**Plain Language Summary for Community Advisory Board**

**Background and history of the work:** Sleep is a biological necessity. Adequate sleep provides the needed physical and mental restoration to thrive in our busy daily lives. Unfortunately, sleep is often a commodity that runs at a deficit, either by choice or by circumstance. Pregnancy is a key life transition when sleep is often compromised, even though the restoration sleep provides during pregnancy is needed then more than ever. By some estimates as many as 75% of pregnant women report poor overall sleep quality. Poor sleep is likely due to a multitude of causes, ranging from hormonal fluctuations to heartburn, back pain, increased urination, and stress. Whatever the cause, poor sleep carries with it a risk for pregnancy complications, including preterm birth. Indeed, several prior research studies found that short sleep duration (i.e., sleeping 6 or fewer hours per night) and a self-report of poor overall sleep quality were associated with increased risk of preterm births compared to longer, more restful sleepers[2,3].

Unfortunately, sleep is rarely assessed during prenatal visits. In part this is because sleep disturbance is so common among pregnant women and it is difficult for clinicians to separate out women who have typical sleep complaints from those with more severe, and possibly toxic, sleep concerns. We propose that one important step towards understanding the impact of poor sleep on pregnancy and preterm birth is to focus on patients with diagnosed sleep disorders, specifically women with clinical insomnia. Insomnia is characterized by 1) a difficulty in falling or staying asleep, 2) causing clinical distress or impairment, and 3) occurring at least three nights per week for a period of at least three months.

In collaboration with the UCSF Preterm Birth Initiative, our group recently demonstrated a link between insomnia and preterm birth risk[1]. To do this, we relied on data from the California birth registry that documented all live births between January 1, 2007 and December 31, 2012. These data were linked to hospital discharge records, which included information about the diagnosis of clinical insomnia among the mothers. We found that women with a diagnosis of insomnia were nearly twice as likely to deliver before 37 weeks and 2.3 times more likely to deliver before 34 weeks compared to women without a sleep disorder. This heightened risk remained after accounting for several factors previously related to preterm birth such as race, mother's age, number of prior children, pre-pregnancy weight, education level, medical conditions, and history of prior preterm birth among other factors. The increased rate of preterm birth among women with insomnia is alarming. The next question we are seeking to answer is *why* women with insomnia more likely to deliver prematurely?

**Project summary:** The goal of the proposed project is to identify the biological processes that lead women with insomnia to deliver preterm. There is growing evidence that clinical insomnia negatively affects the immune system often leading to high levels of inflammation, which in turn has been linked to preterm birth. Unfortunately, prior studies of sleep and preterm birth have focused on one or two biomarkers, even though preterm birth is complex and involves multiple biological pathways. We believe prior approaches provide an incomplete, and possibly misleading, view of how poor sleep leads to preterm birth. To improve on this prior work, we are proposing to comprehensively examine blood samples from 150 women, including women with and without insomnia who either experienced a spontaneous preterm birth or delivered at term. These blood samples are directly linked to the data we described above via the California Biobank Program. Using cutting edge technology and advanced statistical methods, we will be able to determine which biological pathways are associated with preterm birth among women with insomnia. Findings from this project will 1) lead to a critical advancement in our understanding of how insomnia "gets under the skin" to affect preterm birth and 2) highlight new biological targets for prevention of preterm birth among women with insomnia.

**Community engagement and impact:** There is so much that we do not know about how sleep contributes to adverse pregnancy outcomes. Despite our growing understanding that sleep is fundamental to health, the biological processes that link sleep disturbance, including insomnia, to preterm birth remain undiscovered. In fact, because insomnia and sleep complaints, more generally, are rarely assessed during prenatal visits, the impact of insomnia in the daily lives of pregnant women is unknown. We are engaging the community to get a handle on this problem. Dr. Jennifer Felder, who is a postdoctoral fellow in my lab as well as a fellow in the UCSF Preterm Birth Initiative, is recruiting nationwide through community list serves, social media websites, and at local pregnancy events. We are asking pregnant women to complete a brief survey about their sleep

during pregnancy, their experiences with the healthcare system around their sleep, and their interest in behavioral sleep interventions to improve sleep complaints (a link to the survey can be found here: https://ucsf.co1.qualtrics.com/SE/?SID=SV_5alKTulw4RyEsAd). To date, we have approximately 50 respondents, and there is an early indication that insomnia is a problem that fails to get adequate attention from providers.

We believe the impact of our proposed study will be significant. The prevalence of poor sleep, including insomnia, is higher in populations already at increased risk for preterm birth, including low income and minority populations. What we need, however, is a way to predict which women with insomnia will go on to deliver preterm.  Advances in measuring the biology of insomnia and preterm birth allows us to discover new pathways that will help us treat people earlier, through both behavioral interventions to improve sleep and possibly through molecular techniques that target the pathways negatively affected by insomnia.

We are committed to continued engagement with the community around the problem of sleep and preterm birth, both through this project and through other initiatives.  Because data from this project comes from the already collected information available in the California birth registry and biobank, retention of participants is not an issue. However, we take very seriously the mission to disseminate this work to help those in the most need. In addition to publishing this data in scientific journal, we intend to hold a collaboratory focused on the importance of sleep as part of the UCSF Preterm Birth Initiative. Additionally, we have been very effective in engaging local and national media around the influence of sleep on health (http://www.sfgate.com/health/article/Sleep-key-to-well-being-expert-says-3933483.php; https://www.ucsf.edu/news/2015/08/131411/short-sleepers-are-four-times-more-likely-catch-cold), and we are confident that these findings will garner similar national attention.  Finally, we plan to engage with local community groups, such as Black Infant Health, to have a collaborative discussion about this study, the role of sleep in our daily lives, and the opportunities for interventions to improve sleep prior to and after delivery.