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Justifying an ideal first pregnancy age: Vernacular science knowledge and the facilitation of lay argument

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Abstract
Members of the lay public often draw from vernacular science knowledge—or metaphors, images, and terms related to technical science—to make normative assessments about behavior. Yet, little is known about vernacular science knowledge in terms of its forms and functions. In a national survey, US adults ($N = 688$) were asked to identify an ideal age for first pregnancy, and to explain their decision. Participants drew from arguments related to hormonal processes, the language of risk, and the quality and quantity of "eggs" to navigate and identify an ideal timeline for first pregnancy. Their responses illustrated patterns of justification that involved the (a) employment of scientific concepts as heuristic cues for critical analysis, (b) conflation of details, and (c) synecdochal explication. These findings reveal some of the key ways in which vernacular science knowledge may shape the trajectory of lay argument in a range of contexts.

Keywords
discourses of science, health communication, public understanding of science, representations of science, risk communication

1. Introduction

The age at which women become pregnant and have children has been associated with a host of diverse social, economic, and health outcomes for both mothers and families (Brehmer et al., 2017; Gibb et al., 2014). Becoming pregnant as an adolescent, for instance, has been related to compromised maternal and infant well-being (Chen et al., 2007; Patel and Sen, 2012), just as pregnancy in one's late 30s has been shown to correspond with higher rates of problems in conception, pregnancy, and labor, as well as infant chromosomal and congenital anomalies (Carolan and Frankowska, 2011; Cleary-Goldman et al., 2005).

Myriad factors influence the timing of pregnancy—such as socioeconomic status, education, and access to contraception (Borrero et al., 2015; Faisal-Cury et al., 2017; Secura et al.,

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2014)—but Wagner (2007) argued that lay comprehension of fertility often shapes fertility-related norms and behaviors and is driven by, what he called, "vernacular science knowledge" (p. 7). Vernacular science knowledge is "an intermediate state" between nuanced scientific understanding and ignorance wherein laypeople draw from "images and metaphors" about science to "come to communicable terms" with their world (p. 15). Vernacular science knowledge lacks precision, and is often technically incorrect, but Wagner asserted that this form of understanding is a key resource in how people conceptualize, strategize, and communicate not only about human fertility but also about a range of other scientifically oriented topics such as genetics, biotechnology, and psychiatry.

Wagner's (2007) focus on the vernacular highlights how this realm of understanding is both shaped by, and a part of, "colloquial language" (p. 14). Vernacular science manifests in everyday talk and the ways in which lay individuals explain or defend decision making. The value of this conceptual lens is that it provides an infrastructure for identifying the science-oriented metaphors, images, and terms that are employed by lay populations in conversation about specific science-oriented subject matters. Moreover, this framework encourages researchers to link their findings about the content of vernacular science knowledge to the ways in which its use facilitates particular modes of argument and justification. For example, researchers can identify vernacular science knowledge related to pregnancy timing by studying how laypeople converse about their own and others' choices, and mapping how this knowledge seems to drive and otherwise affect the argument patterns of those who enlist it. This analytic process has the potential to reveal shared beliefs that hold meaning for a population, as well as "deeply entrenched scientific myth(s)" that, in the case of human sexuality, may be "perpetuated in school education and media programs" and "based on outdated and vastly simplified science" (p. 17).

The present research is designed to advance understanding about how vernacular science knowledge shapes lay justification patterns both in general and in the particular context of pregnancy timing. In a national survey of US adult men and women ($N = 688$), participants were asked to select a specific age as the ideal for a woman's first pregnancy and to justify their choice. The emphasis in this study is not so much on the specific age that was selected as it is on the forms and uses of vernacular science knowledge that participants enlisted to explain their selection. The goal is to explicate what types of argument vernacular science knowledge facilitates and, in turn, what sorts of conclusions about health, sex, and gender are made possible by the justification patterns that unfold in its wake.

2. Social representation theory, vernacular science, and communication

Wagner's (2007) conceptualization of vernacular science knowledge draws heavily from social representation theory (SRT), which focuses on the communal representations that individuals use to communicate with others in a collective, particularly as unfamiliar ideas are introduced and integrated into lay discourse (Moscovici, 1988, 2001). SRT maintains that scientific knowledge and its associated representations tend to play a significant role in the vernacular realm, particularly in the process of justifying actions (Hine, 2014; Wagner, 2007). Working from this framework, scholars contend that the diffusion of science is less a top-down, deficit-oriented process than a "creative reconstruction," wherein expert knowledge is transformed into social representations that function as a bridge between "science and the life world" (Bauer and Gaskell, 1999: 166). As new scientific ideas and technologies are introduced into the public imaginary, laypeople transition from ignorance about those ideas to a mode of "collective symbolic coping," wherein relevance is established and communal representations form and circulate (Wagner, 2007: 12).

These representations coalesce into pockets of vernacular science knowledge that, through "similarity, metaphor, and analogy," "render [the scientific idea] intelligible" in everyday discourse and lay interactions (pp. 9, 12). Communication grounded in vernacular science knowledge supports not technical scientific engagement or validation—although it can exist side-by-side with such reasoning and may eventually develop into more valid scientific constructs with the science's increasing public visibility—but, rather, lay interaction grounded in commonsense and social integration in the modern world (Jovchelovitch, 2008). Identification and analysis of such communication reveals "the position occupied by scientific information in everyday social life" and demonstrates that scientific information, for those who are not experts, is always mediated by broader cultural categories (O'Connor and Joffe, 2014: 621).

According to Wagner (2007), medical science is the most viable source for generating vernacular science knowledge in that its popularity and relevance encourages laypeople to adopt and employ its terms in their everyday talk and normative contentions. Currently, research on the communication of vernacular science knowledge tends to focus almost exclusively on non-medicalized contexts (notable exceptions include Joffe, 2011; and Hine, 2014) and provides little clarification about the specific components of such communication, which is described only in terms of its tendency toward metaphor, analogy, and anchoring with and to accepted cultural ideas and categories (O'Connor and Joffe, 2014; Wagner, 2007). Although research in a range of contexts indicates that interpersonal talk can play a role in shaping broader attitudes, beliefs, and behaviors (Dunlop et al., 2014; Morgan, 2009; Southwell and Yzer, 2009), scholars have yet to explicate the forms that lay talk about science takes in specific contexts or the ways in which the enlistment of vernacular science knowledge may shape lay argumentation patterns. In an effort to extend scholarship on vernacular science knowledge to that of medical talk, as well as to identify its forms and functions both in laypersons' discourse about pregnancy timing and more generally, the following research questions were posed:

RQ1. How do laypeople deploy vernacular science knowledge to justify their selection of an ideal age for first pregnancy?

RQ2. What argument patterns are supported by the enlistment of vernacular science knowledge in lay discourse about pregnancy timing?

3. Method

Participants

A total of 1000 adults were recruited via Qualtrics Panels to participate in a national survey study. Participants in this study included men and women aged 40–65 years. This age group was selected because it included those nearing the end of their own reproductive lifecycles who were therefore more likely to communicate in the realm of vernacular science knowledge than those in the heart of their childbearing years who—because of their potential personal interest in the subject matter—may tend to "exhibit a much more accurate form of knowledge about their area of expertise than does the average person" (Wagner, 2007: 14). The survey was stratified by age (40–65 years), sex, education, and race. Sex was stratified so that there were equal numbers of men and women. Education and race were stratified to conform to US Census demographics and enhance transferability of findings. Approximately 28.5% of the US population has a bachelor's degree or more, so the sample was stratified such that 71% of the participants had less than a bachelor's degree. Participants were recruited from 49 US states (one state, Utah, was oversampled and excluded from this study for broader comparative purposes). After removing participants with significant

missing data, the final sample for this analysis was 688 ranging in age from 40 to 65 years ($M = 57.63$, standard deviation (SD) = 6.51).

Procedures

Following the attainment of institutional review board approval and participant recruitment through Qualtrics Panels, participants took an online, exploratory survey that included questions about their basic demographic information and queried them about the ideal age for a woman's first pregnancy. Attention to a woman's age at first pregnancy, rather than at subsequent pregnancies, was driven by research suggesting that age at first pregnancy is related to the pace and number of subsequent pregnancies (Bumpass et al., 1978; Guzzo and Furstenberg, 2007). Focus on an ideal, in this case, was grounded in research that demonstrates that individuals' conceptualizations of an ideal course of action often aligns with "upward" social comparison (Taylor and Lobel, 1989: 569; Wood, 1989), which sheds light on the types of behaviors that individuals tend to promote among those in their communities. In an attempt to capture the types of communication that laypeople engage when justifying their choice of an ideal first pregnancy age, the survey asked participants to explain, in their own words, why they selected the age that they did. Typed answers ranged from one word to three complete sentences.

Data analysis

Evidence of the communication of vernacular science knowledge emerged through the process of analysis, which was guided by constant-comparative techniques (Charmaz, 2014). Each entry was assessed in its entirely by the first author (R.E.J.), who tracked emerging themes and wrote memos exploring and articulating those themes. Open coding (Lindlof and Taylor, 2011) then occurred during which R.E.J. began a list of theoretical categories and continuously compared the readings of the survey responses with each theoretical category and revised as necessary. Themes were collapsed and refined throughout this process, as well as in the process of subsequent axial coding, wherein emergent categories were compared with and related to each other (Corbin and Strauss, 2015).

R.E.J. drew from this initial comparative work to develop a coding scheme that both authors used to code the same 50 responses. After coding, both authors met to discuss the coding process and further refine the coding scheme. The second author (A.N.B) then used the resulting coding scheme to code the remainder of the participant responses. During this process, it became clear that a number of participants were drawing from scientific language and ideas to justify their ideal age selection. Thus, the authors focused their analysis more specifically on the responses that referenced or otherwise employed vernacular science knowledge (Wagner, 2007).

After these early stages of analysis, both authors analyzed the resulting 182 responses that had been coded as engendering vernacular scientific knowledge. Ultimately, 72 entries were eliminated from the category as the authors concluded that basic appeals to "maturity" or "development" did not necessarily constitute scientific appeals, and neither did general discussions of human health or the physical body. The responses that remained either explicitly drew from scientific, reproductive terms (e.g. "menstruation," "ovarian reserve"), alluded to specialized scientific knowledge or processes (e.g. "female changes," "eggs"), or denoted scientific analytic methods through language choices (e.g. appeals to the law of averages or biological norms). Drawing from the resultant 110 responses, R.E.J. developed and refined second-level codes for each major theme. All 110 responses were then recoded using these second-level codes. The examples provided throughout this article are drawn from the 110 responses in which vernacular scientific knowledge was in evidence. Pseudonyms are used in place of participants' names.

4. Results

Our constant-comparative methodology led us to group participants' comments into one of three major content themes that drew from and exhibited vernacular science knowledge. These included appeals to hormonal processes, the language of risk, and the quality and quantity of ova or "eggs." We used these findings to explicate how vernacular science knowledge was communicated in the process of justifying an ideal first pregnancy age and how that knowledge seemed to support specific patterns of lay argument, particularly in a medically oriented context. Although a variety of different lay argument patterns emerged during the process of data analysis, three central patterns emerged repeatedly that involved employing scientific terms as heuristic cues, conflating scientific details, and justification from synecdoche.

Hormonal processes

Of the 110 participants who drew from vernacular science knowledge in their responses, 68 offered justification for their selection of an ideal pregnancy age by appealing to hormonal processes. Scientifically generated topics such as menstruation, puberty, and hormones in general were common, and participant answers suggested that they often garnered these communicative resources from their secondary education. Lewis—a 58-year-old White man—attributed his justification to "what I remember from sex ed and biology classes in high school." A number of participants cited the start of menstruation as a central marker for deciphering ideal pregnancy age. In some cases, participants conflated the start of menstruation with ideal pregnancy age, which, from a larger cultural perspective may be read as contradictory given that adolescent pregnancy is widely disparaged in most Western societies as irresponsible and harmful (Geronimus, 2003; Gregson, 2009). Many participants who communicated in this way employed colloquialisms such as "period" or "cycle" to describe menstruation and highlight perceived "fertility," while others, such as Jane—a 59-year-old White woman—utilized more technical language to explain that she "picked what I thought was average age for menses to begin." Jane's appeal to averages also signaled a more scientific—and less anecdotal—paradigm of analysis. Similarly, Jon—a 48-year-old Black man—noted that "probably this is when a female starts to ovulate." Discussions along these lines of more obscure and technical processes such as ovulation (which involves the release of the ovum from the ovaries into the fallopian tubes) suggest participant exposure to the language of reproductive endocrinology, a field that has been increasingly included in mainstream discourse since the creation of reproductive health clinics in the 1930s and 1940s (Jensen, 2016). The contradiction that emerges in these cases between participants' selection of an early ideal pregnancy age and societal norms disparaging adolescent pregnancy is emblematic of vernacular science knowledge writ large, wherein incongruous meanings and views are commonplace and often held simultaneously without consequence (Wagner and Hayes, 2005).

Of those participants who cited the age of initial menstruation as a heuristic cue for delineating a later, subsequent ideal first pregnancy age, frequent mention was made of "hormones"—a term that was also initially popularized by mainstream coverage of reproductive endocrinology research (Jensen, 2015: 335)—as having achieved a degree of establishment and stabilization. Gus—a 44-year-old White man—explained that "hormones have probably stabilized," employing a qualifier ("probably") that could signal either a less exact and therefore less scientifically grounded account or a broader, post-structural conceptualization of science as inherently variable. And Susan—a 62-year-old White woman—noted that her choice of an ideal pregnancy age aligned with her perception of when the "hormones are strong," while Rob—a 49-year-old Black man—claimed that "this is the age the hormones are at their peak, which means very fertile." By contrast, some

participants drew from less scientifically situated phrases, referencing, for instance, "puberty" or "pubity" [sic] as gauges for measuring ideal age for first pregnancy. Betty—a 63-year-old White woman—engaged a relatively colloquial representation of hormonal reasoning, noting "the body has had time to acclimate to the female changes and become strong enough to obtain and sustain childbirth." By appealing to "female changes" rather than to more precise terms such as "puberty," "menstruation," or "ovulation," Betty positioned her argument firmly in the realm of the vernacular while still drawing from resources associated with technical scientific knowledge.

In contrast to those who situated ideal first pregnancy age as in relationship to the *beginning* of the hormonal cycle via puberty and menstruation, a few participants considered ideal first pregnancy age in relationship to the *end* of the hormonal cycle via menopause. Geraldine—a 62-year-old White woman—noted that "female[s] are no longer fertile after menopause and that age varies." Others conceptualized hormonal processes on a continuum, referencing either the entirety of a specific monthly "cycle" or—as Cecil, a 56-year-old White man, did—broader "biological clocks which differ per person (puberty, menopause, etc)." Participants who adopted this lifecycle approach to hormonal justification seemed to be less willing to provide a concrete age for ideal pregnancy, noting that they could not supply a single number as the ideal exists within a range. As Geraldine wrote, "The ideal time for a female to get pregnant? Well, it depends." Appeals to hormonal processes—particularly when such processes functioned as cues for justification—seem to have granted these participants the confidence to engage in metacommunication (e.g. interrogating the bounds of the query), which in some cases helped to facilitate their rejection of the question posed.

Risk communication

A total of 28 of the 110 participants drawing from vernacular science knowledge communicated via appeals to a second theme anchored in risk communication. Participants spoke most often about the risk of negative outcomes for the fetus or infant that could be incurred if women became pregnant with them either too early or too late. Elise—a 54-year-old Black woman—offered one of the more informal explanations along these lines, noting, "I believe that the early twenties are the premium biological age to have a healthy pregnancy/baby." Labeling her response a belief rather than a fact signaled the lay nature of her comment, while use of the term "biological" denoted a more formal, scientifically informed perspective that contributed a sense of reliability and authority to her age selection as it connected to the potential for infant health. Other participants were a bit more particular about the problems that the wrong first pregnancy age may see for offspring. Henry—a 56-year-old White man—wrote, simply, "birth defects," while Thomas—a 60-year-old Hispanic man—explained that "After that, it is possible to have children with problems, e.g. Down Syndrome." Although there were several comments discussing the risks for especially young mothers (e.g. Denise—a 65-year-old White woman—wrote that "teenagers are too young and can have children with health problems"), most of these concerns were tied to the risks of an older age in the mother. Adam—a 60-year-old White man—reasoned that "younger is safer and less defects," and Andrew—a 65-year-old White man—stated that "chances for birth defects increase after 35." The unqualified feel of these comments could very well be connected to the circulation of high profile, unequivocal public health discourses such as the American Society of Reproductive Medicine's (ASRM) (2016) "Protect Your Fertility" campaign, which feature a range of definitive claims related to the risks associated with advanced maternal age and waiting too long for pregnancy (Bute et al., 2010; Harter et al., 2005).

Participants justified their choice of an ideal age for first pregnancy not just in terms of potential risk to offspring but also in terms of women's risk of experiencing infertility or an inability to

conceive and carry a healthy infant to term. Gladis—a 58-year-old White woman—contended that the "ability to become pregnant begins to decline at 30." Likewise, Kyle—a 57-year-old White man—responded that "a woman's fertility starts to fall precipitously at 35, so she should try to conceive before that time." Offering up a slightly more tentative assessment—though ultimately communicating a corresponding conclusion—Ralph—a 61-year-old White man—reflected, "It seems the longer women wait the harder it is to get pregnant." Often the "risk" in these responses was communicated in terms of general "safety" or the avoidance of "complications," whether in terms of conception, pregnancy, birth, child-rearing, or all of the above. James—a 65-year-old White man—contended that the selected age constituted the "safest time, not too old for complications." Tim—a 60-year-old Hispanic man—offered similar sentiments, noting, "When a person is younger they can handle the ordeal of pregnancy. There can be fewer chances of complications with the pregnancy, birth and baby." Likewise, Deb—a 63-year-old White woman—argued that the "body is flexible and there is low risk of complications." Citing "safety" and "complications" in this context functioned to, first, highlight the nonspecific, lay nature of the comment and, second, suggest the respondent's awareness of (and appeal to) a more specific medical-scientific discourse related to risk. That these comments are vague and therefore not necessarily technically correct in a scientific sense aligns with Wagner's (2007) finding that the communicative resources associated with vernacular science knowledge function to facilitate a general grappling with the modern world rather than a degree of technical accuracy.

This tendency toward the general rather than specific was evident not only in vague references to complications but also in the frequent conflation of distinct scientific issues and risks into one lump category. For instance, without clear differentiation, participants spoke both of risks to the mother and risks to the infant, as well as to unspecified complications in general. Steve—a 60-year-old Black man—offered a comment that flowed freely from an emphasis on the mother's risks to that of the infant: "because it [conception and pregnancy] usually does not happen at 55 and, if it did, the woman would be at jeapordy [sic] for all types of health problems as well as taking high risk for herself and her baby." Other comments separated—but just barely—the risks to mother and baby. Alan—a 62-year-old White man—cited "the wellbeing of the mother and the optimal outcome of the fetus," and Rachel—a 46-year-old White woman—explained that "she's in better health and less risk for problems with newborn." The conflation of specific risks seemed to function, in these cases, as a vernacular communicative resource that demanded very little specificity while still allowing for a general appeal to science and, with it, the specificity (and validity) required of that sphere of discourse.

Arguments from quality and quantity about eggs

A third and final theme among responses that employed vernacular science knowledge concerned mention of "eggs" or "ova" and judgment in relation to their supposed quality or quantity. A total of 14 participants justified their responses in this way and thereby drew from what argumentation scholars Perelman and Olbrechts-Tyteca (1969) identified as comparative argumentation strategies grounded in either that which stands apart in terms of a specific criteria or that which is "better than another for quantitative reasons" (p. 85). In these responses, eggs were situated as a synecdoche (wherein a part stands for the whole; Lanham, 1991) for a woman's overarching "fertility," a link that is also widely evident in mainstream media about reproductive health issues, especially coverage of advanced maternal age (Harter et al., 2005). Criteria for egg quality in this context included health and youth. Helena—a 57-year-old White woman—selected an ideal pregnancy age according to both these criteria, "primarily because of the age and health of her eggs." And Cynthia—a 52-year-old Hispanic woman—was reflexive about her appeal to medical dictates as

an overarching criteria and egg health as a subcriteria, writing, "I am thinking about the ease of getting pregnant and the health of the egg that is fertilized—purely medical response." Anne—a 53-year-old Asian woman—differentiated between the supposed age of a woman's eggs and a woman's chronological age, explaining "the eggs aren't that old yet, yet the mother should be more mature mentally to handle the stress of raising a child." Anne's differential scale for age assessment seemed to allow for identifying an age at which an individual woman could be old enough to be "mature" but still have eggs that were considered "young." This kind of careful delineation, which mirrored that of a scientific assessment, suggested an unwillingness to conflate egg health with women's chronological age while still recognizing a connection between the two measurements.

Although most discussions of quality were framed positively, offering something of a gain framing (Tversky and Kahneman, 1981), several participant quality assessments were framed negatively or as a potential loss. Margaret—a 42-year-old White woman—contrasted her choice of an ideal pregnancy age with an age at which "your eggs are old, and you have a greater chance of having a disabled child," thereby engaging loss framing both in terms of consideration of egg quality and issues of risk. Patricia—a 61-year-old White woman—also drew from a loss frame to justify her choice of an ideal first pregnancy age, contending that eggs "deteriorate the older they are," a contention that other participants mirrored with warnings about potential "decline."

The flip sides of these quality-oriented arguments were those asserting and assessing egg quantity as a goal in and of itself. That is, participants communicating in this fashion tended to associate more eggs with "fertility" and, therefore, ideal pregnancy age. For instance, Genavive—a 52-year-old White woman—contended that "females are most fertile, with largest number of eggs earlier than 30-35 years." Likewise, Terry—a 55-year-old White woman—explained of a particular age, "She is the most fertile, that is when she has the most abundance of eggs," drawing from not one but two adjectives depicting quantity. Lucile—a 64-year-old White woman—appealed to the time of "highest egg production," and Nancy—a 40-year-old Black woman—attempted to select an age associated with having "a good supply of quality eggs," an argument that combined criteria of quantity and quality by suggesting that having lots of eggs was only valuable if they were also of "quality."

Several participants signaled this argument-from-quantity by discussing the "ovarian reserve," a scientific term that incorporates the idea that females are born with their lifetime supply of ova or oocytes and therefore that the ova in the ovaries at any one time make up the entirety of a woman's ova supply (Broekmans et al., 2009). Once individual ova have been released from the ovaries, women cannot produce more (Faddy and Gosden, 1996). Grace—a 43-year-old White woman—offered only this concept as an explanation for her age selection, writing "based on ovarian reserve." And Jon—a 40-year-old Hispanic man—communicated similarly, though with a little more detail. He wrote, "Because of her ovarian reserve, starts declining at some point in time (mid 20's)." Technically, Jon's explanation was a bit off in that the ovarian reserve starts declining immediately after the first ovum is released (usually in a woman's early adolescence) (Frisch, 2002). But, regardless of this technical inaccuracy, this participant appealed to a relatively obscure clinical concept to justify a lay decision, and he did so with minimal explanation, which suggests either that he assumed others would be familiar with this term or that the term was so authoritative in and of itself that he believed it required no further explanation. In this respect, an appeal to a highly technical term seemed to communicate lay credibility and release the speaker from having to overcome a significant burden of proof related to evidence or warrants.

Finally, in several cases, participants who justified their responses by discussing "eggs" skipped the establishment of criteria entirely and described the eggs themselves as "fertile" and therefore worthy of positive evaluation. Harriet—a 56-year-old White woman—explained that at the selected age, "eggs are more fertile," while Dennis—a 65-year-old White man—described "eggs that are the most fertile." Lay use of the term "fertility" is hardly surprising given the terms' rise in mainstream

use. Beginning at the end of the 20th century, discussions of fertility moved from the realm of the almost purely clinical to the mainstream, particularly in widespread discussions of "biological clocks" (another metaphor that several participants in this study employed) and rising maternal ages in the wake of widespread contraceptive availability and professional opportunities (Harter et al., 2005). What is notable here is the conflation of women's eggs with their overall assessment as fertile or not. In this characterization, the eggs do not provide ways in which to assess reproductive health status but, instead, make up the entire substance of an individual's reproductive health. Other factors related to reproductive health, whether interrelated biochemical systems or male bodies and cells, are overlooked entirely in these responses. In this context, the lack of specificity that is emblematic of vernacular science knowledge makes for a streamlined mode of communication grounded in synecdochal argument that focuses on one aspect of science and the human body and lacks a more comprehensive assessment of reproduction and successful pregnancy timing.

5. Discussion

The results of this exploratory study suggest that over 15% ($n = 110$) of the 688 participants in our sample drew from vernacular science knowledge in their responses to justify decisions about an ideal first pregnancy age. From a theoretical perspective, this study extends SRT and conceptualizations of vernacular science knowledge by illustrating the specific forms that the communication of vernacular science knowledge take in this medically oriented context, and considering the patterns of argument that the employment of this knowledge seems to promote. In this respect, this study extends Wagner's (2007) theory of vernacular science knowledge to incorporate three channels through which lay justification unfolds in its wake. These channels include the employment of scientific concepts as heuristic cues for critical analysis, conflation of details, and interpretation from synecdoche, each of which has significant implications, particularly for those who use vernacular science knowledge and those who communicate science to and with lay public.

First, technical scientific concepts related to hormonal processes were employed by laypeople as heuristic cues for justifying their selection of an ideal first pregnancy age. For some participants, this approach created seemingly insurmountable contradictions (e.g. the selection of an adolescent age as ideal for first pregnancy in the context of societal norms disparaging adolescent pregnancy), though they did not communicate them as such in their survey responses. The communication of contradictory viewpoints is a noted characteristic of vernacular science knowledge driven by the lack of specificity and scientific validity employed in that context and generally does not, according to Wagner and Hayes (2005), disturb ongoing vernacular interactions. For other participants, drawing from scientific constructs such as menstruation, ovulation, or menopause as heuristic cues for identifying an ideal age for first pregnancy did not yield contradictory responses so much as a diversity of argument patterns, wherein science provided the starting point for analysis but not necessarily the path toward final assessment. For instance, some participants selected an age by reasoning backward from menopause, while others reasoned forward from menstruation, ovulation, and puberty. In this respect, communicating within the realm of vernacular science may involve the ability to employ technical constructs to carve out a unique path forward toward lay decision making. For a few participants in this study, this focus on establishing unique justification pathways rather than set conclusions built the infrastructure for metacommunication related to critical thinking, rejection of the question at hand, and, potentially, a re-envisioning of science as variable rather than absolute. Vernacular science knowledge in these cases seemed to support ingenuity in argumentation over rote application on the part of laypeople.

Second, participants engaged in the conflation of scientific details, often in terms of the broader cultural category of risk communication, to illustrate why they selected the ideal pregnancy ages

that they did. This finding aligns with scholarship by Beck (2008), who characterized the contemporary age as a "risk society" focused on probabilities and the potential for negative outcomes in the future, as well as research indicating that reproductive health issues such as pregnancy and infertility are increasingly communicated in technical and mainstream contexts primarily through the lens of risk (Reagan, 2010; Seigel, 2014). In these cases, participants were able to situate their choices in the realm of scientific validation without actively participating in the details of that discourse by translating scientific appeals to risk into less specific and more informal terms such as "safety" and "complications," as well as by grouping different types of risk together into one overarching classification. That these appeals seemed to mimic the assured tone of widespread public health campaigns and media depictions of age-related infertility and advanced maternal age adds credence to theories that situate the public diffusion of science as not a clearly top-down process (Golinski, 1999; Johnson and Quinlan, 2015). Rather, science is shown, in this case, to merge with the vernacular realm through a process that involves bridging expert knowledge with colloquial talk, often via mainstream depictions of science and the development of social representations (Bauer and Gaskell, 1999). In addition, the imprecision in these appeals (coupled with the tone of conviction) suggests that such justification could be manipulated easily. Although vernacular science knowledge may uphold creative explication—as it did among participants who drew from appeals to hormonal processes—its association with lack of attention to scientific differentiation and detail creates something of an unstable infrastructure from which to do that argumentative work. For instance, the tendency among participants in this sample to conflate maternal health risks with fetal health risks could encourage them to, also, conflate women with fetuses or infants, a practice that may contribute to a broader devaluation of maternal health and recent rises in maternal mortality rates (see, for example, Kassebaum et al., 2014).

Third, participants employed synecdochal analysis where the part (in this case, "eggs") stands in for the whole (a woman's fertility writ large) to justify their choice of an ideal first pregnancy age. Responses along these lines were not always technically accurate when scientific terms were discussed such as "ovarian reserve," but, as Wagner (2007) contended, vernacular science knowledge generally does not align with technical accuracy as it functions to facilitate, first and foremost, interaction and engagement in a rapidly changing, technologically diverse society. In this specific context, deliberations about synecdochal egg quality and quantity offered a reference point for the circumlocution of ideal first pregnancy age that combined a degree of technical assessment with lay informality. The almost singular focus on eggs, however, demonstrates another course through which vernacular science knowledge can facilitate faulty and potentially harmful decision making. Martin (1991, 2001) identified the problematic implications of giving specific body parts or products more or less agency and separating them from woman writ large. For instance, she analyzed how high school biology textbooks personified sperm as active agents in the process of conception and eggs as passive recipients, a characterization that not only attributed traditional gender roles to biological products and processes but also, then, functioned to re-inscribe those roles onto men and women in a societal context. Similarly, in the present case, this particular subset of participant comments conflating eggs with women and their level of fertility signals both the hefty communicative value that vernacular science knowledge can provide for lay audiences as they evaluate and select ideal markers of health behavior and the harms that such knowledge can also support and reiterate.

On the whole, what the data in this study make clear is that vernacular science knowledge—much like technical science knowledge—functions in a variety of different ways and that there is value in mapping how that knowledge is communicated and what kinds of argument that communication facilitates. This project illustrates just three argument pathways that seemed to be facilitated by the employment of vernacular science knowledge among participants, but these are neither

comprehensive nor necessarily mutually exclusive. Future research is needed to create a more comprehensive picture of what the communication of vernacular science knowledge looks like in diverse scenarios and the multifarious pathways toward justification that such communication upholds. The present research employed online surveys to assess vernacular science knowledge, which allowed the researchers to assess a relatively large amount of data from diverse participants and garner a general, exploratory sense of vernacular science use among laypeople in the United States. However, the format of an online survey necessarily limits the kinds of inquiries and investigations that researchers can engage, and scholarship that employs an interview structure or that involves the recording of interpersonal conversations would certainly provide more opportunities for exploring the nuances of vernacular science knowledge via on-the-spot probing and, perhaps, a more naturalistic setting. This study is limited also in that participants were not asked whether they had personally experienced reproductive problems or fertility-related issues, and research demonstrates that such experience can mediate engagement with science so that individuals who have personal experiences related to the issue at hand tend to be more knowledgeable about associated scientific topics (O'Connor and Joffe, 2014). We attempted to mitigate this issue by surveying only those who were reaching the end of their own reproductive timelines at 40–65 years, but future research should attend to this demographic variable more specifically to assess if and how those who have associated experiential backgrounds may employ scientific language and resources differently. Correspondingly, future research should examine a younger sample of participants, those who are in the heart of their childbearing years, to assess, first, if that group of individuals is too close to the topic to engage with science at a vernacular level and, second, if and how they engage vernacular science knowledge about this issue in comparison with older demographics.

Despite these limitations, this study provides an infrastructure for research that delineates specific forms of vernacular science knowledge and the ways in which those forms uphold certain argument pathways among laypeople. In the adjudication of ideal first pregnancy age, laypeople drew from vernacular science knowledge in ways that supported their own creative explication but that also made them susceptible to possible manipulations of information and the construction of potentially harmful sex and gender stereotypes. These findings reveal not only that vernacular science knowledge is generated from the medical realm and that theorizing about the communication of vernacular science knowledge must incorporate this sphere of discourse, but also that an ongoing project of scholarly differentiation among the diverse uses and implications of such communication is vital for the assessment and implementation of public health and science communication initiatives.

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