ELECTRONIC COMPANION

The Markov property of B is tested in §1, and the treatment effect is estimated in §2 and partially justified in §3. Figs. 1-2 and 4-7 and Tables 6-9 and 12 of the Electronic Companion are discussed in the main text.

1 Testing the Markov Property of the BMI Process

We use the approach in Garber *et al.* (1994) to test the hypothesis that B is a first-order Markov chain. Let $n_{ijk}(t)$ be the number of individuals in our data set with BMI level k at age t, j at $t-2$, and i at $t-4$. To ensure a reasonable number of samples at each BMI level at each age, we use $m = 6$ BMI levels: $0-16, 16-18, 18-20, 20-22, 22-24, > 24$. Let $\hat{P}_{ij}(t_1, t_2)$ be the maximum likelihood estimate (MLE) for the probability that someone has BMI level j at age t_2 given that the BMI level was i at t_1. The testing method is based directly on the Chapman-Kolmogorov equations, $\mathbf{\hat{P}(t, t+2)\hat{P}(t+2, t+4) = P(t, t+4)}$, where $\mathbf{(t, t+2)}$ is the one-step transition matrix. For a given time t, the chi-square test statistic compares the number of expected and actual transitions from state i to k,

$$\sum_{(i,k):n_k \sum_{j=1}^m \hat{P}_{ij}(t,t+2)\hat{P}_{jk}(t+2,t+4)>0} \frac{\{n_i[\sum_{j=1}^m \hat{P}_{ij}(t,t+2)\hat{P}_{jk}(t+2,t+4) - \hat{P}_{ik}(t,t+4)]\}^2}{n_i \sum_{j=1}^m \hat{P}_{ij}(t,t+2)\hat{P}_{jk}(t+2,t+4)}, \quad (1)$$

where n_i is the total weight of all paths that are in state i at time t.

To find the distribution of the above statistic for a Markov chain, we simulate a number of Markov paths using the following procedure.

Step 1. Fix age t ($t = 0, 2, \ldots, 14$) and the gender. Find all BMI paths, $B_i(t), B_i(t+2), B_i(t+4)$, $i = 1, \ldots, J$, that have no blank data at the three time points. Compute the sample chi-square statistic χ_S^2 using equation (1).

Step 2. Randomly generate BMIs $B_i(t), i = 1, \ldots, J$, multinomially with replacement according to the weights w_i of the J paths. Find their states $C_i(t)$ among the six discretized levels, $0-16, 16-18, 18-20, 20-22, 22-24, > 24$, for $i = 1, \ldots, J$.

Step 3. For each state $C_i(t)$, use the one-step transition matrix $\hat{\mathbf{P}}(\mathbf{t}, \mathbf{t}+\mathbf{2})$ to randomly generate $C_i(t+2)$. Then use the one-step transition matrix $\hat{\mathbf{P}}(\mathbf{t}+\mathbf{2}, \mathbf{t}+\mathbf{4})$ to randomly generate $C_i(t+4)$.

Step 4. For the J simulated paths $C_i(t), C_i(t+2), C_i(t+4)$, $i = 1, \ldots, J$, estimate the transition matrices and estimate the chi-square statistic from equation (1).

Step 5. Repeat steps 2-4 10000 times to get 10000 bootstrapped chi-square statistics that form the distribution of the statistic for Markov chains. Compare this statistic to the statistic evaluated in step 1.

Step 6. Steps 1-5 are repeated 16 times for the two genders and ages $t = 0, 2, 4 \ldots, 14$.

The results are in Table 1 in the Electronic Companion. If χ^2_S is less than χ^2_{95}, which is the 95$^{\text{th}}$ percentile of the chi-square statistic evaluated from the simulated Markov chain, then we do not reject the null hypothesis that B is a first-order Markov chain. Out of the 16 cases, four cases fail the test: boys age 12 and girls ages 0,6,14. Using a Bonferroni correction, which looks at the 1-0.5/8=0.99625$^{\text{th}}$ fractile of the chi-square distribution because eight ages are being tested, the Markov hypothesis is not rejected for any age-gender combination.

The estimated transition probabilities $\hat{P}_{ij}(t)$ for the first-order Markov chain for males appear in Tables 2-3 in the Electronic Companion, and for females appear in Tables 4-5 in the Electronic Companion.

2 Estimating the Treatment Effect

The relevant data for our calculations are the sample size and the mean and standard deviation of the initial BMI, the final (i.e., 12 months later) BMI (we note that the 12-month results achieved in Reinehr *et al.* 2006 were maintained over three years, Reinehr *et al.* 2007), and the change in BMI over the 12 months, for both the control and treatment arms (Table 10 in the Electronic Companion). For the studies of Reinehr *et al.* (2006) and Nemet *et al.* (2005), the standard deviation of the change in BMI was calculated as in Whitlock *et al.* (2010) by assuming that the initial and final BMI have a correlation coefficient of 0.9. Savoye *et al.* (2007) reports the standard deviations of the pretreatment BMI (7.6) and the change in BMI (3.1), but not the standard deviation of the final BMI. Because there is no real solution to $3.1^2 = 7.6^2 + x^2 - 2(0.9)7.6x$, we substitute the correlation coefficient 0.92 for 0.9 in this equation to obtain a positive value for the standard deviation of the final BMI.

With these data in hand, we estimate the impact of treatment in three steps. First, we transform the BMI data in the "Initial" and "Final" columns in Table 10 in the Electronic Companion from B to X using a Taylor series expansion around the mean of B, μ_B, which yields

$$X \approx \frac{(\ln \mu_B)^\lambda - 1}{\lambda} + \frac{(\ln \mu_B)^{\lambda-1}}{\mu_B}(B - \mu_B) + \frac{(\ln \mu_B)^{\lambda-2}(\lambda - 1 - \ln \mu_B)}{2\mu_B^2}(B - \mu_B)^2. \quad (2)$$

From (2), we can compute the mean and standard deviation of X to be

$$\mu_X \approx \frac{(\ln \mu_B)^\lambda - 1}{\lambda} + \frac{(\ln \mu_B)^{\lambda-2}(\lambda - 1 - \ln \mu_B)}{2\mu_B^2}\sigma_B^2, \quad (3)$$

$$\sigma_X \approx \frac{(\ln \mu_B)^{\lambda-1}}{\mu_B}\sigma_B. \quad (4)$$

If we denote the "Initial" and "Final" values by X_t and X_{t+1}, respectively, then the mean of the change is given by $\mu_{X_{t+1}} - \mu_{X_t}$ and the standard deviation of the change is calculated, again using the assumption that the correlation coefficient is 0.9, via $\sqrt{\sigma_{X_t}^2 + \sigma_{X_{t+1}}^2 - 1.8\sigma_{X_t}\sigma_{X_{t+1}}}$. Because the Box-Cox parameter λ differs for males and females, we perform these calculations separately for each gender (Table 11 in the Electronic Companion).

In the second step, we compute the mean and standard deviation of the net treatment (i.e., treatment minus control) effect over the three studies. We use the subscript $i = 1, 2, 3$ for studies Savoye *et al.* (2007), Reinehr *et al.* (2006) and Nemet *et al.* (2005), respectively, and let the subscript $j = 1$ be the control group and $j = 2$ be the treatment group. Denoting the weights of the three studies by p_i, we have from Fig. 3 of Whitlock *et al.* (2010) that $p_1 = 0.3830, p_2 = 0.3649, p_3 = 0.2521$. Letting $\mu_{\Delta X_{ij}}$ and $\sigma_{\Delta X_{ij}}$ be the mean and standard deviation of the change in transformed BMI for arm j of study i, we have that the net treatment effect has mean $\sum_{i=1}^{3} p_i(\mu_{\Delta X_{i2}} - \mu_{\Delta X_{i1}})$ and variance $\sum_{i=1}^{3} p_i^2(\sigma_{\Delta X_{i2}} - \sigma_{\Delta X_{i1}})$, assuming independence. These calculations yield a net treatment effect with a mean μ_T and standard deviation σ_T of (-0.00183,0.00059) for males and (-0.00214,0.00069) for females.

In the final step, we use μ_T and σ_T to estimate μ_{hxt} and σ_{hxt}. Recalling that μ_T and σ_T represent only treatment whereas the pdf h_{xt} incorporates both treatment and natural progression, we set $\mu_{hxt} = \mu_{gxt} + \mu_T$ and $\sigma^2_{hxt} = \sigma^2_{gxt} + \sigma^2_T$. Fig. 3 in the Electronic Companion reveals that $\sigma^2_{gxt} \gg \sigma^2_T$, and hence $\sigma^2_{hxt} \approx \sigma^2_{gxt}$, in most cases, which is consistent with the observation that the standard deviation of the treatment arms and control arms are very similar in each of the three studies above and in other similar meta-analyses (e.g., Analysis 1.2 and Analysis 2.4 in Oude Luttikhuis 2009).

3 Justifying the Treatment Effect

In this section we present analysis that partially justifies our assumption that treatment reduces the transformed BMI X_t by an amount that is independent of gender, age and pre-treatment BMI level. Fig. 4 in the Electronic Companion shows a plot of the change in BMI due to treatment as a function of pre-treatment BMI level, B_t; i.e., for each value of B_t, we convert it to X_t, then add the treatment mean μ_T, then convert the sum back to untransformed BMI, and then subtract the original B_t. Fig. 4 in the Electronic Companion also shows a point on the graph for each of the three studies in Table 1 of Whitlock *et al.* (2010), which corresponds to the study's mean pre-treatment BMI level (averaged over treatment and control arms) and the mean change in BMI level between the treatment and control arms. Fig. 4 in the Electronic Companion shows that our treatment model accurately captures the dependence on pre-treatment BMI, albeit in a somewhat narrow range of pre-treatment levels.

The results in Epstein *et al.* (2007) allow us to assess how accurately we capture the impact of age on treatment efficacy. In Figure 1 of Epstein *et al.* (2007), the change in z-BMI after 24 months has a mean of -1.08 for children $< 10\frac{1}{3}$ and -0.86 for children $> 10\frac{1}{3}$. The standard error of the mean is approximately 0.08 in both cases. For each z-BMI level above the 95$^{\text{th}}$ percentile on the CDC curve for each age and gender (these are the subset of children that are treated by Epstein *et al.* 2007), we find the corresponding X_t, then reduce it by μ_{hxt}, then convert the result back to z-BMI using the CDC curve for two years later, and compute the change in z-BMI as the post-treatment z-BMI minus the original z-BMI. We average all of these changes over all values of z-BMI above the 95$^{\text{th}}$ percentile in the CDC charts to get an average change in z-BMI for a particular gender and for ages 6,8,...,16. Finally, we combine genders and average these numbers for ages 6,8,10 and for ages 12,14,16 to get -0.4861 for ages 6,8,10 and -0.4525 for ages 12,14,16. Although the absolute values of these numbers are lower than the corresponding numbers of -1.08 and -0.86 in Epstein *et al.* (2007) (suggesting that Epstein's reported improvements are higher than those in the three studies in Table 1 in Whitlock *et al.* 2010), we are more interested in the younger-to-older ratio, which is $\frac{1.08}{0.86} = 1.256$ in Epstein *et al.* (2007) and $\frac{0.4861}{0.4525} = 1.074$ in our analysis. Although this comparison is somewhat crude (e.g., we do not know the age distribution in the Epstein studies), it is reassuring that we are successfully predicting that this ratio is greater than one; i.e., our modeling approach is more conservative than assuming that the treatment-induced change in z-BMI is independent of age. Nonetheless, to the extent that we are underestimating this ratio, our assumptions are not conservative with respect to our conclusion that the optimal policy outperforms the USPSTF policy.

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Age	Male			Female		
t	χ^2_S	χ^2_{95}	$\chi^2_{99.625}$	χ^2_S	χ^2_{95}	$\chi^2_{99.625}$
0	0.7045	0.9402	1.4999	1.2829	1.0673	1.4080
2	0.5745	1.1914	1.9189	0.9768	1.0207	1.3231
4	0.6993	0.9142	2.1686	0.4915	0.9407	1.4375
6	0.6966	1.0191	1.3690	1.2684	0.9493	1.9908
8	0.9628	0.9891	1.6084	0.7651	0.9774	1.7675
10	0.9241	1.0191	1.2002	0.8996	1.0280	1.4458
12	1.2886	1.0584	1.3100	0.7945	0.9692	1.4232
14	0.4844	0.8869	1.1817	1.2342	1.0098	1.8881

Table 1: Markovian test results. χ^2_S is the sample chi-square statistic evaluated from the dataset. χ^2_{95} and $\chi^2_{99.625}$ are the 95^{th} and 99.625^{th} percentiles of the chi-square statistic evaluated from a simulated Markov chain.

age 0-2	<16	16-18	18-20	20-22	22-24	>24
<16	0.3511	0.3936	0.1204	0.107	0.0199	0.0079
16-18	0.5119	0.3369	0.0412	0.0494	0	0.0607
18-20	0.2454	0.3861	0.1633	0.133	0	0.0722
20-22	0.2787	0.3441	0.0941	0.1417	0.0902	0.0512
22-24	0.3961	0.4006	0.2033	0	0	0
>24	0.2282	0.3676	0.2822	0	0	0.122
age 2-4	<16	16-18	18-20	20-22	22-24	>24
<16	0.7564	0.196	0.0139	0.0195	0	0.0142
16-18	0.524	0.3363	0.0894	0.0374	0.003	0.0098
18-20	0.381	0.3892	0.21	0.0135	0	0.0063
20-22	0.3037	0.3739	0.2381	0.0097	0.0746	0
22-24	0.3985	0.3797	0	0.1937	0.0281	0
>24	0.6165	0.2539	0.1296	0	0	0
age 4-6	<16	16-18	18-20	20-22	22-24	>24
<16	0.7636	0.1844	0.0355	0.011	0.0043	0.0012
16-18	0.452	0.361	0.1098	0.0609	0	0.0162
18-20	0.3145	0.3279	0.1495	0.1465	0.0506	0.0111
20-22	0.2898	0.2454	0.0887	0.1521	0.0216	0.2023
22-24	0	0.4711	0	0	0.3248	0.2041
>24	0.3307	0.3814	0.2089	0.0422	0	0.0368
age 6-8	<16	16-18	18-20	20-22	22-24	>24
<16	0.6133	0.2702	0.0868	0.0138	0.0068	0.0091
16-18	0.1566	0.408	0.2976	0.0914	0.024	0.0224
18-20	0.0754	0.0929	0.3263	0.2468	0.2171	0.0416
20-22	0.0116	0.1068	0.0547	0.1973	0.1417	0.4878
22-24	0	0.2555	0	0	0.0557	0.6888
>24	0.087	0.1354	0	0	0.0981	0.6795

Table 2: The estimated transition probabilities $P_{ij}(t)$ for the first-order Markov chain for males of ages 0-8.

age 8-10	<16	16-18	18-20	20-22	22-24	>24
<16	0.4916	0.4025	0.0814	0.0168	0.005	0.0027
16-18	0.0977	0.4062	0.309	0.1296	0.0398	0.0177
18-20	0.0343	0.1053	0.3002	0.3127	0.18	0.0675
20-22	0	0.062	0.0481	0.1988	0.3146	0.3766
22-24	0.0999	0	0.0488	0.0524	0.1211	0.6778
>24	0.0219	0.0522	0.0427	0.0191	0.062	0.802
age 10-12	<16	16-18	18-20	20-22	22-24	>24
<16	0.367	0.4121	0.1814	0.0243	0	0.0152
16-18	0.0516	0.334	0.4149	0.1369	0.0391	0.0235
18-20	0.0122	0.0626	0.3038	0.4126	0.1151	0.0937
20-22	0	0.0134	0.0663	0.0861	0.4532	0.381
22-24	0	0.0198	0.0181	0.1099	0.142	0.7103
>24	0.01	0.0163	0.04	0.0601	0.043	0.8306
age 12-14	<16	16-18	18-20	20-22	22-24	>24
<16	0.1358	0.4811	0.2709	0.0675	0.0176	0.0271
16-18	0.0178	0.2297	0.4522	0.2388	0.0477	0.0137
18-20	0.004	0.0346	0.2845	0.4872	0.154	0.0356
20-22	0	0.0273	0.086	0.2845	0.3522	0.2499
22-24	0	0	0.0047	0.1486	0.2115	0.6352
>24	0.0093	0.0092	0.0178	0.0282	0.0976	0.8379
age 14-16	<16	16-18	18-20	20-22	22-24	>24
<16	0.1189	0.5137	0.2804	0.087	0	0
16-18	0.0193	0.143	0.5473	0.2681	0.0223	0
18-20	0.0038	0.0065	0.2356	0.5604	0.1511	0.0427
20-22	0	0.0102	0.1405	0.402	0.3285	0.1187
22-24	0	0	0.0349	0.1851	0.3929	0.3871
>24	0	0.0055	0.0023	0.0191	0.0742	0.8989
age 16-18	<16	16-18	18-20	20-22	22-24	>24
<16	0.0688	0.1027	0.236	0.0646	0.2384	0.2895
16-18	0	0.2611	0.5264	0.1569	0.0297	0.0258
18-20	0	0.0264	0.3871	0.4854	0.09	0.0111
20-22	0	0	0.0604	0.4095	0.4297	0.1003
22-24	0	0	0.0148	0.1076	0.4652	0.4123
>24	0	0	0	0.0083	0.0726	0.9191

Table 3: The estimated transition probabilities $P_{ij}(t)$ for the first-order Markov chain for males of ages 8-18.

age 0-2	<16	16-18	18-20	20-22	22-24	>24
<16	0.4885	0.3781	0.0637	0.0083	0.0026	0.0587
16-18	0.5706	0.2474	0.0838	0.0319	0.0211	0.0453
18-20	0.4393	0.338	0.1391	0.012	0	0.0715
20-22	0.5292	0.2927	0.0743	0	0.0715	0.0324
22-24	0.6953	0	0	0	0.3047	0
>24	0.6187	0.3813	0	0	0	0
age 2-4	<16	16-18	18-20	20-22	22-24	>24
<16	0.7336	0.1818	0.0557	0.0023	0.0131	0.0135
16-18	0.5701	0.3335	0.0825	0.0086	0.0052	0
18-20	0.3094	0.4539	0.13	0.0677	0.0389	0
20-22	0.4328	0.2881	0.1324	0.1197	0	0.027
22-24	0.1204	0	0.4525	0.1913	0	0.2358
>24	0.4351	0.3856	0.0605	0.0187	0	0.1001
age 4-6	<16	16-18	18-20	20-22	22-24	>24
<16	0.7115	0.1991	0.0647	0.0096	0.0054	0.0097
16-18	0.4361	0.3248	0.1361	0.0766	0.0205	0.006
18-20	0.314	0.1592	0.2123	0.2003	0.0961	0.0181
20-22	0.3428	0	0.0779	0.1819	0.35	0.0475
22-24	0.3513	0	0.0628	0.16	0.0567	0.3691
>24	0.1433	0.1187	0	0	0.1333	0.6047
age 6-8	<16	16-18	18-20	20-22	22-24	>24
<16	0.5646	0.3004	0.0912	0.0316	0.0047	0.0075
16-18	0.1942	0.3533	0.2902	0.1145	0.0234	0.0244
18-20	0.0927	0.0975	0.2332	0.2226	0.2277	0.1263
20-22	0.0215	0.0743	0.1123	0.2681	0.2415	0.2823
22-24	0.1315	0.0258	0.029	0.1992	0.1468	0.4677
>24	0.2048	0.0517	0	0.2213	0.0779	0.4443

Table 4: The estimated transition probabilities $P_{ij}(t)$ for the first-order Markov chain for females of ages 0-8.

age 8-10	<16	16-18	18-20	20-22	22-24	>24
<16	0.5385	0.3008	0.1202	0.0186	0.0199	0.0021
16-18	0.0825	0.3138	0.3845	0.1465	0.0445	0.0282
18-20	0.0323	0.1045	0.2973	0.3508	0.1771	0.038
20-22	0.0299	0.0478	0.0606	0.2706	0.2903	0.3008
22-24	0.0081	0.013	0.0146	0.141	0.0865	0.7369
>24	0.0145	0.0262	0.0846	0.0879	0.0694	0.7172
age 10-12	<16	16-18	18-20	20-22	22-24	>24
<16	0.2938	0.4518	0.1724	0.0629	0.014	0.0051
16-18	0.0513	0.2797	0.4564	0.1511	0.0461	0.0153
18-20	0	0.05	0.2488	0.4417	0.1819	0.0776
20-22	0.0133	0	0.0974	0.2738	0.299	0.3164
22-24	0	0.0177	0.0423	0.1228	0.1913	0.626
>24	0	0.0062	0.0128	0.0485	0.0496	0.8829
age 12-14	<16	16-18	18-20	20-22	22-24	>24
<16	0.2043	0.6053	0.1563	0.0237	0.0104	0
16-18	0.0225	0.2392	0.5301	0.1541	0.0322	0.022
18-20	0	0.0448	0.3017	0.5102	0.113	0.0303
20-22	0	0.0323	0.1387	0.3937	0.3	0.1353
22-24	0	0.0154	0.0121	0.1856	0.3335	0.4534
>24	0	0	0.0379	0.0474	0.0636	0.8511
age 14-16	<16	16-18	18-20	20-22	22-24	>24
<16	0.3359	0.4354	0.1425	0.0862	0	0
16-18	0.0213	0.3785	0.4698	0.0793	0.0356	0.0154
18-20	0	0.0983	0.415	0.3836	0.099	0.0041
20-22	0	0.0018	0.1367	0.5283	0.2426	0.0905
22-24	0	0.0128	0.0114	0.1506	0.4759	0.3493
>24	0	0	0	0.0229	0.1108	0.8663
age 16-18	<16	16-18	18-20	20-22	22-24	>24
<16	0.4287	0.5713	0	0	0	0
16-18	0.0178	0.4162	0.4402	0.1024	0.0163	0.007
18-20	0	0.0528	0.4665	0.3906	0.0849	0.0052
20-22	0.0053	0	0.1125	0.5004	0.2984	0.0835
22-24	0	0	0.009	0.1359	0.4926	0.3626
>24	0	0.001	0.009	0.0236	0.0714	0.8951

Table 5: The estimated transition probabilities $P_{ij}(t)$ for the first-order Markov chain for females of ages 8-18.

	0	2	4	6	8	10	12	14	16
<12	-	-	-	-	-	-	-	0	0
12-13	-	-	-	-	-	-	-	0	0
13-14	-	-	-	-	-	-	-	-	0
14-15	-	-	-	+	-	-	-	-	-
15-16	-	-	+	-	-	-	-	-	-
16-17	-	-	+	-	-	-	-	-	-
17-18	-	+	-	-	-	-	-	-	-
18-19	-	-	-	-	-	-	-	-	-
19-20	-	-	-	-	-	-	-	-	-
20-21	-	-	-	-	-	-	-	-	-
21-22	-	-	-	-	-	-	-	-	-
22-23	-	-	-	-	+	-	-	-	-
23-24	-	-	-	-	-	-	-	-	-
24-25	-	0	0	-	-	-	-	-	-
25-26	0	0	-	-	-	-	-	-	-
26-27	0	0	-	0	-	-	-	-	-
27-28	0	-	0	-	-	+	-	-	-
28-29	0	-	0	0	-	-	-	-	-
29-30	0	-	0	0	-	-	-	-	-
30-31	0	0	0	-	-	-	-	-	-
31-32	0	-	-	0	-	-	-	-	-
32-33	0	0	0	0	0	-	-	-	-
33-34	0	0	0	0	0	-	0	-	-
34-35	0	0	0	0	0	-	-	-	-
35+	-	-	-	0	-	-	-	-	-

Table 6: The 95% K-S normality testing results of $X_{t+2} - X_t$ for males with a 25 bucket system.
Rows represent BMI levels at t, columns represent age t.
"+": normality test failed; "-": normality test passed; "0": insufficient data.

	0	2	4	6	8	10	12	14	16
<12	-	-	-	-	-	-	0	0	0
12-13	-	-	-	-	-	-	-	0	0
13-14	-	-	-	-	-	-	-	0	0
14-15	-	-	+	-	-	-	-	-	0
15-16	-	-	-	+	-	-	-	-	-
16-17	-	-	+	-	-	-	-	-	-
17-18	-	-	-	-	-	-	-	-	-
18-19	-	-	-	-	-	-	-	-	-
19-20	-	-	-	-	-	-	-	-	-
20-21	-	-	-	+	-	-	+	-	-
21-22	-	-	-	-	-	-	-	-	-
22-23	-	-	-	-	-	-	-	-	-
23-24	0	-	-	-	-	-	-	-	-
24-25	-	-	-	-	-	-	-	-	-
25-26	0	0	-	0	-	-	-	-	-
26-27	0	-	0	-	-	-	-	-	-
27-28	0	0	0	0	-	-	-	-	+
28-29	0	0	0	-	0	-	-	-	-
29-30	0	-	0	0	-	-	-	-	-
30-31	0	0	0	-	-	-	-	-	-
31-32	0	-	-	0	0	-	-	-	-
32-33	0	0	0	0	-	-	-	-	-
33-34	0	0	0	0	0	-	-	-	-
34-35	0	0	-	0	0	-	-	-	-
35+	-	-	0	0	-	-	-	-	+

Table 7: The 95% K-S normality testing results of $X_{t+2} - X_t$ for females with a 25 bucket system.
Rows represent BMI levels at t , columns represent age t .
"+": normality test failed; "-": normality test passed; "0": insufficient data.

	0	2	4	6	8	10	12	14	16
<16	-	-	+	+	+	+	+	-	-
16-18	-	+	+	+	-	+	-	-	-
18-20	-	-	-	-	+	-	-	-	-
20-22	-	-	-	-	-	-	-	-	-
22-24	-	-	-	-	+	+	-	-	+
24+	-	-	-	-	+	+	+	+	+

Table 8: The 95% K-S normality testing results of $X_{t+2} - X_t$ for males with a 6 bucket system.
Rows represent BMI levels at t, columns represent age t.
"+": normality test failed; "-": normality test passed; "0": insufficient data.

	0	2	4	6	8	10	12	14	16
<16	-	+	+	+	+	+	-	-	-
16-18	-	-	-	+	-	-	-	-	-
18-20	-	-	-	+	+	-	-	-	-
20-22	-	-	-	+	+	-	+	-	+
22-24	-	-	-	+	+	-	-	-	-
24+	-	-	-	-	+	-	+	+	+

Table 9: The 95% K-S normality testing results of $X_{t+2} - X_t$ for females with a 6 bucket system.
Rows represent BMI levels at t , columns represent age t .
"+": normality test failed; "-": normality test passed; "0": insufficient data.

Study	Control Arm							Treatment Arm						
		Initial		Final		Change			Initial		Final		Change	
	Size	Mean	SD	Mean	SD	Mean	SD	Size	Mean	SD	Mean	SD	Mean	SD
Savoye	69	36.2	6.2	37.8	7.7	1.6	3.2	105	35.8	7.6	34.1	8.0	-1.7	3.1
Reinehr	37	26.1	4.0	28.1	3.4	2.0	1.8	174	27.0	4.4	27.1	4.0	0.1	1.9
Nemet	20	28.0	5.2	28.6	5.8	0.6	2.5	20	27.7	3.6	26.1	4.7	-1.6	2.1

Table 10: Data (including samples sizes, and means and standard deviations of BMI) used to compute the effects of treatment. Data taken from Tables 1 and 2 of Savoye *et al.* (2007), Table 2 of Reinhehr *et al.* (2006), Table 5 of Nemet *et al.* (2005), and Fig. 3 of Whitlock *et al.* (2010).

Study	Control Arm						Treatment Arm					
	Initial		Final		Change		Initial		Final		Change	
Male	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Savoye	0.435	0.0031	0.435	0.0035	0.00058	0.00046	0.434	0.0038	0.433	0.0044	-0.00111	0.00058
Reinehr	0.428	0.0037	0.43	0.0027	0.00196	0.00098	0.429	0.0038	0.429	0.0034	0.0002	0.00037
Nemet	0.429	0.0042	0.43	0.0045	0.00035	0.00029	0.43	0.003	0.428	0.0043	-0.00179	0.00138
Female	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Savoye	0.457	0.0036	0.458	0.0042	0.00068	0.00055	0.456	0.0045	0.455	0.0052	-0.0013	0.00068
Reinehr	0.449	0.0043	0.451	0.0032	0.00228	0.00113	0.45	0.0044	0.45	0.004	0.00023	0.00043
Nemet	0.451	0.0049	0.451	0.0052	0.00041	0.00035	0.451	0.0035	0.449	0.0051	-0.00208	0.0016

Table 11: The transformed BMI values that correspond to the BMI values in Table 10 of the Electronic Companion, for both males and females.

Gender	Disease	β_0	β_1	Odds Ratio	McFadden Pseudo-R^2
Male	Hypertension	-3.979	0.113	1.12	0.023
Male	Diabetes	-6.339	0.150	1.16	0.039
Female	Hypertension	-6.791	0.233	1.26	0.122
Female	Diabetes	-7.320	0.184	1.20	0.082

Table 12: The coefficients for the logistic regression, where β_0 is the intercept and β_1 is the coefficient for the independent variable in equation (4) of the main text.

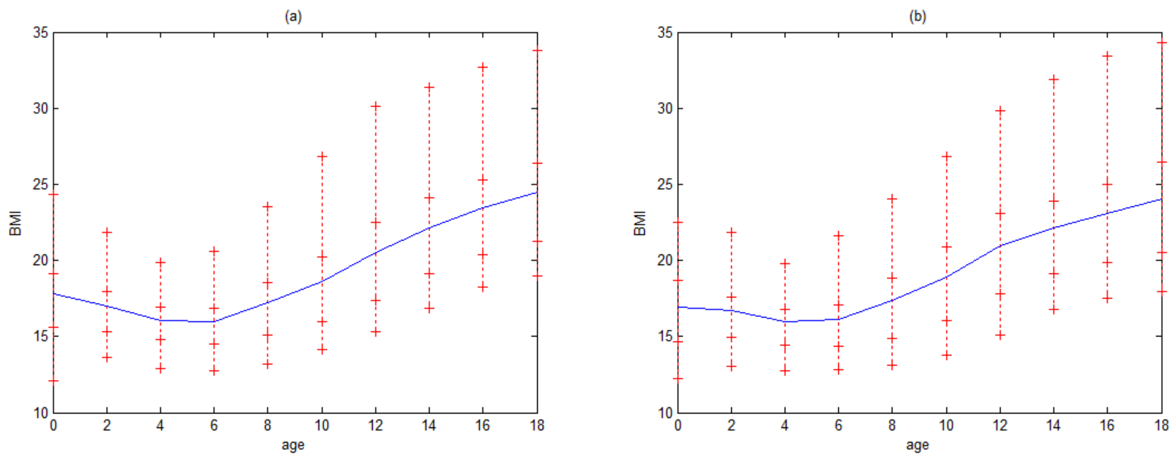

Figure 1: Box-like plots for BMI for **(a)** males and **(b)** females. The solid line connects the mean BMI at each age. On each vertical line, the inner pair of dashes represent the 25^{th} and 75^{th} percentiles, and the outer pair of dashes represent the 5^{th} and 95^{th} percentiles.

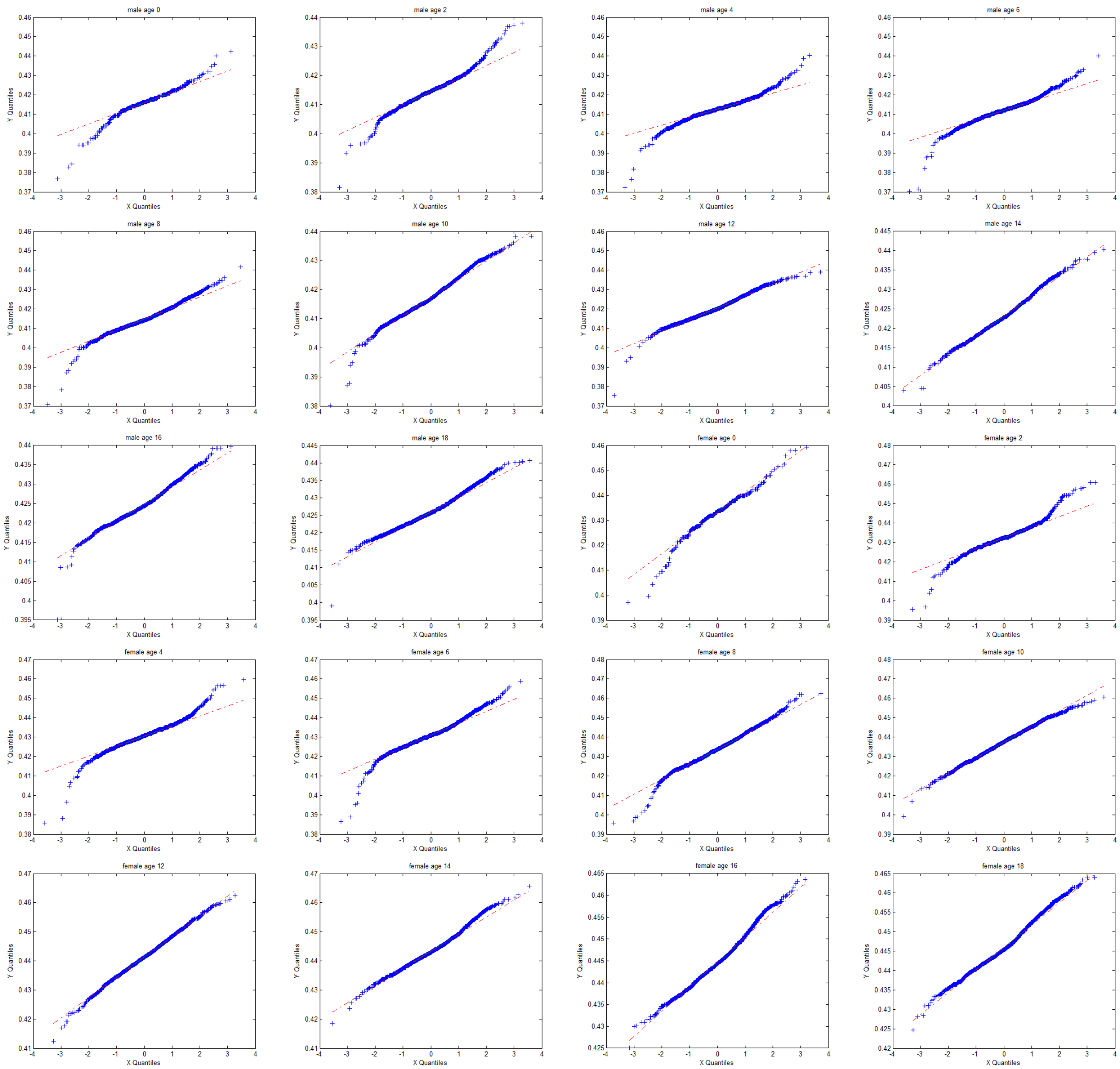

Figure 2: Q-Q plots to assess normality of X_t, the Box-Cox transformation of ln BMIs.

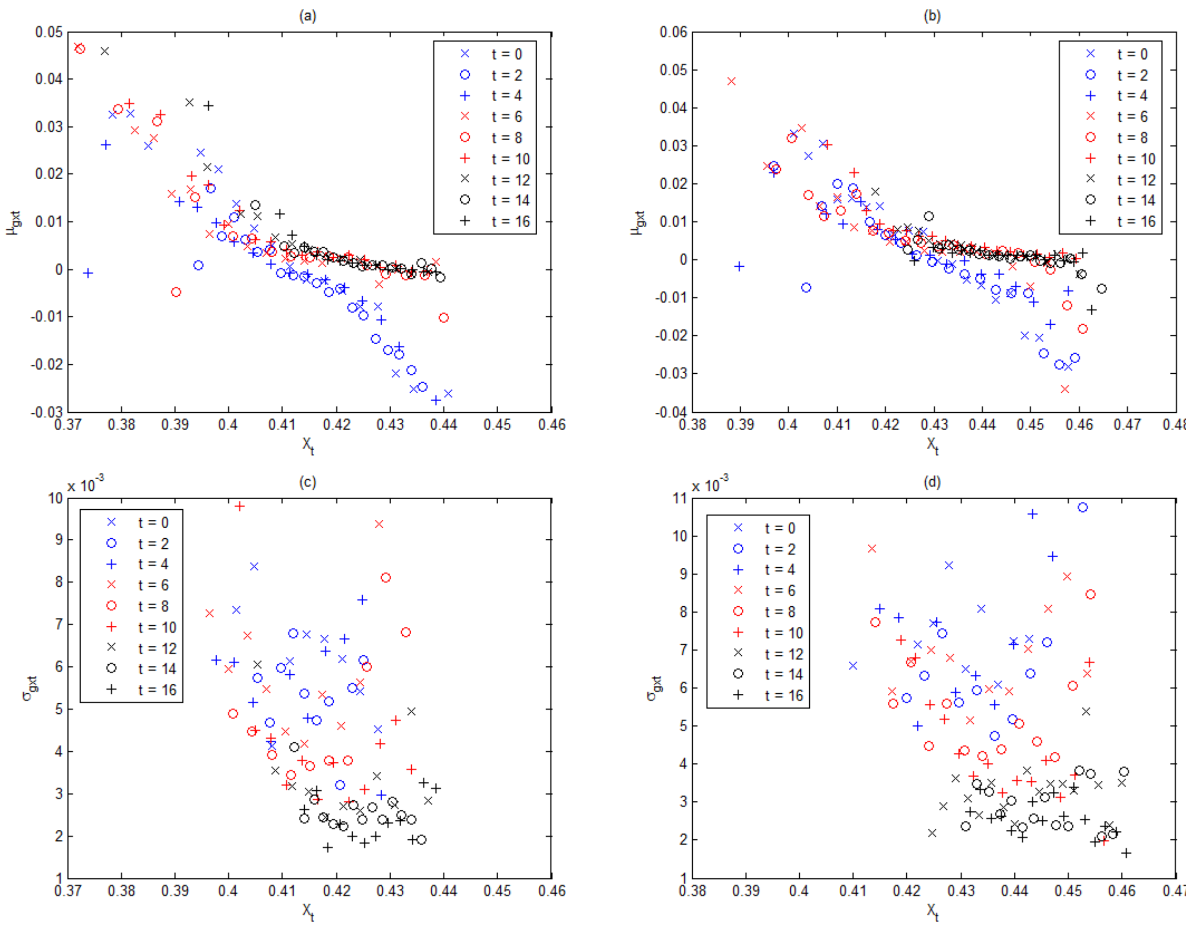

Figure 3: The mean μ_{gxt} and standard deviation σ_{gxt} of the increments $X_{t+2} - X_t$ as a function of $X_t = x$ for $t = 0, 2, \ldots, 16$ in the absence of treatment. **(a)** mean for males; **(b)** mean for females; **(c)**standard deviation for males; **(d)** standard deviation for females.

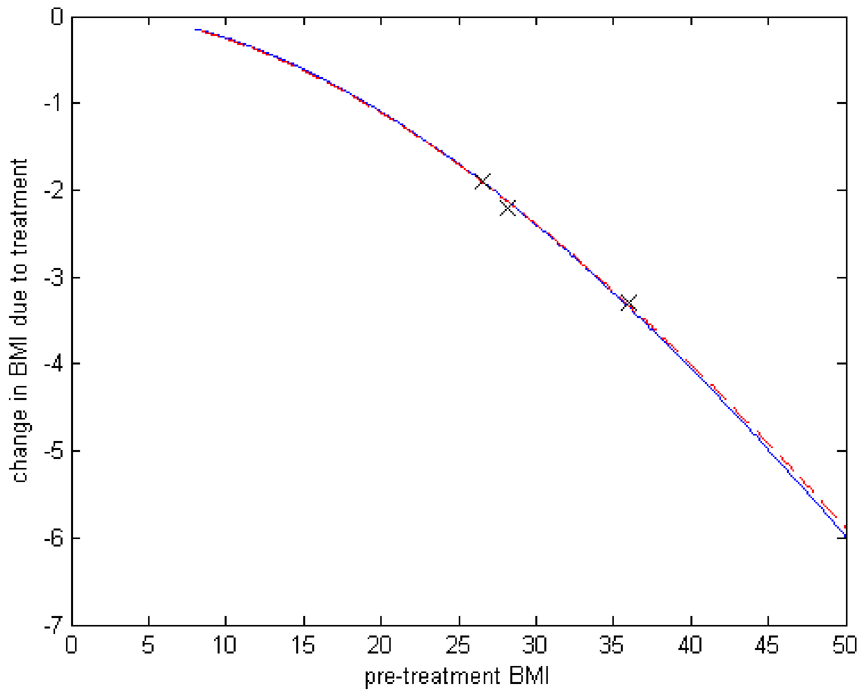

Figure 4: The mean change in BMI in the presence of treatment (μ_{hxt}) as a function of pre-treatment BMI x, as predicted by our model for males (—) and females (- - -). The three x's correspond to the mean pre-treatment BMI level and the mean change in BMI between the control and treatment arms for the three studies in Table 10 of the Electronic Companion.

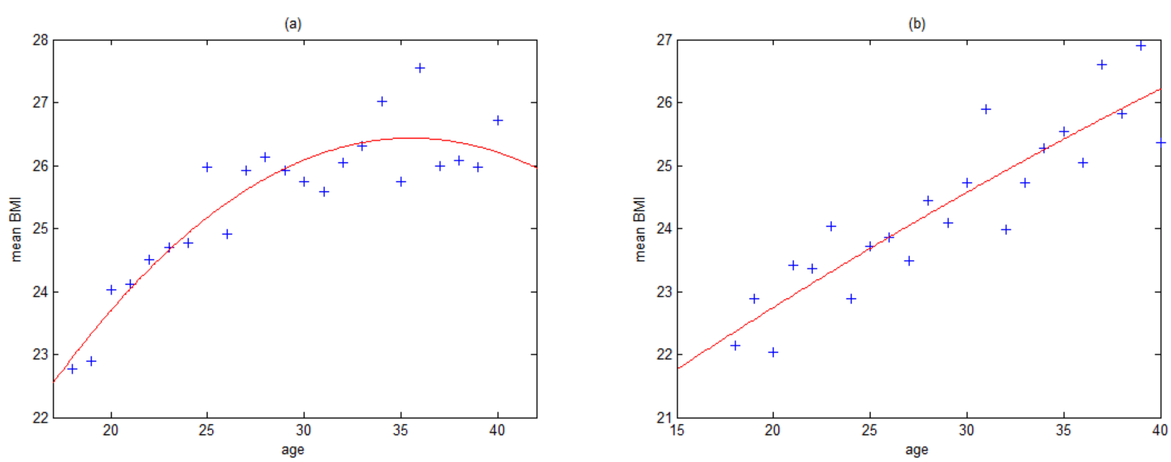

Figure 5: The mean B_t for $t = 18, \ldots, 40$ from the NHANES data, along with the best-fitting quadratic curve, for **(a)** males and **(b)** females.

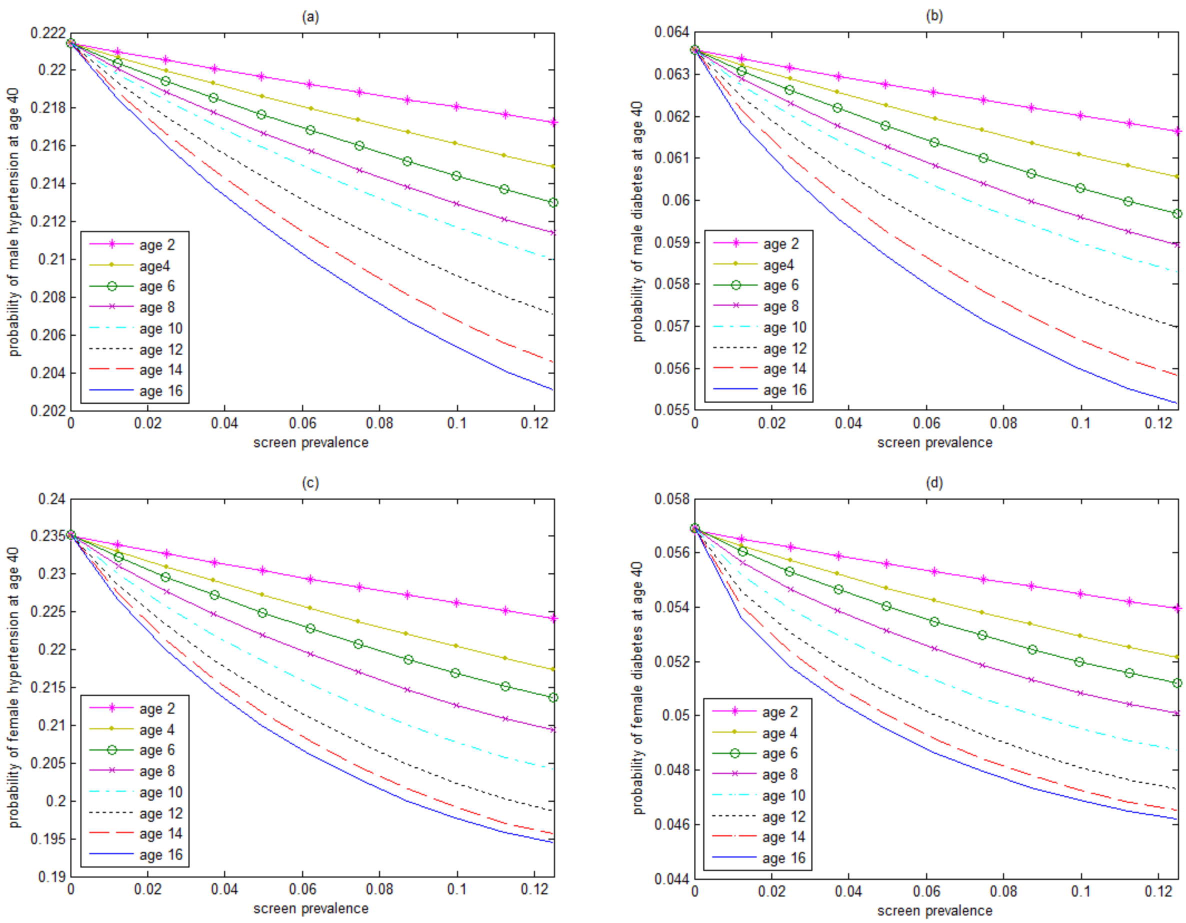

Figure 6: Tradeoff curves of disease prevalence at age 40 vs. treatment prevalence (equation (3) in the main text) for optimal single-age screening policies. **(a)** hypertension among males; **(b)** diabetes among males; **(c)** hypertension among females; and **(d)** diabetes among females.

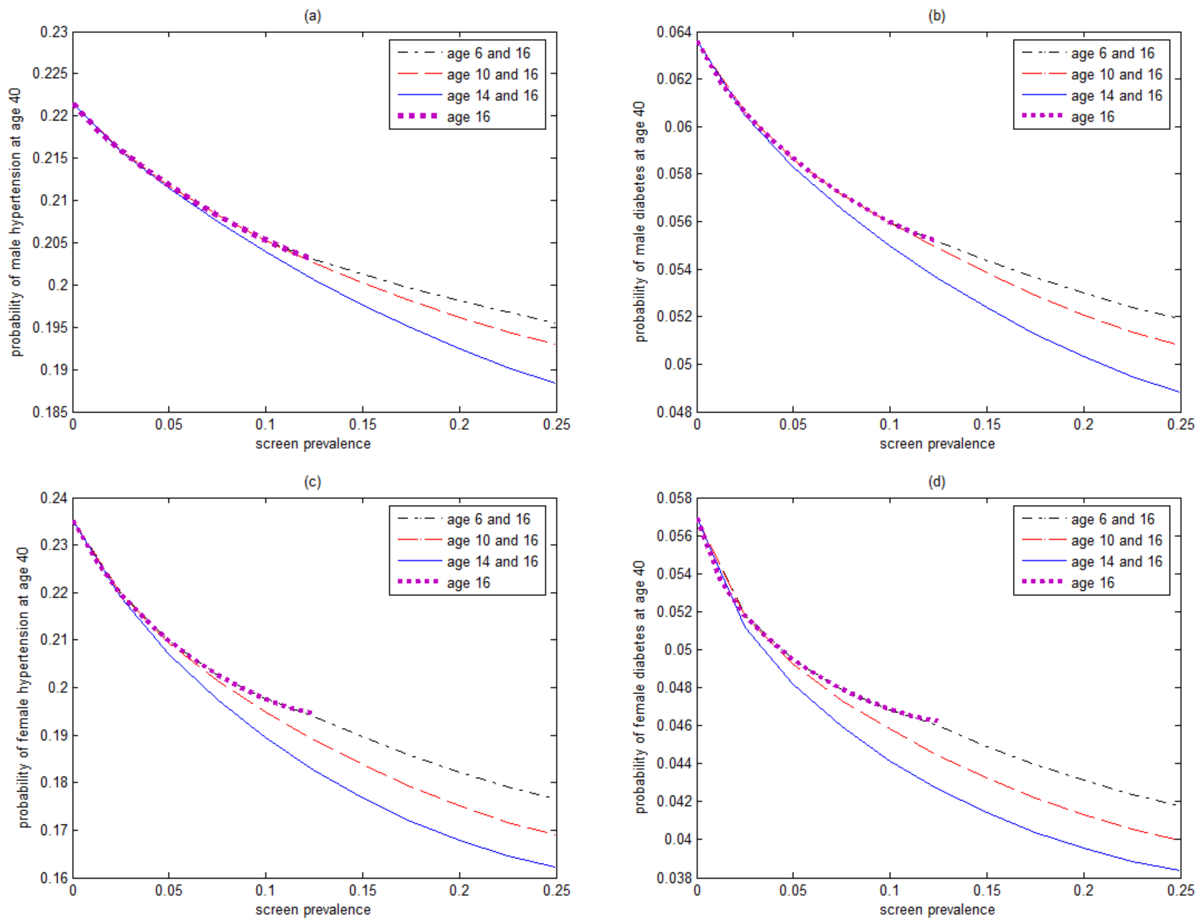

Figure 7: Tradeoff curves of disease prevalence at age 40 vs. treatment prevalence (equation (3) in the main text) for optimal two-age screening policies for ages (6,10), (10,16) and (14,16), and for the age-16 screening policy from Fig. 6 of the Electronic Companion. **(a)** hypertension among males; **(b)** diabetes among males; **(c)** hypertension among females; and **(d)** diabetes among females.