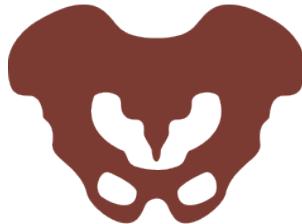




FEMALE PELVIC FLOOR DYSFUNCTION 2010 TO 2050

Over the next 30 years, growth in demand for services to care for female pelvic floor disorders will increase at twice the rate of growth of the same population. Demand for care for pelvic floor disorders comes from a wide age range of women... These findings have broad implications for those responsible for administering programs to care for women, allocating research funds in women's health and geriatrics, and training physicians to meet this rapidly escalating demand

- Karl M. Luber, MD, Sally Boero, MD, Jennifer Y. Choe, MD. *The demographics of pelvic floor disorders: Current observations and future projections.* Presented at the Sixty-seventh Annual Meeting of the Pacific Coast Obstetrical and Gynecological Society, Kamuela, Hawaii, November 14-19, 2000.



HERMAN & WALLACE | PELVIC REHABILITATION INSTITUTE

113 CHERRY STREET
SUITE 71393
SEATTLE, WA 98122
WWW.HERMANWALLACE.COM

Introduction

The purpose of this white paper is to estimate the size of the American female population experiencing pelvic floor dysfunction in 2010, and to project the growth of this population to the year 2050. As evidenced by the quotation by Doctors Luber, Boero, and Choe on previous page, the medical community has determined that the growth of this population will significantly outpace growth of the American population overall. In addition to providing quantitative estimates of the affected population, this white paper identifies four fundamental facts placing upward pressure on the number of American women experiencing pelvic floor dysfunction over the next 40 years.

As a corollary to the final point of Luber, Boero, and Choe above, Herman & Wallace encourages medical professionals researching potential areas of specialization to consider pelvic rehabilitation. Clinicians with the skills and expertise to effectively treat pelvic floor dysfunction will be well positioned for a long and successful career.

Factors Driving Growth in Pelvic Floor Dysfunction

Herman & Wallace has identified four macro-structural factors that indicate our nation can expect an increase in female pelvic floor dysfunction for years to come. Two factors are biologic: The difference in pelvic floor dysfunction prevalence between men and women, and that the prevalence of pelvic floor dysfunction increases with age. Two factors are demographic: The American population is getting older, and that women, on average, live longer than men in America. These forces, when considered together, lead the Institute to forecast steady and significant growth in the number of America females experiencing pelvic floor dysfunction each year until 2050.

1. Pelvic Floor Dysfunction Affects Women at Significantly Higher Rates than Men

While much remains to be explored on the difference between pelvic floor dysfunction in men and women, a handful of facts clearly emerge from the academic literature on the topic:

- Pregnancy is a major cause of pelvic floor dysfunction in women.
- Even in nulliparous women (those who have never given birth), the incidence of pelvic floor dysfunction is much higher than in men.
- With each additional pregnancy that a woman experiences, there is greater risk of pelvic floor dysfunction.

Pregnancy places increased stress on the pelvic floor throughout gestation, leaving the muscles fatigued and weak, which can lead to urinary incontinence. Vaginal birth can be traumatic to the pelvic region and cause damage or tearing to the pelvic organs and muscles, such damage is a significant contributor to fecal incontinence and pelvic organ prolapse. Additionally, the risk of

pelvic floor dysfunction increases with each pregnancy a woman experiences. Nygaard et al¹ found that 12.8% of women who had never given birth experience pelvic floor dysfunction, while 18.4% of those who have had one child, 24.6% of those who have had two children and 32.4% of women who have had three or more children, reported pelvic floor dysfunction.

The major sex difference in pelvic floor dysfunction is explored by the results of a stress incontinence study by MacLennan et al.². Data from study participants show that 10.9% of nulliparous women experienced stress incontinence, while only 2.5% of men reported experiencing stress incontinence. After the first pregnancy, the female prevalence rate rose to 37.4%. These results clearly indicate a stark difference between the sexes. Nulliparous women reported experiencing stress incontinence four times more often than men, and women experiencing one or more pregnancies, more than fourteen times more often.

The estimated total fertility rate of the United States in 2011 is 2.06³; meaning that, on average, a young American woman entering fertility in 2011 will give birth to just over two children throughout her lifetime. While some women will choose to have no children, and others will elect to have more than two, there is little doubt that pregnancy will continue to affect the prevalence of female pelvic floor dysfunction in America for generations to come.

¹Ingrid Nygaard MD et al. *Prevalence of Symptomatic Pelvic Floor Disorders in US Women*. Journal of the American Medical Association, September 17, 2008—Vol 300, No. 11

² Alastair H. MacLennan, Anne W. Taylor, David H. Wilson, Don Wilson. *The prevalence of pelvic floor disorders and their relationship to gender, age, parity and mode of delivery*. British Journal of Obstetrics & Gynaecology. December 2000, Volume 107, pages 1460-1470.

³ Central Intelligence Agency. *The World Fact Book*. ISSN 1553-8133



2. The Prevalence of Pelvic Floor Dysfunction Increases with Age

As humans age, our muscles, ligaments, and connective tissue can weaken and deteriorate.

Muscles of the pelvic floor are no different; when these muscles weaken to the point of no longer holding organs and waste properly in place within our bodies, the result is pelvic floor dysfunction.

Table 1: Pelvic Floor Disorders Network - Prevalence of Pelvic Floor Dysfunction amongst American Females

Age	Prevalence of Pelvic Floor Dysfunction (one or more forms)
20-39	9.7% (95% Confidence Interval: 7.8% - 11.7%)
40-59	26.5% (95% CI: 23.0% - 29.9%)
60-79	36.8% (95% CI: 32.0% - 41.6%)
80 and Older	49.7% (95% CI: 40.3% - 59.1%)

While the correlation between age and prevalence of pelvic floor dysfunction is widely documented, new evidence has emerged that age itself may not be the causative factor. In a 2008 study of over 4,100 community-dwelling women, Lawrence et al. found that “after adjusting for confounding variables, age group alone no longer represented an important contributing factor to the prevalence of any single pelvic floor disorder. Rather, common comorbid conditions such as obesity, hormone therapy, prior hysterectomy, and vaginal parity seem to represent more important correlates for pelvic floor disorders than age alone.⁴”

Other researchers find a causal relationship between age and pelvic floor dysfunction⁵.

Differences in study design and statistical techniques employed may account for the schism of

⁴ Jean M. Lawrence, ScD, MPH et al. *Prevalence and Co-Occurrence of Pelvic Floor Disorders in Community-Dwelling Women*. The American College of Obstetricians and Gynecologists. Volume 111. No. 3. March 2008

⁵ MacLennan et al write “Pelvic floor disorders are very common and are strongly associated with female gender, ageing, pregnancy, parity and instrumental delivery”



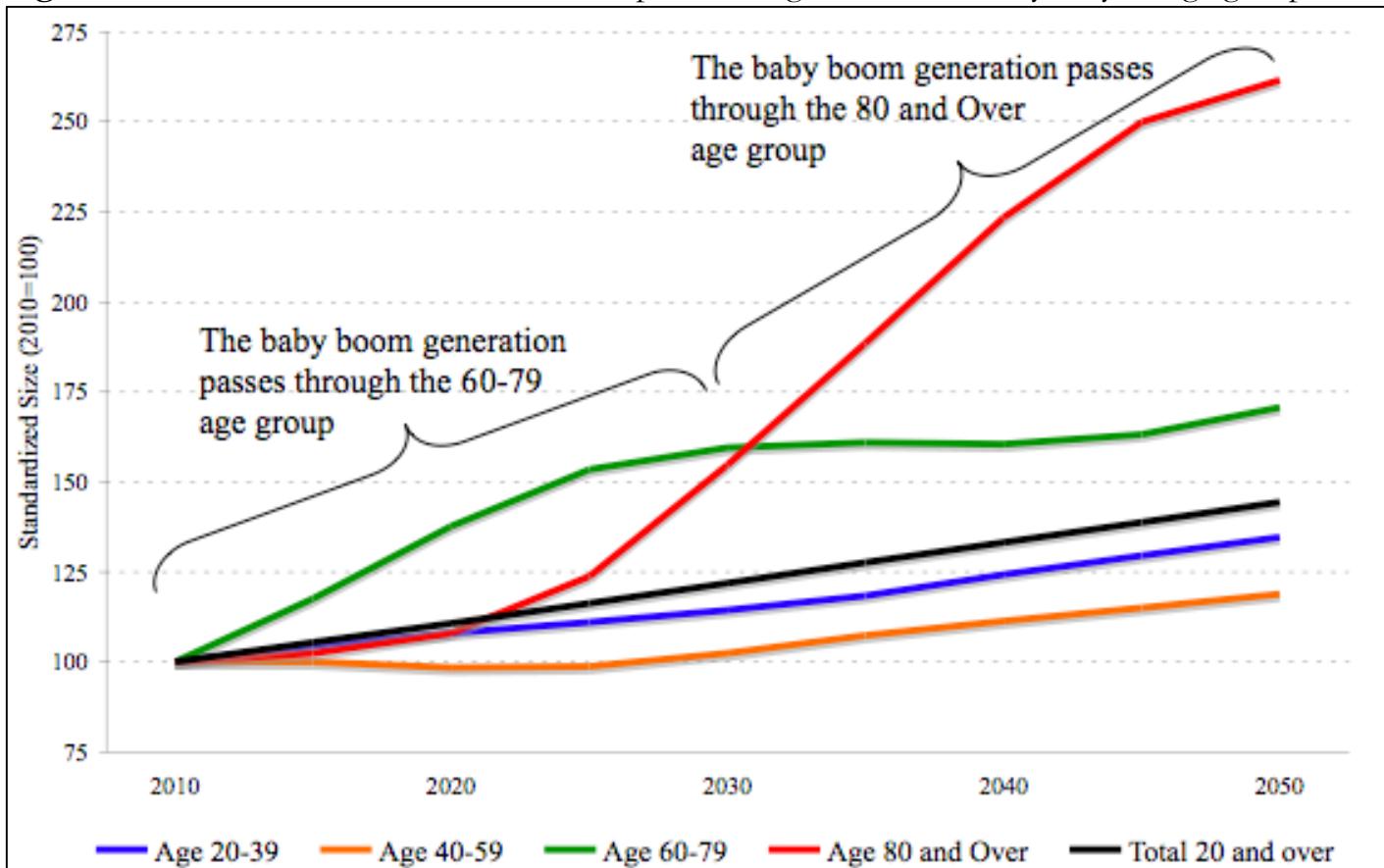
opinion. According to the findings of Lawrence et al., age has only a correlative relationship with pelvic floor dysfunction. Accordingly, changes in other comorbid conditions (obesity rate, use of hormone therapy, incidence prior hysterectomy, and vaginal parity) could yield shifts in pelvic floor dysfunction rates amongst older women. While this is a topic of research Herman & Wallace will continue to monitor and integrate into our curriculum, exploring the underlying cause of pelvic floor dysfunction is not the purpose of this white paper. Regardless of cause, the evidence is clear that pelvic floor dysfunction increases with age, which is a major driver of growth given the age structure of the American population.

3. The American Population is Growing Older

Between 1946 and 1964, an estimated 77.3 million Americans were born. This era is commonly referred to as the “baby boom”, and members of this generation have had a profound effect on America. During this era, the birthrate (defined as the number of births per 1000 members of the population) drastically increased from 20.4 in 1945 to just over 26.0 in 1949. The birthrate hovered at around 25 throughout much of the 1950s, until it dipped down below 20, signifying the end of the boom in 1965. As a point of reference, the 2009 US birthrate was 13.8.

In 2010, when the first baby boomers turned 64 years old, the American population over the age of 65 was 40.2 million—or about 13.0% of the entire population. By 2040, the number of Americans over the age of 65 will increase to 81.2 million and will comprise 20.0% of the population; meaning, in just 30 years, the number of Americans over the age of 65 is expected to double.

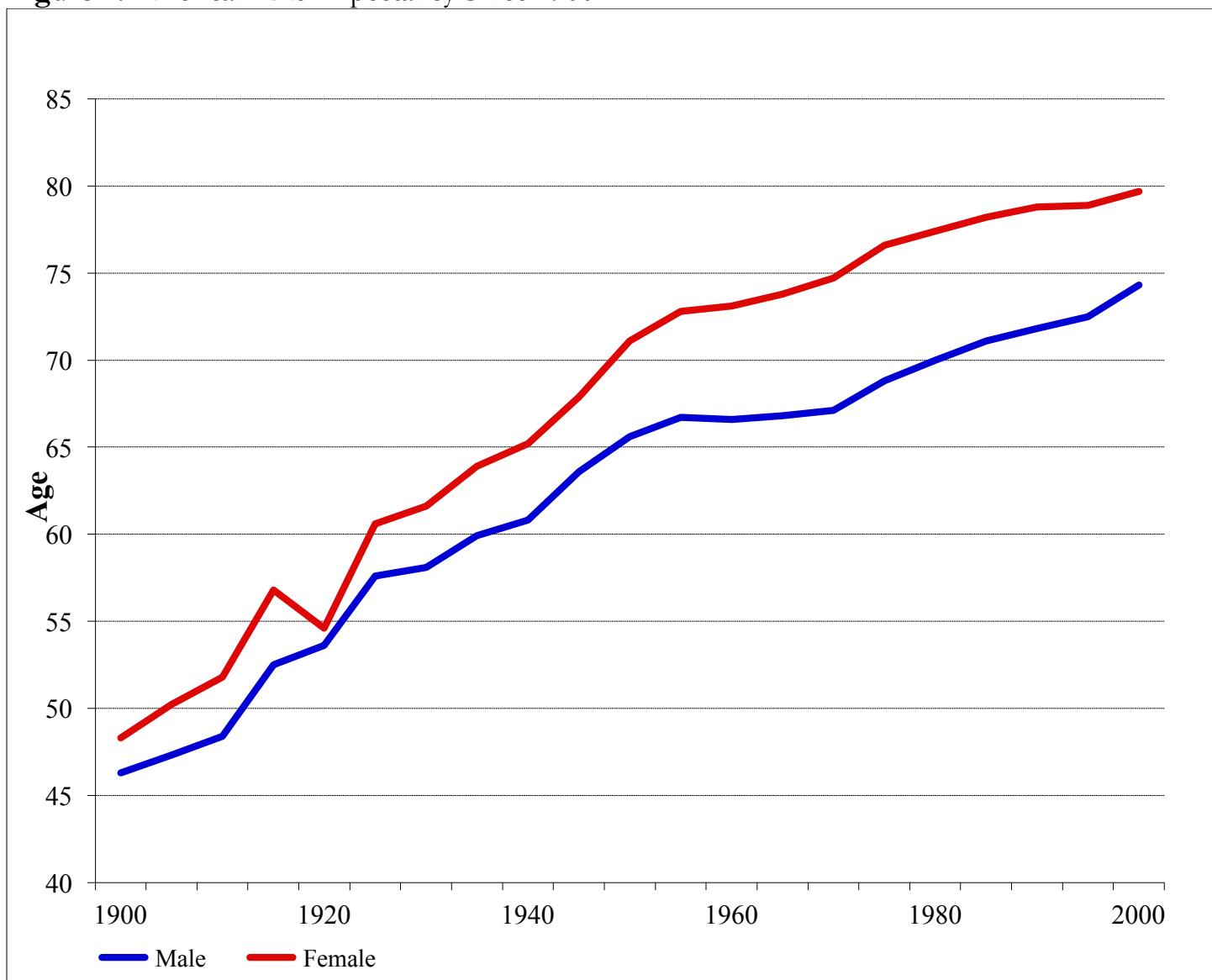
Figure 1: Standardized American Female Population Age 20 and over, by 20-year age groups



4. Women Live Longer than Men

Researchers have yet to reach a consensus on the reasons why American women have a greater life expectancy than men, though the data are very clear on the differential. The fact that men drink, smoke, and drive more than women, and tend to work more dangerous occupations, all contribute to the difference, yet biological (non-behavioral) factors likely play a role as well. This differential is expected to persist throughout the elderly years of the baby boomers (see Figure 2).

Figure 2: American Life Expectancy Since 1900⁶



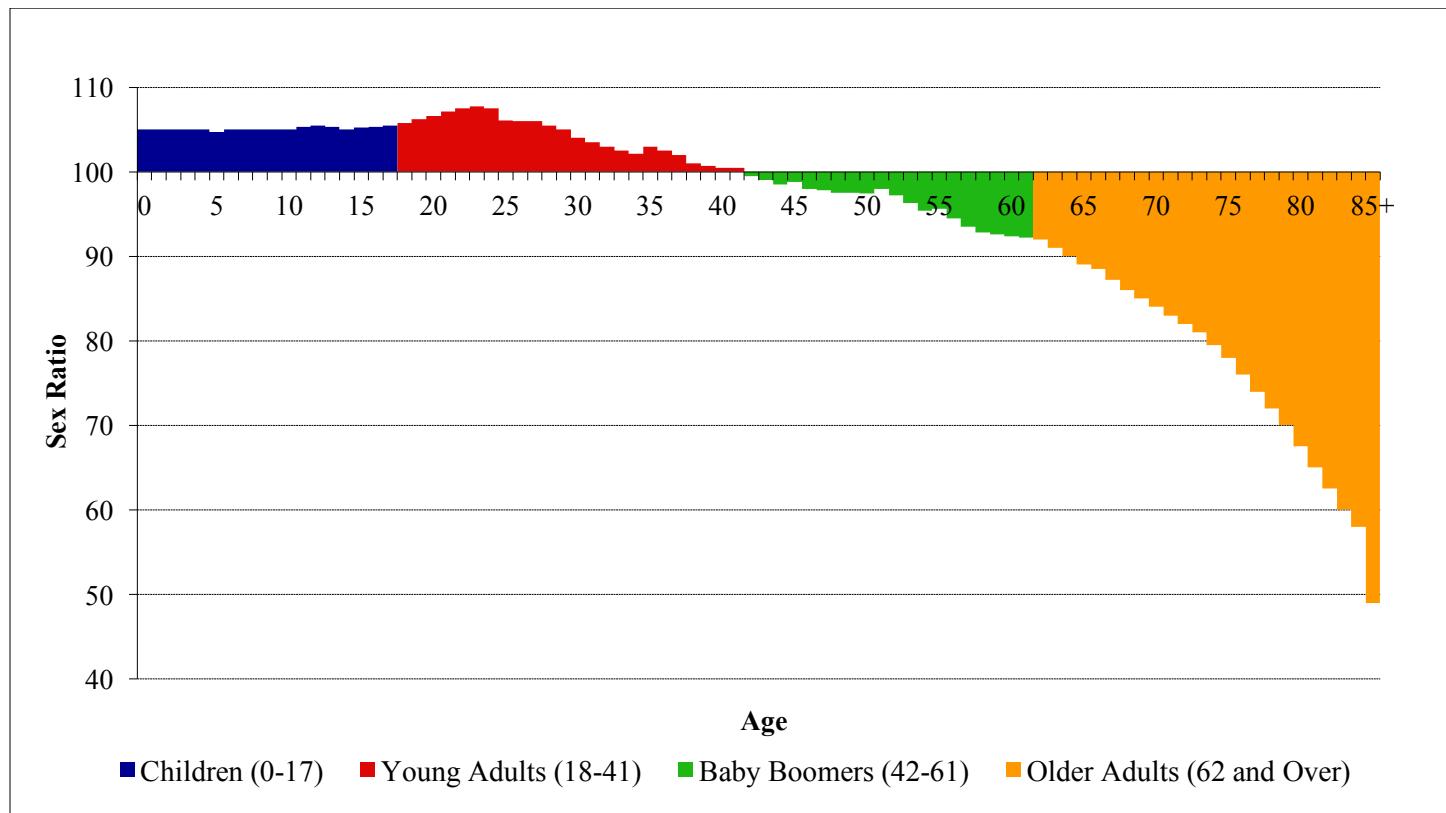
As the baby boomers continue to age throughout the first half of the 21st century, the ratio of elderly men to elderly women will shrink each year. This phenomenon is not unique to the baby boom generation, but the sheer size of the baby boom will yield an unprecedented number of elderly American women in the near future. In addition to the difference in life expectancy between men and women, the data clearly show that life expectancies have steadily grown throughout the

⁶ Center for Disease Control. *National Health Center Statistics*. Retrieved on May 23rd 2011 from: <http://www.cdc.gov/nchs/fastats/lifexpec.htm>



20th century (see Figure 2). While this trend cannot continue indefinitely, rehabilitation professionals must prepare for the increased longevity of these Americans, and ready themselves with the necessary skills to treat this cohort.

Figure 3: 2006 American Sex Ratio by Age⁷ (Male Population ÷ Female Population × 100)



Illustrated in Figure 3 (above), the baby boom generation has already started to shift toward becoming increasingly female. As the baby boomers increase in age, and the generation's sex ratio further resembles that of older Americans (age 62 and over in 2006), the nation will be home to an unparalleled number of elderly women. The 85+ data point clearly shows that there are over twice as many women age 85 and older than there are men (sex ration of less than 50). The prevalence data indicate that many of these women will suffer from some form of pelvic floor dysfunction.

⁷ Data from US Census Bureau “Selected Characteristics of Baby Boomers 42 to 60 Years Old in 2006”

Estimating the Size of the Affected Population

The 2005-2006 National Health and Nutrition Examination Survey (NHANES) conducted by the National Centers for Health Statistics Centers for Disease Control and Prevention included a subset of interview questions (and a physical examination) regarding symptoms of pelvic floor disorders. The results were used by the Pelvic Floor Disorders Network (PFDN) to estimate prevalence rates for three symptomatic pelvic floor disorders in non-pregnant women aged 20 years or older.

- Urinary Incontinence: Score of 3 or greater on a validated incontinence severity index, constituting moderate to severe leakage
- Fecal Incontinence: At least monthly leakage of solid, liquid, or mucous stool
- Pelvic Organ Prolapse: Seeing/Feeling a bulge in or outside the vagina

The survey found that age, parity, family poverty income ratio⁸, and body mass index (BMI) were significantly associated with pelvic floor dysfunction. Education level and race were not significantly associated pelvic floor dysfunction. While the findings regarding parity, family poverty income ratio, and BMI are important from both an academic and clinical standpoint, this white paper focuses on the prevalence of pelvic floor dysfunction in four 20-year age cohorts to generate estimates of the current affected population and future projections.

Table 1 (repeated): Prevalence of Pelvic Floor Dysfunction amongst American Females

Age	Prevalence of Pelvic Floor Dysfunction (one or more forms)
20-39	9.7% (95% Confidence Interval: 7.8% - 11.7%)
40-59	26.5% (95% CI: 23.0% - 29.9%)
60-79	36.8% (95% CI: 32.0% - 41.6%)
80 and Older	49.7% (95% CI: 40.3% - 59.1%)

⁸ Defined as the ratio of a family's income to the poverty threshold for a family of the same size. A score of less than 1 indicates a women living with a family below the poverty line, a score between 1 and 2 indicates a family living between 100% and 200% of the poverty line, and a score above 2 indicates a family living over 200% of the poverty line.



While the 2005-2006 NHANES did not extend to females age 19 and below, Herman & Wallace recognizes that pelvic floor dysfunction affects this age group. Rather than incorporating prevalence rates from other studies focused on this age group, this white paper addresses only the population above age 20. Data collection methods, symptomatic definitions, and break points differ across studies and attempting to measure this population with data from additional sources (however valid they may be in their own right) would provide an imperfect and unscientific estimate. As a point of reference however, the National Association for Continence estimates that 20% of 5-year-olds, 5% of 10-year-olds, and 1.0%-1.5% of 15-year-olds experience nocturnal enuresis (bed wetting). Measuring the size of this younger population will be the focus of future analysis.

In 2008, the US Census Bureau released its United States population projections for 2010, and each five-year increment thereafter to 2050. The data were based on the 2000 census results, and projections were generated using the “cohort-component method”, which accounts for births, deaths, and net migration. The projections are listed below:

Table 2: US Census Bureau American Female Population Projections by Age (Figures are in millions)

Age	2010	2020	2030	2040	2050
20-39	41.39	44.67	47.31	51.42	55.73
40-59	43.28	42.63	44.32	48.15	51.40
60-79	24.38	33.54	38.88	39.09	41.61
80 and Older	7.29	7.87	11.27	16.28	19.05
Total 20 and Older	116.34	128.71	141.78	154.95	167.81

NHANES pelvic floor dysfunction prevalence rates are applied to the respective cohort to estimate the size of the effected American female population in each ten-year increment from 2010



to 2050. The estimates are below:

Table 3: Herman & Wallace Projections of American Female Population experiencing one or more forms of Pelvic Floor Dysfunction (Figures are in millions)

Age	2010	2020	2030	2040	2050
20-39	4.01	4.33	4.58	4.98	5.40
40-59	11.46	11.29	11.74	12.76	13.62
60-79	8.97	12.34	14.30	14.38	15.31
80 and Older	3.62	3.91	5.60	8.09	9.47
Total 20 and Older	28.07	31.88	36.24	40.22	43.81

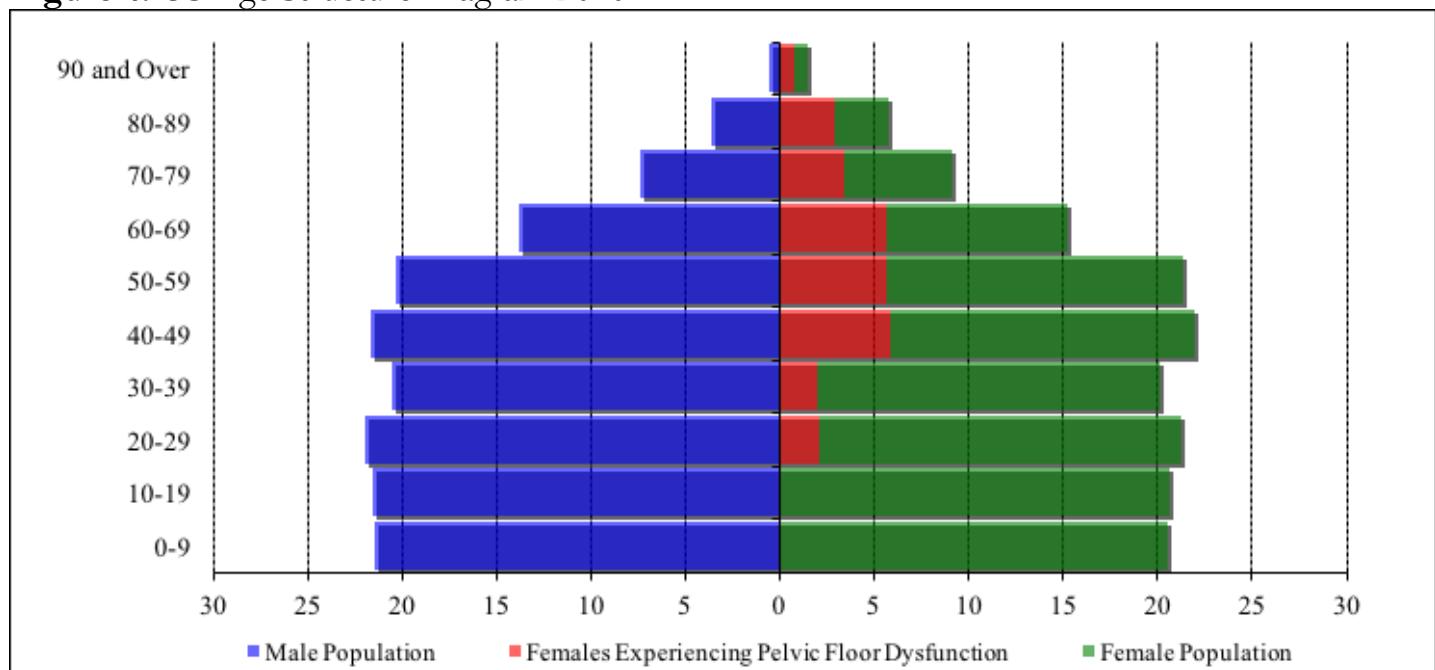
Points of interest:

1. Age group 40-59 is the largest cohort in year 2010, but is quickly outpaced by age group 60-79 which exceeds age group 40-59 by over 1 million women in 2020
2. After 2020, age group 60-79 remains the largest cohort throughout the length of the period studied
3. The largest absolute increase in affected population will occur in the 60-79 age group with 6.34 million more women experiencing Pelvic Floor dysfunction in 2050 than in 2010—just over a 70% increase.
4. The largest relative increase will occur in the 80 and over age group with 3.62 million women affected in 2010 and 9.47 million affected in 2050; an increase of 161.6%
5. The decade with most growth will be the 2020s. 4.36 million more American women will experience pelvic floor dysfunction in 2030 compared to 2020.



To provide a visual display of the expected growth in American females suffering from pelvic floor dysfunction, as well as emphasize the magnitude of the demographic effect of the baby boom generation, below are a series of Age Structure Diagrams for the US population starting in 2010 and ending in 2050.

Figure 4: US Age Structure Diagram 2010

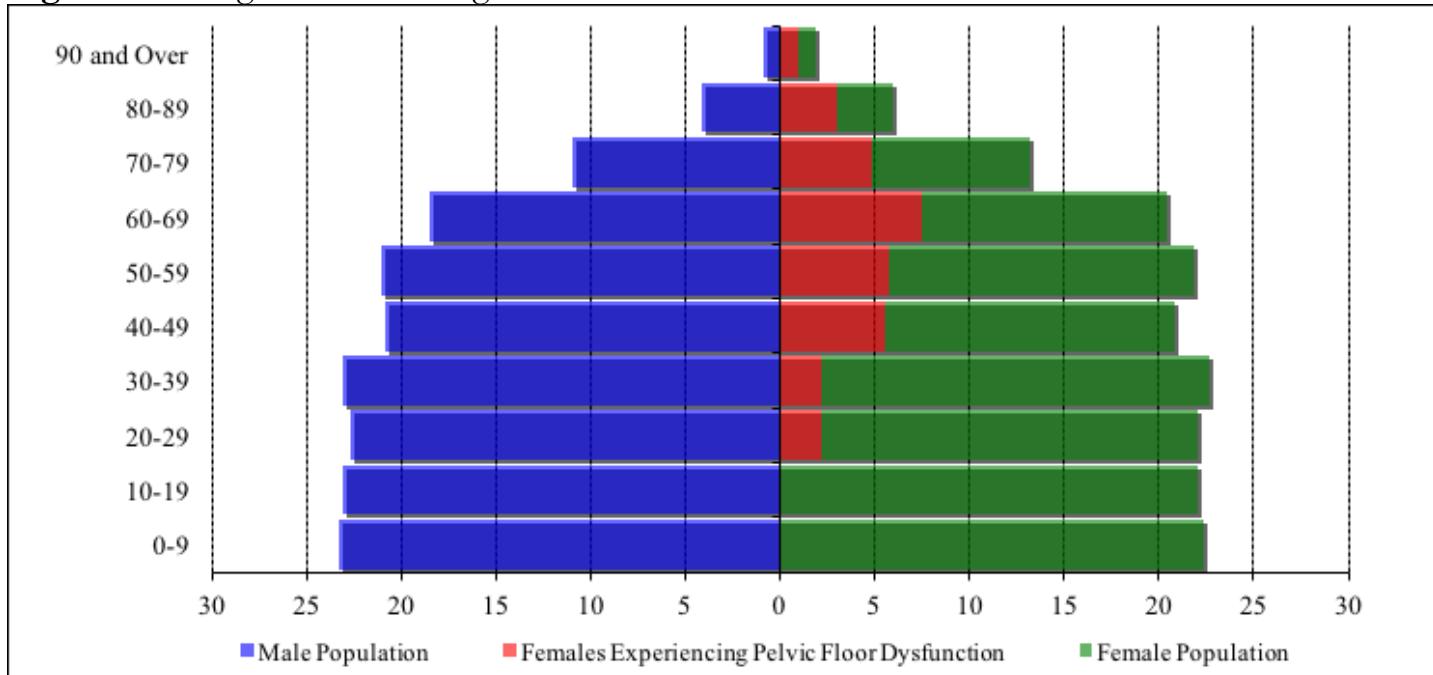


Estimated female population 20 and over experiencing pelvic floor dysfunction: 28.07 million

Estimated female population 20 and over: 116.34 million

Prevalence of pelvic floor dysfunction amongst females age 20 and over: 24.1%

Figure 5: US Age Structure Diagram 2020

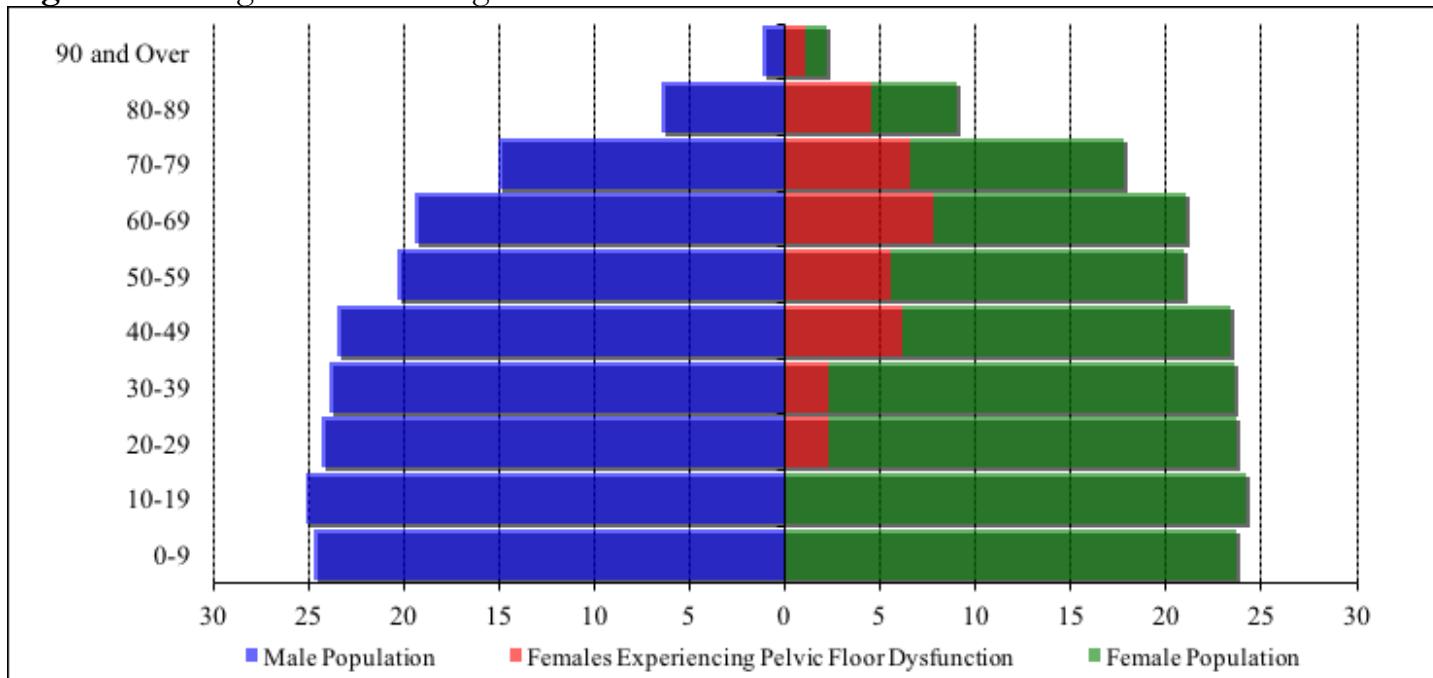


Estimated female population 20 and over experiencing pelvic floor dysfunction: 31.88 million

Estimated female population 20 and over: 128.71 million

Prevalence of pelvic floor dysfunction amongst females age 20 and over: 24.7%

Figure 6: US Age Structure Diagram 2030



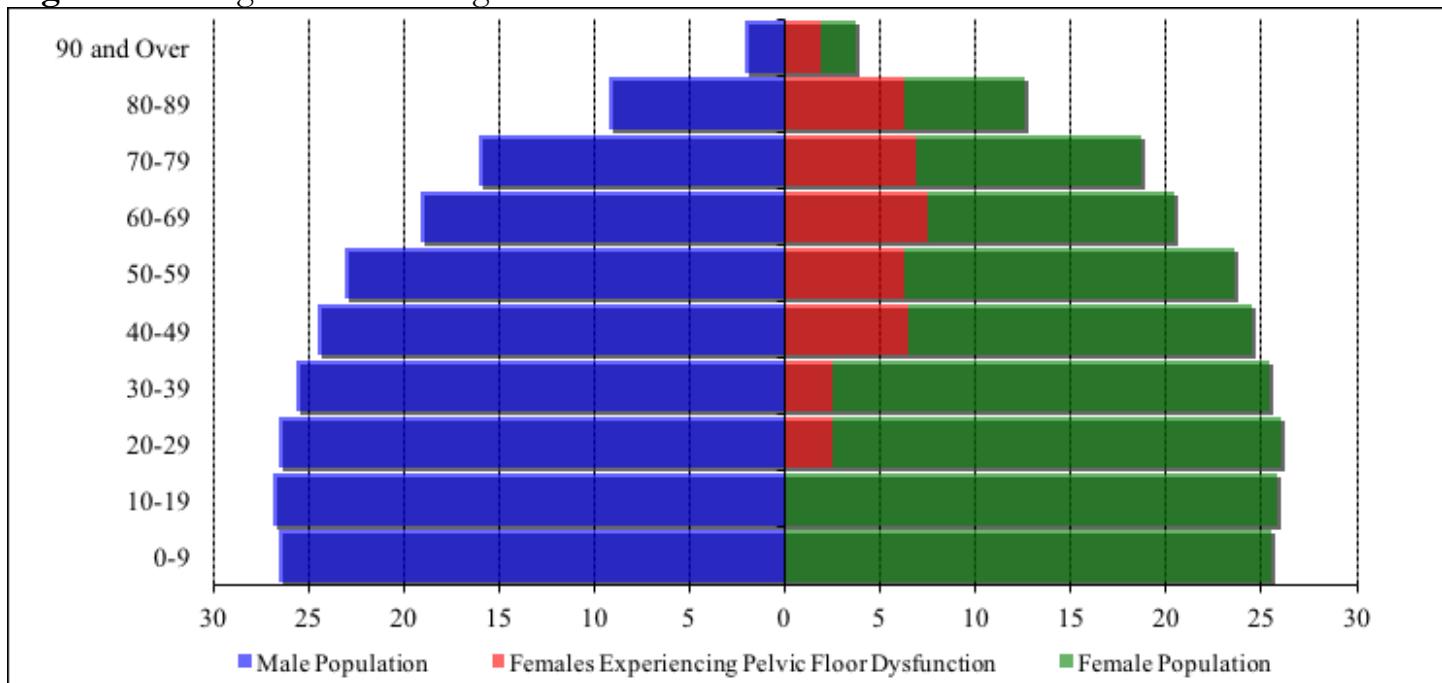
Estimated female population 20 and over experiencing pelvic floor dysfunction: 36.24 million

Estimated female population 20 and over: 141.78 million

Prevalence of pelvic floor dysfunction amongst females age 20 and over: 25.5%



Figure 7: US Age Structure Diagram 2040

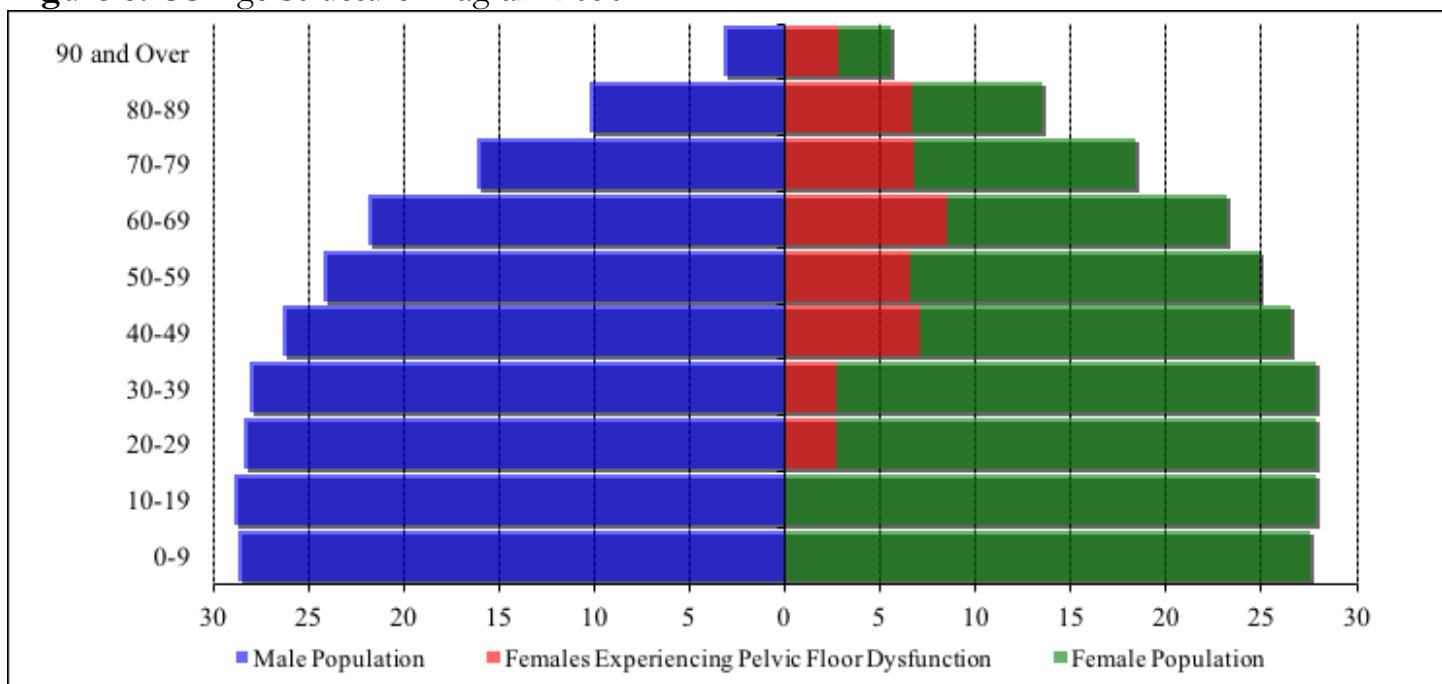


Estimated female population 20 and over experiencing pelvic floor dysfunction: 40.22 million

Estimated female population 20 and over: 154.95 million

Prevalence of pelvic floor dysfunction amongst females age 20 and over: 25.9%

Figure 8: US Age Structure Diagram 2050



Estimated female population 20 and over experiencing pelvic floor dysfunction: 43.81 million

Estimated female population 20 and over: 167.81 million

Prevalence of pelvic floor dysfunction amongst females age 20 and over: 26.1%



Conclusion

The impending growth in the number of pelvic floor dysfunction cases in America over the next 40 years is well represented in the academic literature. Higher prevalence of pelvic floor dysfunction amongst females and the elderly, longer female life expectancy, and the aging baby boom generation all contribute to this imminent epidemiological trend. To echo many of the authors cited in this white paper, the medical and rehabilitation community must prepare for this future growth. Learning, implementing, and mastering the techniques to treat pelvic floor dysfunction is an excellent strategy to properly position oneself for a career in a growing field where therapists' treatments and interventions will have an immeasurably positive effect on a patients' quality of life.

