted in Figure 1. Their formula consists of the average of the two desires scales less the absolute value of the difference between them. We found that their definition generated a bipolar measure where the highest scores fell in the ambivalent pole cell of our model and the lowest scores fell in either the antinatal-pole or the pronatal pole cells. (This can be depicted by folding Figure 1 along the diagonal from upper left to lower right so that the antinatal pole cell completely overlaps the pronatal pole cell.) We interpret the resulting bipolar measure as reflecting uncertain net desires at the high end and certain net desires at the low end. Interestingly, scores that fell in the indifferent pole cell of our framework were located near the midpoint of their bipolar scale. This occurred because on one hand the positive and negative components of indifferent pole-cell scores were equal in strength (implying some uncertainty), but on the other hand the strength of both components was very low (implying relatively little uncertainty). This approach to ambivalence has certain limitations when applied to positive and negative childbearing desires because the antinatal and pronatal scores are not distinguished from each other, and the indifferent scores appear midway between the two poles; nevertheless it represents one of several alternative models that deserve further exploration.

In our own ongoing research with the sample used in the study reported here, we plan three primary efforts: studies of the antecedents of ambivalence—indifference, pronatalism, and antinatalism—in order to determine the extent to which these constructs have distinct background determinants; studies of the sexual, contraceptive, and other behavioural mechanisms through which each of the four construct types may affect the risk of pregnancy; and, studies of the sample women's perception of their romantic partner's ambivalence, indifference, pronatalism, and antinatalism and how her perceptions of him contribute to the risk of pregnancy.

The findings we report here are tentative and need further testing with other samples, different age groups, and men as well as women. It may be that priming methods will be helpful in countering what to many respondents is the somewhat counter-intuitive notion that women and men of reproductive age may have both positive and negative childbearing desires (see the appendix in Miller (2011) for an example of the priming technique). Despite their limitations, we believe the findings presented here have considerable potential for advancing our understanding of the motivational antecedents of unplanned pregnancy and for unifying our conceptual approach to the complex problem of 'mixed feelings' about getting pregnant. Many of the service-provision and policy implications of the theoretical and measurement approach outlined here will have to wait for further research on the developmental antecedents, behavioral consequences, and partner influences of the four-part typology that it suggests. For the present, however, our findings have one clear implication: sexually active young women who are situationally unprepared for childbearing but who are nevertheless ambivalent, indifferent, or pronatal in their pregnancy desires bear an increased risk for an unplanned pregnancy. We hope that further research will show how these women will be able to benefit from interventions and policies that are tailored to the specific configuration of their positive and negative childbearing desires.

Acknowledgments

This research was supported by two grants from the National Institute of Child Health and Human Development (R01 HD050329, R01 HD050329-S1, PI Barber), a grant from the National Institute on Drug Abuse (R21 DA024186, PI Axinn), and a population centre grant from the National Institute of Child Health and Human Development to the University of Michigan's Population Studies Center (R24 HD041028).

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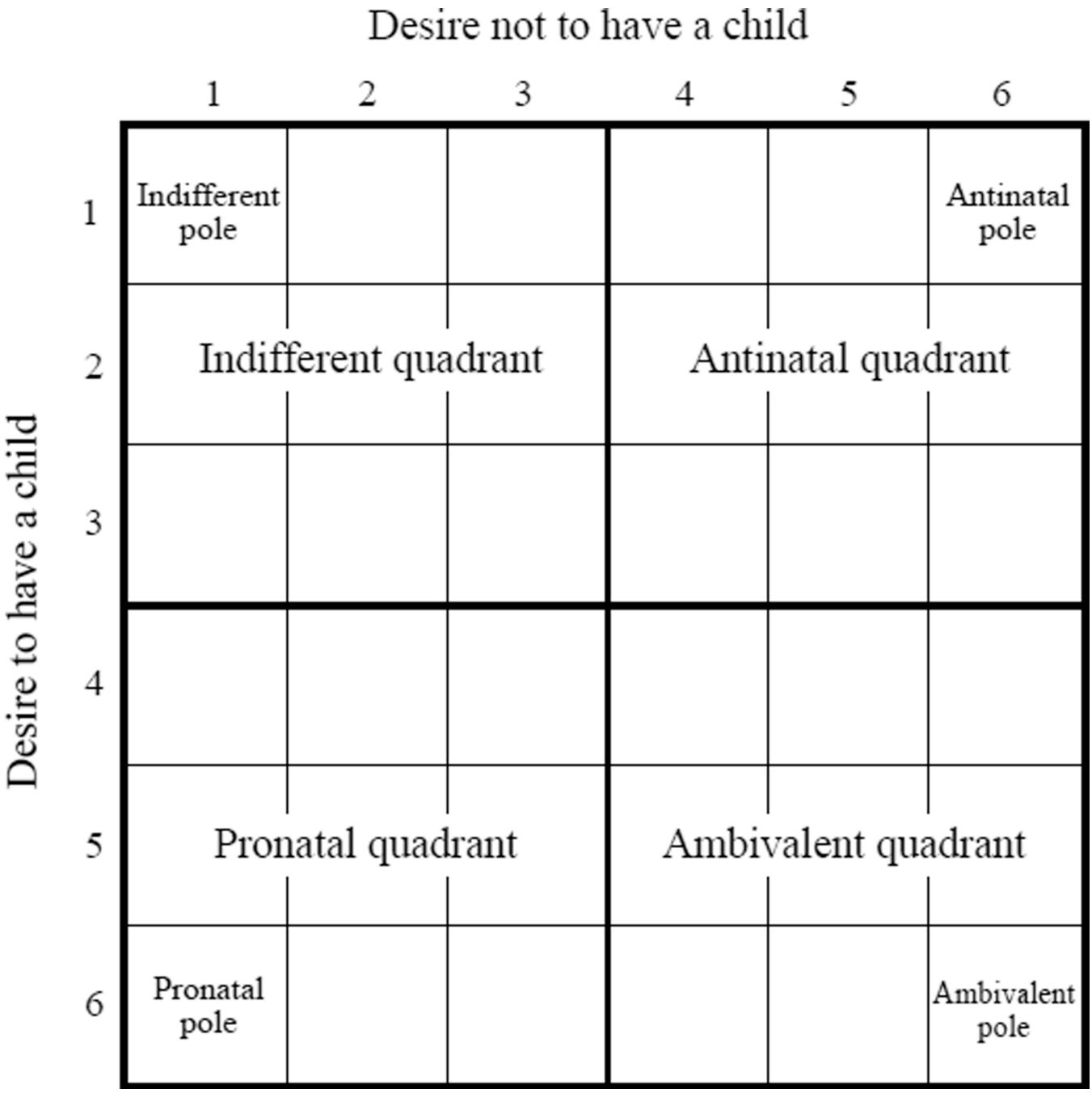

Figure 1.
A graphic representation of the interaction between two unipolar dimensions of childbearing desires, one positive and the other negative, both varying from 1 to 6.

Table 1

Descriptive statistics of sample-characteristic measures used as control variables in the analyses (N=887 women aged 18 or 19, 34,377 observations over 2.5 years in a county in Michigan, United States)

	Mean	Std. Dev.	Min.	Max.
African American	0.35		0	1
Enrolled in school full time	0.67		0	1
Graduated high school	0.81		0	1
Receiving public assistance	0.25		0	1
Importance of religion	2.69	0.92	1	4
Biological mother <20 years old at 1st birth	0.36		0	1
Family structure				
Both biological or one biological and step parent	0.53		0	1
One biological parent only	0.39		0	1
Other	0.08		0	1
Mother's education < high school graduate	0.09		0	1
Income				
<= US$14,999	0.14		0	1
$US15,000–44,999	0.28		0	1
$US45,000–74,999	0.19		0	1
$US75,000 or greater	0.19		0	1
Don't know/refused	0.20		0	1
Age at first coitus 16 years or less	0.52		0	1
Lifetime number of sexual partners 2 or more	0.48		0	1
Ever had sexual intercourse without birth control	0.37		0	1
Number of previous pregnancies	0.26	0.71	0	10
Cohabiting	0 .14		0	1
Age	19.18	0.57	18.12	20.34
Time-to-pregnancy	8.27	5.04	0	18.02
Time-to-pregnancy squared	93.83	92.21	0	324.59
Number of journals	89.59	33.72	4	165

Source: Relationship Dynamics and Social Life study.

Table 2

Descriptive statistics of pregnancy-desire measures used in the analyses (N=887 women aged 18 or 19, 34,377 observations over 2.5 years in a county in Michigan, United States)

	Mean	Std. Dev.	Min.	Max.
Core measures				
Desire to become pregnant	1.20	0.83	1	6
Desire to avoid pregnancy	5.79	0.83	1	6
Differences between core measures				
Signed difference	−4.59	1.56	−5	5
Desire to become pregnant - Desire to avoid pregnancy				
Absolute difference	4.76	0.94	0	5
Desire to become pregnant - Desire to avoid pregnancy				
Products of core measures				
Ambivalent continuous	6.43	2.45	1	36
(Desire to become pregnant×desire to avoid pregnancy)				
Indifferent continuous	6.49	2.88	1	36
(Reverse-coded desire to become pregnant x Reverse-coded desire to avoid pregnancy)				
Pronatal continuous	1.97	4.41	1	36
(Desire to become pregnant×Reverse-coded desire to avoid pregnancy)				
Antinatal continuous	34.11	6.79	1	36
(Reverse-coded desire to become pregnant×Desire to avoid pregnancy)				
Quadrant-based combinations of core measures				
Ambivalent dummy	0.02	0.14	0	1
Indifferent dummy	0.01	0 .10	0	1
Pronatal dummy	0.02	0 .15	0	1
Antinatal dummy	0.92	0 .23	0	1
Antinatal non-pole-cells dummy	0.03	0 .17	0	1
Antinatal poll-cell dummy	0.91	0 .28	0	1

Source: As for Table 1

Table 3

Logistic regression estimates of the effects of positive and negative pregnancy desires, individually and in combination, and two forms of their interaction on the hazard of pregnancy (N=887 women aged 18 or 19, 34,377 observations over 2.5 years in a county in Michigan, United States)

	Coefficients				
Fi					
Core measures					
Desire to become pregnant	0 0.39***		0.22 *		
	(0.06)		(0.10)		
Desire to avoid pregnancy		−0.37 ***	−0.24 **		
		(0.06)	(0.09)		
Differences between core measures					
Signed difference				.23 ***	
				(.03)	
absolute difference					−0.31***
					(0.06)
Summary statistics					
Chi square	170.52	177.44	174.93	174.72	169.35
Log likelihood	−703.71	−703.23	−700.58	−700.59	−707.29
Model pseudo R^2	0.141	0.141	0.144	0.144	0.136
Motivational pseudo R^2	0 .028	0 .033	0 .035	0.035	0 .023

Note: Coefficients are effects on log odds. Standard errors are in parentheses. Model pseudo R^2 includes the effects of both control and motivational variables.

+ p<.10,

* p<.05,

** p<.01,

*** p<.001 (two-tailed tests)

Source: As for Table 1

Table 4

Logistic regression estimates of the effects of sixdummy variables, individually and in combination, on the hazard of pregnancy (N=887 women in a county in Michigan, United States)

	Coefficients						
Quadrant-based combinations of core measures							
Ambivalent dummy	1.35 ***						1.75 ***
	(0.36)						(0.37)
Indifferent dummy		1.11 **					1.54 ***
		(0.41)					(0.42)
Pronataldummy			1.49 ***				1.85 ***
			(0.31)				(0.33)
Antinatal dummy				−1.66 ***			
				(0.25)			
Antinatalnon-pole-cells dummy					0 .39		0.82 *
					(0.39)		(0.40)
Antinatalpole-cell dummy						−1.47 ***	
						(0.22)	
Summary statistics							
Chi square	154.19	157.03	168.78	176.09	149.48	181.44	177.67
Log likelihood	−714.05	−716.95	−710.74	−698.70	−719.45	−699.56	−696.69
Model pseudo R^2	0.128	0.124	0.132	0.147	0.121	0.146	0.149
Motivational pseudo R^2	0.008	0.006	0.016	0.038	0.001	0.036	0.041

Note: Coefficients are effects on log odds. Standard errors are in parentheses. Model pseudo R^2 includes the effects of both control and motivational variables.

+ p<.10,

* p<.05,

** p<.01,

*** p<.001 (two-tailed tests)

Source: As for Table 1