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Is thyroid status a common denominator of age-related disease?

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Citation

Vliet, N. A. van. (2023, January 25). *Is thyroid status a common denominator of age-related disease?*. Retrieved from https://hdl.handle.net/1887/3512954

Version:	Publisher's Version
License:	Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden
Downloaded from:	https://hdl.handle.net/1887/3512954

Note: To cite this publication please use the final published version (if applicable).

CHAPTER 5

Thyroid Stimulating Hormone and Bone Mineral Density: Evidence From a Two-Sample Mendelian Randomization Study and a Candidate Gene Association Study

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J Bone Miner Res 2018 Jul;33(7):1318-1325.

ABSTRACT

With population aging, prevalence of low bone mineral density (BMD) and associated fracture risk are increased. To determine whether low circulating thyroid stimulating hormone (TSH) levels within the normal range are causally related to BMD, we conducted a two-sample Mendelian randomization (MR) study. Furthermore, we tested whether common genetic variants in the TSH receptor (*TSHR*) gene and genetic variants influencing expression of *TSHR* (eQTLs) are associated with BMD. For both analyses, we used summary-level data of genome-wide association studies (GWAS) investigating BMD of the femoral neck (N=32,735) and the lumbar spine (N=28,498) in cohorts of European ancestry from the Genetic Factors of Osteoporosis (GEFOS) Consortium. For the MR study, we selected 20 genetic variants that were previously identified for circulating TSH levels in a GWAS meta-analysis (N=26,420). All independent genetic instruments for TSH were combined in analyses for both femoral neck and lumbar spine BMD. In these studies, we found no evidence that a genetically determined 1 standard deviation (SD) decrease in circulating TSH concentration was associated with femoral neck BMD (0.003 SD decrease in BMD per SD decrease of TSH, 95% C.I. -0.053; 0.048, P=0.92) or lumbar spine BMD (0.010 SD decrease in BMD per SD decrease of TSH, 95% C.I. -0.069; 0.049, P=0.73). A total of 706 common genetic variants have been mapped to the *TSHR* locus and expression loci for *TSHR*. However, none of these genetic variants were associated with BMD at the femoral neck or lumbar spine. In conclusion, we found no evidence for a causal effect of circulating TSH on BMD, nor did we find any association between genetic variation at the *TSHR* locus or expression thereof and BMD.

INTRODUCTION

Bone is a dynamic tissue that undergoes continuous remodeling to maintain its strength and integrity [1]. When bone remodeling is uncoupled and resorption exceeds formation, bone mineral density (BMD) progressively decreases and ultimately leads to osteoporosis [2]. To develop therapies that are more effective and accompanied by fewer side effects than current treatments, further research into the molecular mechanisms underlying the pathogenesis of osteoporosis is required.

One of these potential underlying mechanisms is thyroid status. Briefly, thyroid status is a composite measure of circulating thyroid stimulating hormone (thyrotropin, TSH) and free thyroxine (fT4). In healthy individuals, circulating levels of TSH and fT4 are regulated by the hypothalamic-pituitary-thyroid-axis (HPT-axis) via feedforward and negative feedback mechanisms [3]. Therefore, circulating levels of TSH and fT4 are inversely related. However, the exact combination of circulating concentrations of TSH and fT4 is determined by the HPT-axis set point, which is unique for each individual [4]. Thyroid hormones have a critical role in adult bone turnover and maintenance [5]. Hyperthyroidism (TSH concentration below the normal reference range and fT4 circulating level above the normal reference range) is associated with low BMD and an increased risk of fracture, and is an established cause of secondary osteoporosis [6]. Furthermore, a similar relationship has been reported in individuals with subclinical hyperthyroidism (reduced circulating concentration of TSH but circulating fT4 within the normal reference range) [7, 8], and in euthyroid individuals with a relatively low TSH and relatively high fT4 within the normal reference range [9, 10]. Accordingly, individuals with subclinical hyperthyroidism had increased bone loss during prospective follow-up compared to euthyroid individuals [11]. In addition to effects of thyroid hormone on bone, some studies have suggested direct effects of TSH on bone [12, 13]. However, others have not confirmed these findings [14, 15]. Therefore, it remains unclear whether observed changes in bone mass and strength result from increased fT4 levels alone, or whether the associated decrease in TSH also contributes.

Mendelian randomization (MR) can be used to determine whether an association is causal, as it eliminates confounding and reverse causation. MR analysis uses genetic variants associated with an exposure as instrumental variables instead of direct measurements of the exposure [16]. Because genetic traits are inherited independently according to Mendel's second law, the determinant is randomly distributed in the population and independent of the outcome. In the present study, this assumes that genes associated with thyroid status and genes associated with BMD are inherited independently. Thus, analogous to randomized

clinical trials, by using MR analysis the exposure can be assigned randomly and so associations between exposure (thyroid status) and outcome (BMD) can be investigated in the absence of confounding and reverse causation. MR studies can be performed on circulating TSH and fT4 levels within the normal reference range [17], as these measures of thyroid status have been shown to be partly and independently genetically determined in large-scale genome-wide association studies (GWAS) [18, 19]. Even though TSH and fT4 levels are highly correlated, different genetic variants were associated with circulating levels of TSH than with fT4 [18]. The genetic independence of these traits highlights the individuality of the HPT-axis set point, and allow for separate analyses of TSH and fT4.

In the present study, we aimed to investigate whether thyroid status is causally associated with BMD through a two-sample Mendelian randomization study. However, due to the limited number of genetic instruments available for fT4 concentration in the largest meta-analysis to date on BMD (i.e. lack of statistical power), only the relationship between TSH and BMD could be investigated rigorously. Additionally, to investigate the TSH receptor, which mediates TSH action in target cells, we explored the *TSHR* gene in a candidate gene study to determine whether genetic variation at this locus or expression thereof is associated with BMD.

MATERIALS AND METHODS

Genetic variants for TSH

We selected single nucleotide polymorphisms (SNPs) for all genetic loci independently associated with circulating levels of TSH (p value < $5x10^{-8}$) identified by the largest GWAS meta-analysis to date [18]. All participants included in the GWAS were of European ancestry, and individuals with known thyroid pathologies, taking thyroid medication, who underwent thyroid surgery and with circulating levels of TSH <0.4 mIU/L or >4.0 mIU/L were excluded from the analyses. For comparability of the different cohorts, the circulating levels of TSH were log transformed, and standardised to Z-values. Due to these transformations, the additive beta estimates of the SNPs can be interpreted as the per-allele standard deviation (SD) change in logTSH concentration. In total, 20 loci for TSH were identified in 26,420 participants. Overall, the mean age of participants ranged from 42.5 to 79.0 years, 44 percent of the participants were men. As an illustration, the descriptives of the two largest included cohorts (PROSPER and SardiNIA) were as follows. In PROSPER, 49.1% were men and the mean age was 75.3 years with 3.4 years SD. In the SardiNIA cohort, 46.9% were men and the mean age was 42.5 with 17.7 years SD. The mean TSH concentration was 1.9 mIU/L and 1.7 mIU/L respectively (SD was 0.8 mIU/L for both cohorts).

Data sources and outcome definition

We used publically available data from the largest meta-analysis to date on BMD from the Genetic Factors of Osteoporosis (GEFOS) consortium [20], which identified novel loci for BMD at the femoral neck, lumbar spine and forearm, sites of the three most common osteoporotic fractures. Forearm BMD data were not used in the present study, because of the relatively low number of participants (N = 8,143). The meta-analysis on femoral neck BMD comprised 32,735 participants from nine cohorts of European ancestry and the meta-analysis on lumbar spine BMD comprised 28,498 participants from eight cohorts of European ancestry. The mean age in the participating cohorts ranged from 17.7 to 80.2 years, and 34 percent of the participants in the meta-analysis were men. From these data, we extracted the per-allele beta estimates of the SNPs previously identified in relation to circulating levels of TSH on femoral neck BMD and lumbar spine BMD, accompanied by the standard errors and the effect alleles.

Power calculation

The statistical power for the MR analyses for TSH on BMD was calculated using a publicly available power calculator [21]. For the femoral neck BMD and the lumbar spine BMD there was sufficient power (femoral neck power = 0.85, and lumbar spine power = 0.80) to detect a causal association with a coefficient of 0.07 SD of BMD per decrease of one SD of TSH when using the data from GEFOS [20].

Statistical analyses

Methods for Mendelian randomization analysis of summary-level data have been described [17, 22, 23]. Briefly, associations between individual genetic instruments for circulating levels of TSH and BMD were estimated, after taking into account multiple testing via Bonferroni correction based on the number of genetic instruments tested. We combined effects of the individual genetic instruments using inverse-variance weighted (IVW) analyses [23], resulting in a weighted mean estimate of the effect of genetically determined 1-SD decrease in circulating level of TSH on BMD of the femoral neck and the lumbar spine in SD. However, this method could suffer from bias, because of potential pleiotropic effects of the genetic variants on other apparently unrelated phenotypes. If genetic variants have pleiotropic effects that influence outcome (eg, BMD) via alternative pathways, the observed associations can be biased. Therefore, MR-Egger regression [24] was conducted as sensitivity analysis to account for potential pleiotropy and to formally test the presence of directional pleiotropy. Additionally, we performed weighted median estimator (WME) analyses [25], which estimate a weighted median effect of genetically determined 1-SD decrease in circulating level of TSH on BMD. Similarity of the IVW and WME effect estimates indicates that the results are robust [25]. We also performed additional sensitivity analyses to account for possible regression dilution of analyses. In two-sample MR analyses,

the reliability of the results depends on the precision of the previously measured association between the genetic variants and the exposure (ie, circulating TSH concentration). If the reported effect sizes for TSH do not reflect the true effect of the genetic variants, the association between the genetically determined levels of TSH and BMD will be erroneous. One of the available tests to assess the resulting imprecision of the MR is I^2_{GX}-statistic [26]. Preferably the I^2_{GX}-statistic is close to 1, but an I^2_{GX}-statistic ≥0.9 is still acceptable [26]. If the I^2_{GX}-statistic is lower, the effect estimate is likely to be diluted, which means the observed association is an underestimation of the true effect. This type of bias can be corrected by simulation extrapolation (SIMEX) [27]. This method simulates estimates of the investigated association with increasing imprecision to extrapolate a more precise estimate.

The combined effects of the genetic variants were calculated using the codes in R that were provided online by the authors [24-26]. Results are presented as the mean effect per 1-SD genetically determined decrease in circulating TSH level together with the 95% confidence interval (CI); a two-sided *p* value of less than 0.05 was considered statistically significant.

Candidate gene association study on the TSH receptor

To investigate whether variation in the TSH receptor gene (*TSHR*) is associated with BMD, we conducted a candidate gene association study using the same publicly available summary level data of the GEFOS consortium [20]. SNPs were indexed if located in the *TSHR* gene or within 50,000 base pairs up- or downstream. Additionally, previously reported SNPs influencing expression of *TSHR* (expression quantitative loci [eQTLs]) were included in the study. We excluded SNPs with a minor allele frequency (MAF) lower than 5% or if the SNP was absent from the GEFOS datasets. To determine an appropriate threshold for statistical significance, we based the correction factor on the number of independent genetic variants, meaning those not in linkage disequilibrium (LD). The number of independent genetic variants was calculated using the web-based tool LDlink (considering an R^2<0.4) [28]. A cutoff of R^2<0.4 was chosen, to limit the number of independent variants to a minimum, resulting in a smaller chance of false negative results. A –log(P-value) plot was constructed using R package ggplot2 [29] for both femoral neck and lumbar spine BMD, with a Bonferroni-corrected significance threshold (p = 0.05/number of independent variants) and a nominal threshold (p = 0.05).

RESULTS

Effect of individual genetic instruments for TSH

The associations between individual genetic instruments for circulating concentration of TSH and BMD are summarised in **Table 1**. Of the 20 SNPs previously associated with circulating TSH level, 19 were available in the BMD datasets; for rs6885099 in *PDE8B* we used rs2046045 as a proxy SNP (R^2 = 1.00, D' = 1.00). None of the individual genetic instruments for circulating concentration of TSH were associated with femoral neck BMD (*p* values >0.05) (**Figure 1A**) or lumbar spine BMD (*p* values >0.05) (**Figure 1B**).

Combined effect of the genetic instruments for TSH

Using the inverse-variance weighted analysis (**Table 2**), we found no evidence for an association between genetically determined lower circulating levels of TSH and femoral neck BMD (0.003 SD decrease in BMD per SD decrease in TSH; 95% CI, -0.053 to 0.048; *p* = 0.92) (**Figure 1C**) or lumbar spine BMD (0.010 SD decrease in BMD per SD decrease in TSH; 95% CI, -0.069 to 0.049; *p* = 0.73) (**Figure 1D**). The estimates from MR-Egger regression and WME analyses were consistent with these results. As the I^2_{GX}-statistic of the combined genetic variants for TSH was 0.81, we performed additional simulation extrapolation (SIMEX) of the MR-Egger estimate, which did not materially change the observations. Moreover, MR-Egger did not indicate the presence of directional pleiotropy given the absence of evidence of deviation of the regression line from the intercept.

Table 1. Associations of individual genetic instruments for TSH with BMD of the femoral neck and the lumbar spine

Gene	SNP	Chromosome	Position	Effect allele	EAF	Effect on TSH in SD	F-Statistic	Femoral neck BMD in SD	Lumbar spine BMD in SD
NR3C2	rs10032216	4	149669506	T	0.781	0.087	63	0.0069	0.0052
FGF7	rs10519227	15	49746364	A	0.245	-0.072	43	0.0005	-0.0123
CAPZB	rs10799824	1	19841174	A	0.161	-0.113	89	-0.0056	-0.0244
ITPK1	rs11624776	14	93595591	A	0.660	-0.064	34	-0.0021	0.0026
VEGFA	rs11755845	6	43904780	T	0.266	-0.065	42	-0.0097	-0.0023
IGFBP5	rs13015993	2	217625523	A	0.736	0.078	61	0.0068	0.0014
MBIP	rs1537424	14	36574018	T	0.608	-0.052	33	0.0108	0.0069
GLIS3	rs1571583	9	4267209	A	0.249	0.057	32	-0.0023	0.0015
PRDM11	rs17723470	11	45227567	T	0.279	-0.065	42	0.0042	0.0036
MIR1179	rs17776563	15	89119104	A	0.322	-0.060	36	0.0039	0.0100
NFIA	rs334699	1	61620496	A	0.052	-0.141	45	0.0009	-0.0091
MAF/LOC440389	rs3813582	16	79749353	T	0.674	0.082	67	-0.0125	-0.0016
INSR	rs4804416	19	7223848	T	0.569	-0.057	40	0.0015	-0.0063
ABO	rs657152	9	136139265	A	0.343	0.058	42	-0.0026	-0.0018
PDE8B	rs6885099	5	76530349	A	0.594	-0.141	245	-0.0033	0.0125
PDE10A	rs753760	6	166046483	C	0.691	0.100	100	-0.0008	0.0099
NRG1	rs7825175	8	32416274	A	0.210	-0.066	36	-0.0035	0.0099
VEGFA	rs9472138	6	43811762	T	0.285	-0.079	62	-0.0115	-0.0028
SASH1	rs9497965	6	148521292	T	0.415	0.051	32	-0.0034	-0.0008
SOX9	rs9915657	17	70127536	T	0.541	-0.064	51	0.0063	-0.0040

Abbreviations: SNP, single nucleotide polymorphism; EAF, effect allele frequency; TSH, thyroid stimulating hormone; SD, standard deviation; BMD, bone mineral density.

Data presented as beta coefficients per effect allele.

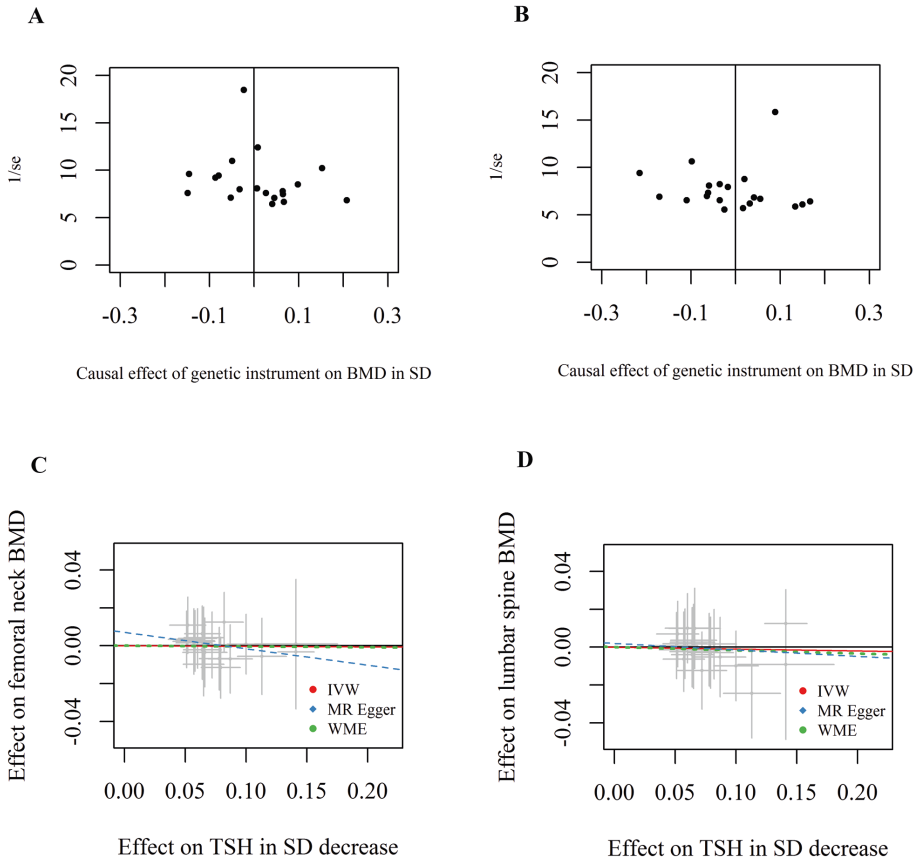

Figure 1. The effect of genetic instruments for TSH levels on BMD
Results are presented as the beta coefficients.
In panel A and **B:** The X-axis presents the per-allele effect on BMD for each individual genetic variant; the Y-axis presents the 1/Standard Error (1/SE) for each effect estimate. The association between 20 individual genetic variants for TSH levels and (**A**) Femoral neck BMD in standard deviations, (**B**) Lumbar spine BMD in standard deviations.
In panel C and **D:** The X-axis presents the decrease in TSH in standard deviations; the Y-axis presents the effect on BMD. The modeled association between genetic instruments for TSH and BMD using Inverse-Variance Weighted analysis (IVW), MR Egger and Weighted Median Estimator (WME) are shown for (**C**) Femoral neck BMD in standard deviations, (**D**) Lumbar spine BMD in standard deviations.

Table 2. Mendelian randomization estimates for TSH on BMD

	Femoral neck BMD in SD	P-value	Lumbar spine BMD in SD	P-value
Inverse-Variance Weighted	0.00 (-0.05; 0.05)	0.92	-0.01 (-0.07; 0.05)	0.73
MR-Egger				
Estimate	-0.09 (-0.23; 0.08)	0.28	-0.03 (-0.20; 0.15)	0.71
Intercept	0.01 (-0.01; 0.02)	0.15	0.00 (-0.01; 0.02)	0.75
MR-Egger+SIMEX				
Estimate	-0.10 (-0.13; 0.03)	0.16	-0.04 (-0.21; 0.14)	0.68
Intercept	0.01 (0.00; 0.02)	0.15	0.00 (-0.01; 0.02)	0.75
Weighted Median	0.00 (-0.08; 0.07)	0.90	-0.02 (-0.10; 0.07)	0.67

Abbreviations: BMD, bone mineral density; SD, standard deviation; TSH, thyroid stimulating hormone; SIMEX, simulation extrapolation. Data presented as beta coefficients with 95% confidence interval per standard deviation decrease of serum level thyrotropin (TSH).

Common genetic variants in the TSH receptor locus and expression loci

A total of 755 common SNPs were mapped either in the *TSHR* locus or in eQTLs. In the GEFOS dataset, 706 of the mapped SNPs were available, amounting to 44 independent loci (**Supplementary Table 1**). –Log (*p* value) plots are shown for the *TSHR* SNPs and BMD of the femoral neck (**Figure 2A**) and the lumbar spine (**Figure 2B**). At the nominal significance of $p < 0.05$, five SNPs were associated with femoral neck BMD and three with lumbar spine BMD. However, none of these associations remained statistically significant following Bonferroni correction for multiple testing.

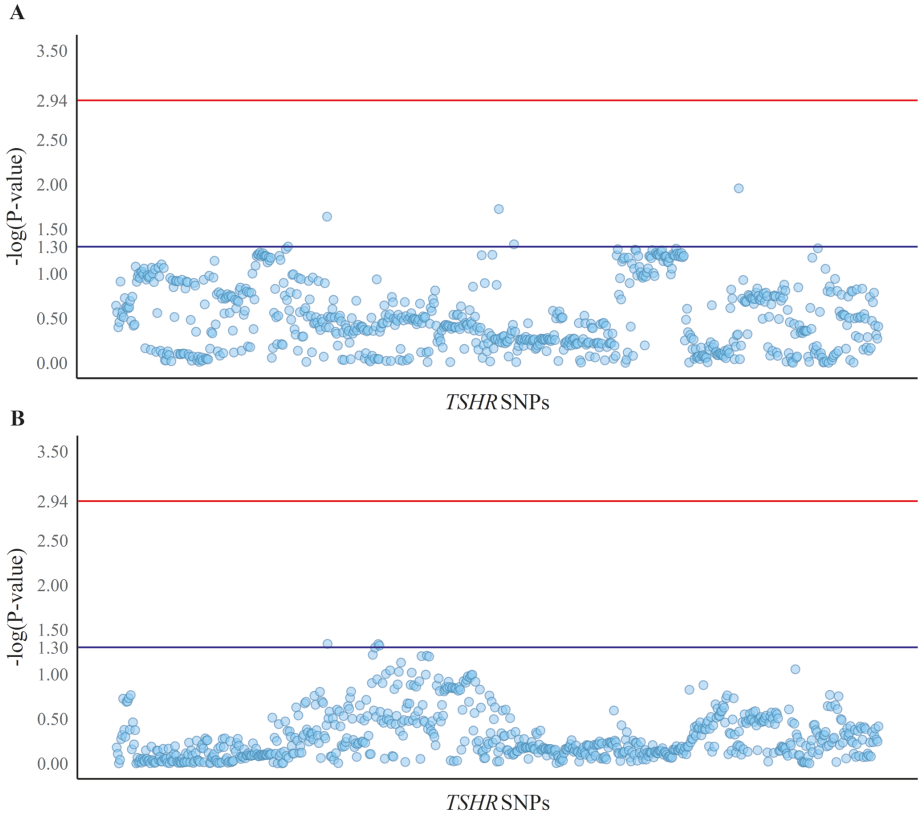

Figure 2. –log (P) plot of the candidate gene analysis
Results are presented as the –log of the P-value for each SNP organized by position number. The lower horizontal line at 1.30 corresponds to the –log of P-value=0.05 indicating nominal significance, the upper horizontal line at 2.94 corresponds to the –log of P-value=1.14×10^{-3} indicating the Bonferroni-corrected threshold of statistical significance. The association between *TSHR* SNPs and (**A**) Femoral neck BMD, (**B**) Lumbar spine BMD

DISCUSSION

We used Mendelian randomization to determine whether lower circulating levels of TSH within the normal range are causally associated with reduced BMD. Despite interrogating the largest publicly available GWAS meta-analyses,[20] we were unable to demonstrate an association between genetic instruments for circulating levels of TSH and femoral neck or lumbar spine BMD. Furthermore, no significant association was found between common genetic variants within the *TSHR* gene or expression regulating regions thereof and BMD. Thus, we found no evidence for a causal relationship between lower circulating levels of

TSH within the normal range and reduced BMD, or for any association between genetic variance in the *TSHR* gene or *TSHR* expression and BMD.

These findings add to previous research regarding the role of TSH in the skeleton, which has yielded contrasting results. In osteoblasts of rodent and of human origin TSH receptors were identified [30], although no expression of the TSHα or β subunits was observed [31]. The reported effects of TSH on osteoblasts *in vitro* are contradictory as inhibition [32], stimulation [33-35] and no effect [31, 36] of TSH on differentiation and function have all been observed. Furthermore, in human osteoblasts, TSH receptor expression and cAMP responses to TSH are low, making physiologically relevant actions of TSH unlikely [37]. In osteoclasts the findings have been more consistent, with the majority reporting TSH inhibiting osteoclast formation and function whilst others have shown no effect [32, 35, 36].

In vivo, thyroid hormone treated *TSHR*-knockout mice displayed decreased BMD and bone strength [32, 38], but importantly, this phenotype also reflects the consequences of profound congenital hypothyroidism and delayed thyroid hormone replacement [31]. Consistent with this, adult rodents, treated with TSH doses insufficient to alter systemic T3 or T4 level, showed suppressed bone resorption and increased formation [35, 39, 40]. By contrast, a similar skeletal phenotype of delayed bone development [31] was reported in two contrasting mouse models for congenital hypothyroidism (i) *Pax8*-knockout mice with no T4 or T3 but grossly elevated TSH in the presence of a fully functional TSH receptor and (ii) *TSHR*-knockout mice with no T4 or T3 but grossly elevated TSH in the absence of a functional TSH receptor. Although these results do not support a predominant role for the TSH receptor in bone, the effects of TSH could be masked by the severely reduced T4 and T3 levels.

Human observational studies have shown strong indications for an association between higher thyroid status within and outside the normal range and lower BMD [6, 8, 9]. Importantly, in observational studies in humans, no conclusions can be drawn on relative roles of TSH or thyroid hormones because they are maintained by the HPT axis in a physiological reciprocal relationship [41]. In genetic studies investigating the relationship between TSH and BMD, the non-synonymous Asp727Glu polymorphism in the human *TSHR* gene (rs1991517) has been associated with higher mean BMD in two studies [42, 43]. However, this observation has not been replicated by other studies and no other common *TSHR* genetic variants have been associated with BMD.

In this study we investigated the effect of circulating TSH levels, within the normal range, on BMD in the absence of confounding, by using genetic variants associated with circulating TSH level as instrumental variables in a two-sample

Mendelian randomization analysis using summary level data. This highly efficient method allows for large sample sizes to be used, but has the disadvantage that stratified analyses, for example by sex, age or menopausal status, are not possible. Analyses in specific subgroups such as postmenopausal women would also have been of interest, due to their increased risk of developing osteoporosis [44]. Furthermore, in previous observational studies stronger associations between thyroid status and BMD were observed in women compared to men [8, 45]. Therefore, we cannot conclude that no association between TSH levels and BMD is present in more vulnerable subgroups. Nonetheless, in the general population as a whole, we found no causal association between TSH and BMD. Another potential limitation of our study is overlap between GWAS meta-analyses of thyroid function parameters and GWAS meta-analyses of BMD; three out of nine cohorts (Framingham Heart Study, TwinsUK study and Rotterdam Study) were included in both studies. If weak instruments were used, this overlap in study populations could lead to bias [46]. Since all genetic instruments were selected from among the top hits of the largest published GWAS on thyroid function to date, the instrument strength was assumed to be sufficient based on previous studies [47]. Therefore, potential effects of weak instrument bias can be expected to be negligible [46]. Furthermore, the genetic instrument identification and the Mendelian randomization were performed in cohorts of European ancestry which may limit generalizability to non-European populations. A potential limitation of our combined genetic variants for circulating TSH level could be that they also reflect the circulating levels of fT4, due to the reciprocal physiological relationship between TSH and fT4 in healthy individuals [41]. However, the GWAS that identified the variants for TSH had identified different genetic variants for fT4 [18]. Reciprocal associations of TSH SNPs with fT4 were assessed in sensitivity analyses, yet, as stated by the authors, the study was underpowered to detect any statistically significant associations [18]. Even though no certain conclusions can be drawn, the results of the sensitivity analysis did not imply strong reciprocal associations with circulating fT4 levels for the SNPs associated with circulating TSH. Therefore, the results for the MR study on lower circulating TSH might be influenced by slightly higher levels of fT4, yet these effects appear to be small. A final limitation of using genetic variants for TSH identified by this GWAS meta-analyses is the euthyroid state of the included participants. Because circulating TSH levels in clinical thyroid dysfunction are unlike the individual set point [48], we cannot extrapolate our results to individuals with TSH outside the reference range. Thus, our results are only applicable to adults with circulating TSH levels within the reference range.

In addition, we investigated the association of common genetic variants in the *TSHR* gene locus and the expression loci with BMD in a candidate gene study. For this analysis we used 706 common genetic variants (44 independent loci), which covered the majority of the common variation in *TSHR* and the eQTLs of

this gene. A limitation of this method is the unknown effect of the tested genetic variants inside the *TSHR* gene on the TSH receptor and on thyroid status, yet we observed no indication for biologically relevant associations between this gene and BMD. Furthermore, an important limitation is the absence of 49 SNPs mapped to the *TSHR* gene in the summary-level data we used. Nevertheless, we found no association between common variation of the *TSHR* locus and BMD despite using the largest human dataset available for BMD of the femoral neck and lumbar spine.

Conclusion

In summary, we found no evidence that circulating TSH levels in the normal range are causally associated with BMD nor did we find any association between common genetic variation in the *TSHR* gene or expression of *TSHR* and BMD. Therefore, the associations found in observational studies between low circulating TSH and lower BMD are possibly related to the reciprocal higher levels of fT4, due to residual confounding or reverse causality. In clinical treatment of thyroid disease, treatment is aimed at normalization of TSH levels into the normal range and alleviation of symptoms. Based on our current results, we found no indications for inappropriateness of current guidelines aimed at restoration of TSH within the normal reference range with regard to bone health. In future research, better genetic tools for fT4 levels are required to further interpret the effects of thyroid status on BMD. Additionally, more clinical end points could be investigated resulting in greater clinical applicability.

DISCLOSURES

Dr. van Heemst reports grants from the European Commission, during the conduct of the study. All other co-authors have nothing to disclose.

ACKNOWLEDGMENTS

This study was supported by the European Commission-funded project THYRAGE (Horizon 2020 research and innovation programme under grant agreement No 666869). We thank the GEFOS consortium for making the summary statistics data files of their meta-analyses available and the authors of the GWAS meta-analysis of Porcu and colleagues[18] for their work on genetic variants associated with thyroid-related traits.

Authors'roles: Study design: NAvV, RN, DvH. Data analysis: NAvV, RN and JBvK. Data interpretation: NAvV, RN, JBvK, RGJW, JHDB, GRW and DvH. Supervision: DvH. Drafting manuscript: NAvV, RN, RGJW, JHDB, GRW and DvH. All authors have critically revised the manuscript content and approved of the final version

of the submitted manuscript. All authors take responsibility for the integrity of the data analysis.

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SUPPLEMENTARY MATERIAL

Supplementary Table 1. Associations between SNPs in the *TSHR* locus and eQTLs and BMD of the femoral neck and lumbar spine

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs1197384	14	81127514	T	0.149	-0.0121	0.0108	0.2722	0.5651	-0.0035	0.0126	0.7850	0.1051
TSHR	rs6574598	14	81131831	C	0.133	-0.0094	0.0109	0.3995	0.3985	0.0000	0.0127	0.9973	0.0012
TSHR	rs59093673	14	81140458	A	0.141	-0.0104	0.0109	0.3495	0.4565	-0.0014	0.0127	0.9114	0.0403
TSHR	rs8019534	14	81169470	C	0.382	-0.0147	0.0093	0.1227	0.9112	0.0071	0.0112	0.5344	0.2721
TSHR	rs1197381	14	81170713	A	0.409	0.0080	0.0076	0.3001	0.5228	-0.0064	0.0088	0.4809	0.3180
TSHR	rs2371336	14	81171177	C	0.382	-0.0087	0.0077	0.2722	0.5651	0.0121	0.0090	0.1885	0.7247
TSHR	rs35178479	14	81171888	C	0.409	0.0079	0.0076	0.3080	0.5115	-0.0073	0.0088	0.4199	0.3769
TSHR	rs2590484	14	81172484	T	0.458	0.0102	0.0075	0.1877	0.7266	-0.0060	0.0088	0.5020	0.2993
TSHR	rs2619673	14	81174902	C	0.383	-0.0093	0.0077	0.2377	0.6239	0.0117	0.0090	0.2041	0.6902
TSHR	rs2596108	14	81175607	T	0.382	-0.0093	0.0077	0.2383	0.6229	0.0118	0.0090	0.2013	0.6962
TSHR	rs12878836	14	81175896	A	0.383	-0.0092	0.0077	0.2455	0.6100	0.0122	0.0090	0.1852	0.7324
TSHR	rs36055485	14	81186946	C	0.456	0.0091	0.0075	0.2387	0.6221	-0.0073	0.0088	0.4180	0.3789
TSHR	rs2060596	14	81187126	A	0.406	-0.0100	0.0077	0.2030	0.6926	0.0126	0.0090	0.1716	0.7656
TSHR	rs8007834	14	81276643	A	0.176	-0.0094	0.0096	0.3389	0.4699	0.0045	0.0112	0.6953	0.1579
TSHR	rs327450	14	81292286	C	0.154	-0.0141	0.0103	0.1812	0.7418	-0.0116	0.0120	0.3455	0.4615
TSHR	rs17111153	14	81298251	T	0.163	-0.0085	0.0096	0.3841	0.4155	0.0058	0.0112	0.6124	0.2130
TSHR	rs58625998	14	81298274	A	0.242	-0.0078	0.0085	0.3729	0.4284	0.0082	0.0100	0.4242	0.3724
TSHR	rs11625199	14	81372745	A	0.490	-0.0133	0.0075	0.0834	1.0787	0.0000	0.0088	0.9957	0.0019
TSHR	rs759916	14	81373641	C	0.401	0.0121	0.0077	0.1236	0.9081	-0.0016	0.0090	0.8644	0.0633
TSHR	rs759917	14	81373831	G	0.401	0.0126	0.0077	0.1079	0.9670	-0.0003	0.0090	0.9778	0.0097
TSHR	rs4016442	14	81373937	A	0.490	-0.0127	0.0075	0.0990	1.0043	0.0006	0.0088	0.9451	0.0245
TSHR	rs6574608	14	81374822	C	0.489	0.0122	0.0075	0.1120	0.9508	-0.0013	0.0088	0.8872	0.0520

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs7157845	14	81375305	G	0.489	-0.0128	0.0075	0.0959	1.0182	0.0002	0.0088	0.9819	0.0079
TSHR	rs10142753	14	81376490	T	0.489	0.0128	0.0075	0.0950	1.0225	-0.0012	0.0088	0.8928	0.0492
TSHR	rs722906	14	81376855	A	0.490	-0.0126	0.0075	0.1023	0.9900	0.0008	0.0088	0.9265	0.0332
TSHR	rs2010847	14	81376921	A	0.490	-0.0131	0.0075	0.0878	1.0566	0.0006	0.0088	0.9482	0.0231
TSHR	rs12885819	14	81377524	G	0.097	0.0055	0.0132	0.6856	0.1639	-0.0058	0.0153	0.7132	0.1468
TSHR	rs6574609	14	81377553	G	0.427	-0.0122	0.0076	0.1165	0.9337	0.0013	0.0089	0.8822	0.0544
TSHR	rs7153979	14	81378061	A	0.401	0.0128	0.0077	0.1043	0.9817	-0.0007	0.0090	0.9396	0.0271
TSHR	rs7154132	14	81378082	C	0.401	0.0125	0.0077	0.1104	0.9569	-0.0010	0.0090	0.9156	0.0383
TSHR	rs7154373	14	81378239	C	0.401	0.0126	0.0077	0.1083	0.9652	-0.0001	0.0090	0.9941	0.0026
TSHR	rs35765671	14	81378554	T	0.098	0.0049	0.0132	0.7156	0.1453	-0.0072	0.0153	0.6474	0.1888
TSHR	rs17615020	14	81378754	T	0.489	-0.0132	0.0075	0.0862	1.0646	0.0009	0.0088	0.9162	0.0380
TSHR	rs7140452	14	81379868	C	0.427	-0.0128	0.0076	0.1000	0.9999	0.0007	0.0089	0.9404	0.0267
TSHR	rs7147306	14	81380066	T	0.436	-0.0119	0.0076	0.1244	0.9053	-0.0002	0.0089	0.9852	0.0065
TSHR	rs6574610	14	81380130	G	0.489	-0.0131	0.0075	0.0893	1.0492	0.0003	0.0088	0.9726	0.0121
TSHR	rs55634365	14	81381104	A	0.097	0.0043	0.0132	0.7517	0.1240	-0.0056	0.0153	0.7198	0.1428
TSHR	rs12896436	14	81382533	G	0.193	-0.0108	0.0097	0.2769	0.5576	0.0042	0.0113	0.7199	0.1428
TSHR	rs12434318	14	81382572	A	0.435	-0.0139	0.0079	0.0853	1.0689	0.0010	0.0089	0.9100	0.0410
TSHR	rs4899780	14	81383229	A	0.426	-0.0125	0.0076	0.1076	0.9682	0.0018	0.0089	0.8438	0.0738
TSHR	rs7144634	14	81383427	T	0.054	-0.0054	0.0153	0.7309	0.1361	-0.0012	0.0178	0.9494	0.0225
TSHR	rs4903947	14	81383901	A	0.490	0.0135	0.0075	0.0790	1.1025	-0.0005	0.0088	0.9523	0.0212
TSHR	rs34611247	14	81384289	G	0.097	0.0036	0.0132	0.7888	0.1030	-0.0063	0.0154	0.6885	0.1621
TSHR	rs12050416	14	81385568	T	0.426	-0.0134	0.0076	0.0864	1.0634	0.0014	0.0089	0.8760	0.0575
TSHR	rs1013890	14	81386625	G	0.054	-0.0014	0.0157	0.9315	0.0308	0.0024	0.0176	0.8949	0.0482

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs12586908	14	81387338	A	0.109	0.0009	0.0121	0.9421	0.0259	-0.0021	0.0140	0.8809	0.0551
TSHR	rs77951617	14	81387913	C	0.054	-0.0039	0.0153	0.8043	0.0946	-0.0004	0.0178	0.9814	0.0082
TSHR	rs35728625	14	81388215	A	0.097	0.0044	0.0132	0.7456	0.1275	-0.0065	0.0154	0.6813	0.1667
TSHR	rs17615156	14	81388568	C	0.053	-0.0035	0.0153	0.8203	0.0860	0.0002	0.0178	0.9901	0.0043
TSHR	rs1016699	14	81389124	G	0.426	-0.0124	0.0076	0.1121	0.9503	0.0018	0.0089	0.8422	0.0746
TSHR	rs1025252	14	81389135	A	0.062	-0.0008	0.0142	0.9568	0.0192	-0.0012	0.0165	0.9443	0.0249
TSHR	rs1025253	14	81389266	G	0.404	0.0122	0.0077	0.1193	0.9235	-0.0006	0.0090	0.9501	0.0223
TSHR	rs759918	14	81390128	C	0.487	0.0113	0.0075	0.1416	0.8489	-0.0025	0.0088	0.7783	0.1089
TSHR	rs2059719	14	81390791	C	0.198	-0.0101	0.0096	0.3063	0.5139	0.0054	0.0112	0.6392	0.1944
TSHR	rs759919	14	81391078	T	0.195	-0.0121	0.0077	0.1217	0.9146	0.0021	0.0089	0.8146	0.0890
TSHR	rs8022411	14	81391185	G	0.404	0.0122	0.0077	0.1207	0.9184	-0.0005	0.0089	0.9563	0.0194
TSHR	rs10140915	14	81391413	C	0.053	-0.0041	0.0151	0.7920	0.1013	0.0003	0.0176	0.9870	0.0057
TSHR	rs4903948	14	81392124	T	0.403	0.0121	0.0077	0.1223	0.9125	-0.0006	0.0090	0.9475	0.0234
TSHR	rs116875278	14	81392483	A	0.053	-0.0040	0.0153	0.7985	0.0977	-0.0007	0.0178	0.9697	0.0133
TSHR	rs10132220	14	81392502	A	0.053	-0.0039	0.0152	0.8020	0.0958	0.0002	0.0177	0.9892	0.0047
TSHR	rs4903949	14	81392513	A	0.488	0.0121	0.0075	0.1174	0.9304	-0.0013	0.0088	0.8852	0.0530
TSHR	rs117857224	14	81392561	C	0.053	-0.0042	0.0153	0.7881	0.1034	-0.0007	0.0178	0.9676	0.0143
TSHR	rs78060889	14	81392888	T	0.053	-0.0042	0.0153	0.7879	0.1035	-0.0007	0.0178	0.9676	0.0143
TSHR	rs2371456	14	81393496	A	0.426	-0.0113	0.0076	0.1464	0.8344	0.0026	0.0089	0.7718	0.1125
TSHR	rs2371457	14	81393703	A	0.403	0.0121	0.0077	0.1227	0.9111	-0.0005	0.0089	0.9599	0.0178
TSHR	rs12433134	14	81393926	T	0.425	-0.0120	0.0076	0.1250	0.9032	0.0023	0.0089	0.7979	0.0980
TSHR	rs60407794	14	81394116	C	0.098	0.0034	0.0132	0.8000	0.0969	-0.0086	0.0153	0.5831	0.2342
TSHR	rs10150391	14	81394123	G	0.053	-0.0029	0.0152	0.8517	0.0697	0.0007	0.0177	0.9670	0.0146

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2162547	14	81394526	T	0.193	-0.0097	0.0097	0.3311	0.4800	0.0042	0.0113	0.7154	0.1454
TSHR	rs12590770	14	81394624	A	0.110	0.0008	0.0120	0.9479	0.0232	-0.0033	0.0139	0.8148	0.0890
TSHR	rs2217175	14	81394797	C	0.053	-0.0029	0.0151	0.8509	0.0701	0.0003	0.0176	0.9880	0.0053
TSHR	rs8005883	14	81395771	G	0.403	0.0120	0.0077	0.1274	0.8950	-0.0006	0.0089	0.9499	0.0223
TSHR	rs8017038	14	81397574	T	0.425	-0.0116	0.0076	0.1359	0.8668	0.0027	0.0089	0.7667	0.1154
TSHR	rs78218384	14	81397830	C	0.095	-0.0100	0.0128	0.4478	0.3489	-0.0091	0.0150	0.5543	0.2563
TSHR	rs28787628	14	81398044	T	0.062	-0.0011	0.0142	0.9383	0.0276	-0.0018	0.0165	0.9152	0.0385
TSHR	rs8021757	14	81398357	G	0.062	-0.0026	0.0142	0.8568	0.0671	-0.0015	0.0165	0.9314	0.0309
TSHR	rs8003193	14	81398506	C	0.062	-0.0005	0.0142	0.9746	0.0112	-0.0008	0.0165	0.9620	0.0168
TSHR	rs58078360	14	81399304	G	0.151	0.0010	0.0104	0.9233	0.0347	-0.0053	0.0120	0.6657	0.1767
TSHR	rs56757452	14	81399586	C	0.160	0.0017	0.0101	0.8691	0.0609	-0.0060	0.0117	0.6169	0.2098
TSHR	rs2195101	14	81399692	A	0.151	0.0007	0.0103	0.9441	0.0250	-0.0051	0.0120	0.6768	0.1696
TSHR	rs2217176	14	81400050	C	0.402	0.0123	0.0077	0.1172	0.9310	-0.0004	0.0089	0.9674	0.0144
TSHR	rs72693043	14	81400093	C	0.204	-0.0117	0.0093	0.2204	0.6568	0.0071	0.0109	0.5226	0.2819
TSHR	rs12878041	14	81400425	G	0.159	0.0014	0.0102	0.8906	0.0503	-0.0072	0.0118	0.5514	0.2586
TSHR	rs12878167	14	81400427	T	0.159	0.0012	0.0102	0.9053	0.0432	-0.0072	0.0118	0.5480	0.2612
TSHR	rs10132871	14	81401059	C	0.150	0.0011	0.0104	0.9165	0.0379	-0.0037	0.0120	0.7666	0.1154
TSHR	rs728444	14	81402760	C	0.402	0.0127	0.0077	0.1058	0.9757	-0.0001	0.0090	0.9950	0.0022
TSHR	rs2371460	14	81403312	T	0.061	-0.0037	0.0091	0.6944	0.1584	0.0003	0.0106	0.9793	0.0091
TSHR	rs56343573	14	81403518	T	0.228	-0.0069	0.0089	0.4508	0.3460	-0.0020	0.0104	0.8529	0.0691
TSHR	rs7159065	14	81403729	C	0.229	-0.0066	0.0089	0.4667	0.3310	-0.0020	0.0104	0.8511	0.0700
TSHR	rs4899781	14	81403850	T	0.442	-0.0123	0.0076	0.1105	0.9564	0.0024	0.0088	0.7897	0.1026
TSHR	rs6574611	14	81404019	A	0.442	-0.0139	0.0076	0.0720	1.1425	0.0008	0.0088	0.9326	0.0303

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs6574612	14	81404074	T	0.228	-0.0082	0.0090	0.3712	0.4304	-0.0010	0.0104	0.9229	0.0349
TSHR	rs7143744	14	81404742	C	0.412	0.0107	0.0077	0.1701	0.7694	-0.0002	0.0089	0.9788	0.0093
TSHR	rs7149702	14	81404972	C	0.376	-0.0027	0.0080	0.7450	0.1278	-0.0038	0.0090	0.6769	0.1695
TSHR	rs4903954	14	81405614	C	0.412	0.0109	0.0076	0.1615	0.7917	-0.0001	0.0089	0.9904	0.0042
TSHR	rs35298517	14	81405743	G	0.147	0.0023	0.0104	0.8321	0.0798	-0.0057	0.0121	0.6466	0.1894
TSHR	rs3742722	14	81405846	C	0.412	0.0107	0.0076	0.1697	0.7702	-0.0003	0.0089	0.9744	0.0113
TSHR	rs17111237	14	81406341	G	0.203	-0.0125	0.0093	0.1899	0.7214	0.0069	0.0109	0.5338	0.2726
TSHR	rs12587883	14	81406514	G	0.091	0.0030	0.0105	0.7810	0.1074	-0.0055	0.0121	0.6561	0.1831
TSHR	rs17111246	14	81406683	A	0.212	-0.0101	0.0092	0.2803	0.5523	0.0070	0.0107	0.5253	0.2796
TSHR	rs12892825	14	81406730	C	0.412	0.0102	0.0076	0.1915	0.7179	-0.0010	0.0089	0.9142	0.0390
TSHR	rs2888046	14	81407048	G	0.412	0.0104	0.0077	0.1844	0.7342	-0.0015	0.0089	0.8712	0.0599
TSHR	rs2114703	14	81407169	T	0.412	0.0107	0.0076	0.1704	0.7685	-0.0002	0.0089	0.9818	0.0080
TSHR	rs2162548	14	81407456	C	0.412	0.0105	0.0076	0.1810	0.7423	-0.0005	0.0089	0.9530	0.0209
TSHR	rs11625251	14	81407891	G	0.087	-0.0146	0.0131	0.2748	0.5610	-0.0090	0.0153	0.5634	0.2492
TSHR	rs3742721	14	81407921	G	0.412	0.0106	0.0077	0.1756	0.7555	-0.0003	0.0089	0.9701	0.0132
TSHR	rs6574613	14	81408100	A	0.406	0.0105	0.0077	0.1818	0.7405	-0.0006	0.0089	0.9493	0.0226
TSHR	rs6574615	14	81408165	G	0.218	-0.0074	0.0094	0.4364	0.3601	0.0009	0.0105	0.9345	0.0294
TSHR	rs3742720	14	81408304	G	0.147	0.0032	0.0105	0.7638	0.1170	-0.0051	0.0121	0.6813	0.1667
TSHR	rs8009260	14	81408591	G	0.423	0.0101	0.0076	0.1959	0.7080	-0.0031	0.0089	0.7346	0.1339
TSHR	rs17111256	14	81408671	A	0.212	-0.0109	0.0092	0.2451	0.6107	0.0059	0.0107	0.5922	0.2275
TSHR	rs72693050	14	81409634	C	0.203	-0.0122	0.0093	0.1996	0.6999	0.0070	0.0109	0.5313	0.2746
TSHR	rs57104434	14	81409791	T	0.218	-0.0117	0.0091	0.2061	0.6859	0.0051	0.0106	0.6345	0.1976
TSHR	rs4899782	14	81410002	T	0.416	0.0112	0.0076	0.1531	0.8151	-0.0018	0.0089	0.8443	0.0735

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs4899783	14	81410262	T	0.416	0.0114	0.0076	0.1432	0.8440	-0.0013	0.0089	0.8887	0.0513
TSHR	rs67231034	14	81410653	T	0.366	-0.0027	0.0078	0.7300	0.1367	-0.0019	0.0090	0.8330	0.0794
TSHR	rs67065081	14	81410660	C	0.416	0.0107	0.0077	0.1704	0.7685	-0.0018	0.0089	0.8470	0.0721
TSHR	rs11627019	14	81410932	T	0.417	0.0088	0.0082	0.2900	0.5377	-0.0036	0.0089	0.6946	0.1583
TSHR	rs11627929	14	81411026	T	0.417	0.0094	0.0082	0.2611	0.5832	-0.0014	0.0089	0.8765	0.0572
TSHR	rs10136404	14	81411299	G	0.417	0.0113	0.0076	0.1477	0.8305	-0.0022	0.0089	0.8130	0.0899
TSHR	rs11623416	14	81411347	G	0.417	0.0110	0.0076	0.1590	0.7986	-0.0023	0.0089	0.8048	0.0943
TSHR	rs2371461	14	81411757	G	0.366	-0.0035	0.0077	0.6550	0.1838	-0.0027	0.0090	0.7677	0.1148
TSHR	rs12895801	14	81412117	C	0.416	0.0109	0.0076	0.1629	0.7881	-0.0022	0.0089	0.8084	0.0924
TSHR	rs35847336	14	81412494	C	0.147	0.0046	0.0105	0.6681	0.1752	-0.0028	0.0122	0.8254	0.0834
TSHR	rs17111270	14	81413039	G	0.417	0.0109	0.0077	0.1640	0.7852	-0.0021	0.0089	0.8142	0.0893
TSHR	rs7145224	14	81413293	C	0.437	-0.0127	0.0076	0.1000	1.0002	0.0048	0.0088	0.5947	0.2257
TSHR	rs7144208	14	81413489	G	0.353	-0.0065	0.0078	0.4185	0.3783	0.0023	0.0091	0.8045	0.0945
TSHR	rs72693053	14	81413849	G	0.205	-0.0123	0.0093	0.1946	0.7109	0.0033	0.0108	0.7655	0.1161
TSHR	rs8012343	14	81413969	A	0.431	-0.0135	0.0076	0.0816	1.0881	0.0037	0.0088	0.6840	0.1650
TSHR	rs17544072	14	81414285	C	0.435	-0.0144	0.0076	0.0633	1.1989	0.0024	0.0088	0.7945	0.0999
TSHR	rs17615911	14	81414351	T	0.435	-0.0145	0.0076	0.0610	1.2146	0.0019	0.0088	0.8324	0.0797
TSHR	rs17615941	14	81414408	G	0.435	-0.0145	0.0076	0.0616	1.2101	0.0020	0.0088	0.8285	0.0817
TSHR	rs10146516	14	81414747	A	0.435	-0.0146	0.0076	0.0583	1.2345	0.0022	0.0088	0.8053	0.0941
TSHR	rs10146348	14	81414819	G	0.435	-0.0143	0.0076	0.0645	1.1904	0.0023	0.0088	0.7953	0.0995
TSHR	rs10135774	14	81414913	C	0.435	-0.0145	0.0076	0.0614	1.2116	0.0020	0.0088	0.8209	0.0857
TSHR	rs17626988	14	81415002	A	0.433	-0.0146	0.0076	0.0592	1.2279	0.0023	0.0088	0.8006	0.0966
TSHR	rs2217177	14	81415154	C	0.435	-0.0144	0.0076	0.0632	1.1991	0.0024	0.0088	0.7884	0.1033

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2195103	14	81415462	C	0.435	-0.0143	0.0076	0.0636	1.1965	0.0022	0.0088	0.8037	0.0949
TSHR	rs2217178	14	81415557	T	0.435	-0.0143	0.0076	0.0635	1.1969	0.0022	0.0088	0.8087	0.0922
TSHR	rs10149689	14	81415800	G	0.435	-0.0138	0.0076	0.0748	1.1263	0.0028	0.0088	0.7564	0.1213
TSHR	rs2114705	14	81415926	A	0.434	-0.0142	0.0076	0.0658	1.1817	0.0024	0.0088	0.7933	0.1005
TSHR	rs12050278	14	81416038	C	0.435	-0.0139	0.0076	0.0713	1.1471	0.0022	0.0088	0.8037	0.0949
TSHR	rs12050077	14	81416064	A	0.435	-0.0142	0.0076	0.0663	1.1788	0.0025	0.0088	0.7796	0.1081
TSHR	rs12050279	14	81416153	C	0.071	-0.0024	0.0150	0.8779	0.0566	0.0175	0.0167	0.3067	0.5133
TSHR	rs12586161	14	81416170	G	0.144	0.0044	0.0105	0.6808	0.1670	-0.0005	0.0121	0.9693	0.0136
TSHR	rs12050078	14	81416354	A	0.261	-0.0096	0.0087	0.2757	0.5596	0.0068	0.0101	0.5139	0.2891
TSHR	rs8009120	14	81417218	A	0.422	0.0113	0.0076	0.1481	0.8293	-0.0026	0.0089	0.7789	0.1085
TSHR	rs12050350	14	81417771	C	0.261	-0.0090	0.0087	0.3082	0.5112	0.0060	0.0101	0.5604	0.2515
TSHR	rs12890859	14	81418088	C	0.144	0.0053	0.0105	0.6181	0.2089	0.0000	0.0121	0.9969	0.0014
TSHR	rs55751898	14	81419263	G	0.269	-0.0090	0.0085	0.2975	0.5265	0.0092	0.0099	0.3629	0.4402
TSHR	rs4903955	14	81419789	T	0.435	-0.0144	0.0076	0.0632	1.1992	0.0020	0.0088	0.8269	0.0825
TSHR	rs7154269	14	81420307	G	0.436	-0.0140	0.0076	0.0702	1.1535	0.0027	0.0088	0.7655	0.1160
TSHR	rs12590277	14	81420487	A	0.144	0.0054	0.0105	0.6154	0.2109	0.0000	0.0122	0.9975	0.0011
TSHR	rs12590236	14	81420604	C	0.144	0.0051	0.0105	0.6312	0.1998	0.0002	0.0121	0.9840	0.0070
TSHR	rs2371462	14	81420774	T	0.420	0.0119	0.0076	0.1271	0.8957	-0.0031	0.0089	0.7337	0.1345
TSHR	rs8022139	14	81421345	T	0.166	-0.0137	0.0099	0.1762	0.7540	-0.0113	0.0116	0.3389	0.4700
TSHR	rs8022600	14	81421423	T	0.436	-0.0150	0.0076	0.0529	1.2766	0.0020	0.0088	0.8233	0.0844
TSHR	rs8009058	14	81422868	C	0.169	-0.0130	0.0099	0.1983	0.7026	-0.0092	0.0115	0.4328	0.3637
TSHR	rs2268451	14	81424118	G	0.438	-0.0152	0.0076	0.0498	1.3031	0.0015	0.0088	0.8659	0.0625
TSHR	rs2268452	14	81424136	A	0.268	-0.0098	0.0085	0.2588	0.5871	0.0079	0.0099	0.4347	0.3618

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs45585237	14	81424318	A	0.153	-0.0148	0.0104	0.1621	0.7903	-0.0083	0.0121	0.5041	0.2975
TSHR	rs726019	14	81425412	T	0.097	-0.0130	0.0130	0.3286	0.4834	-0.0071	0.0147	0.6353	0.1971
TSHR	rs726020	14	81425425	G	0.368	-0.0130	0.0078	0.1031	0.9868	0.0027	0.0091	0.7733	0.1117
TSHR	rs726018	14	81425428	A	0.368	-0.0131	0.0078	0.1017	0.9927	0.0027	0.0091	0.7742	0.1112
TSHR	rs12892567	14	81427552	C	0.153	0.0083	0.0102	0.4215	0.3752	0.0079	0.0118	0.5151	0.2882
TSHR	rs61981273	14	81427579	T	0.298	0.0062	0.0086	0.4828	0.3162	-0.0122	0.0100	0.2352	0.6286
TSHR	rs28699303	14	81427675	T	0.097	-0.0176	0.0125	0.1693	0.7714	-0.0088	0.0147	0.5557	0.2551
TSHR	rs76339876	14	81428254	C	0.067	0.0052	0.0149	0.7330	0.1349	0.0187	0.0172	0.2889	0.5392
TSHR	rs179243	14	81428564	T	0.368	-0.0127	0.0078	0.1120	0.9508	0.0029	0.0091	0.7599	0.1193
TSHR	rs179244	14	81429103	A	0.107	-0.0135	0.0120	0.2708	0.5674	-0.0067	0.0140	0.6413	0.1930
TSHR	rs179245	14	81429463	G	0.368	-0.0126	0.0078	0.1156	0.9371	0.0029	0.0091	0.7565	0.1212
TSHR	rs2284715	14	81429871	T	0.153	0.0071	0.0105	0.5076	0.2945	0.0079	0.0118	0.5104	0.2921
TSHR	rs2284716	14	81430845	G	0.153	0.0072	0.0105	0.5053	0.2965	0.0086	0.0117	0.4765	0.3220
TSHR	rs179247	14	81432546	G	0.498	0.0086	0.0075	0.2628	0.5803	-0.0111	0.0087	0.2127	0.6723
TSHR	rs179248	14	81433038	C	0.497	0.0093	0.0078	0.2430	0.6143	-0.0114	0.0087	0.2033	0.6918
TSHR	rs150611635	14	81433675	A	0.090	-0.0005	0.0137	0.9739	0.0115	-0.0125	0.0150	0.4168	0.3801
TSHR	rs2284718	14	81434889	G	0.261	-0.0091	0.0086	0.3028	0.5189	0.0078	0.0101	0.4475	0.3492
TSHR	rs179249	14	81435199	C	0.366	-0.0124	0.0078	0.1205	0.9192	0.0053	0.0091	0.5693	0.2446
TSHR	rs179250	14	81435483	A	0.098	-0.0164	0.0123	0.1947	0.7106	-0.0098	0.0144	0.5042	0.2974
TSHR	rs2284719	14	81435598	A	0.261	-0.0092	0.0086	0.2975	0.5266	0.0076	0.0101	0.4597	0.3375
TSHR	rs77549221	14	81435625	G	0.090	-0.0040	0.0129	0.7598	0.1193	-0.0112	0.0149	0.4646	0.3330
TSHR	rs179251	14	81435760	C	0.366	-0.0127	0.0078	0.1109	0.9550	0.0057	0.0091	0.5383	0.2690
TSHR	rs179252	14	81435985	G	0.491	0.0070	0.0075	0.3622	0.4410	-0.0121	0.0087	0.1747	0.7577

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs7154821	14	81436171	T	0.125	0.0101	0.0107	0.3561	0.4484	0.0156	0.0124	0.2197	0.6582
TSHR	rs72693057	14	81436493	A	0.261	-0.0090	0.0086	0.3086	0.5106	0.0083	0.0101	0.4224	0.3742
TSHR	rs179253	14	81437253	G	0.098	-0.0121	0.0128	0.3525	0.4529	-0.0101	0.0144	0.4899	0.3099
TSHR	rs179254	14	81437340	C	0.366	-0.0123	0.0078	0.1212	0.9164	0.0050	0.0091	0.5920	0.2277
TSHR	rs179255	14	81437602	A	0.491	0.0065	0.0075	0.3947	0.4038	-0.0126	0.0087	0.1570	0.8042
TSHR	rs179256	14	81438070	T	0.095	-0.0106	0.0131	0.4289	0.3676	-0.0025	0.0147	0.8674	0.0618
TSHR	rs35789224	14	81438111	G	0.126	0.0108	0.0107	0.3236	0.4900	0.0162	0.0124	0.2016	0.6955
TSHR	rs2110695	14	81438498	T	0.125	0.0103	0.0107	0.3474	0.4591	0.0160	0.0124	0.2097	0.6784
TSHR	rs77783364	14	81439116	T	0.093	-0.0024	0.0128	0.8534	0.0689	-0.0104	0.0148	0.4923	0.3078
TSHR	rs179257	14	81439266	A	0.365	-0.0122	0.0078	0.1275	0.8944	0.0059	0.0091	0.5252	0.2797
TSHR	rs11850464	14	81439462	T	0.271	-0.0073	0.0085	0.3987	0.3994	0.0091	0.0099	0.3740	0.4271
TSHR	rs150259843	14	81439610	G	0.081	-0.0402	0.0173	0.0231	1.6370	-0.0388	0.0190	0.0456	1.3409
TSHR	rs36193909	14	81439642	A	0.121	0.0117	0.0111	0.3046	0.5162	0.0134	0.0129	0.3121	0.5058
TSHR	rs12589960	14	81439672	A	0.127	0.0091	0.0106	0.4023	0.3955	0.0142	0.0124	0.2632	0.5798
TSHR	rs179258	14	81441293	C	0.105	-0.0124	0.0120	0.3133	0.5040	-0.0030	0.0140	0.8370	0.0773
TSHR	rs179259	14	81441353	A	0.105	-0.0126	0.0120	0.3067	0.5132	-0.0030	0.0140	0.8356	0.0780
TSHR	rs2268453	14	81441998	A	0.120	0.0131	0.0111	0.2496	0.6028	0.0134	0.0129	0.3128	0.5048
TSHR	rs179260	14	81442055	T	0.095	-0.0166	0.0126	0.1974	0.7046	-0.0017	0.0147	0.9093	0.0413
TSHR	rs59431750	14	81442069	G	0.261	-0.0090	0.0086	0.3097	0.5090	0.0093	0.0101	0.3681	0.4341
TSHR	rs179261	14	81442234	C	0.105	-0.0098	0.0126	0.4488	0.3479	-0.0043	0.0141	0.7645	0.1166
TSHR	rs179262	14	81442348	T	0.415	0.0060	0.0082	0.4727	0.3254	-0.0105	0.0089	0.2497	0.6025
TSHR	rs2268456	14	81442410	T	0.126	0.0063	0.0132	0.6422	0.1923	-0.0001	0.0147	0.9948	0.0022
TSHR	rs179263	14	81442515	G	0.415	0.0079	0.0077	0.3132	0.5042	-0.0103	0.0089	0.2605	0.5842

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2284720	14	81443167	G	0.261	-0.0092	0.0086	0.2969	0.5274	0.0090	0.0101	0.3844	0.4153
TSHR	rs2110696	14	81443368	C	0.354	-0.0077	0.0079	0.3430	0.4648	0.0045	0.0092	0.6303	0.2005
TSHR	rs79058377	14	81444032	A	0.092	-0.0013	0.0128	0.9226	0.0350	-0.0068	0.0148	0.6532	0.1849
TSHR	rs2284721	14	81444085	C	0.127	0.0081	0.0106	0.4560	0.3410	0.0133	0.0124	0.2945	0.5309
TSHR	rs76285753	14	81444130	G	0.092	-0.0011	0.0128	0.9322	0.0305	-0.0071	0.0148	0.6415	0.1928
TSHR	rs2284722	14	81444367	A	0.354	-0.0071	0.0079	0.3777	0.4228	0.0053	0.0092	0.5744	0.2408
TSHR	rs4903956	14	81444480	C	0.354	-0.0067	0.0079	0.4087	0.3886	0.0060	0.0092	0.5216	0.2826
TSHR	rs2160214	14	81444588	C	0.127	0.0076	0.0106	0.4815	0.3174	0.0153	0.0123	0.2275	0.6430
TSHR	rs2215981	14	81444967	A	0.410	0.0061	0.0077	0.4380	0.3585	-0.0107	0.0089	0.2444	0.6119
TSHR	rs4411444	14	81445108	G	0.485	-0.0043	0.0078	0.5940	0.2262	0.0119	0.0088	0.1835	0.7363
TSHR	rs1035144	14	81445121	C	0.483	0.0009	0.0075	0.9103	0.0408	-0.0127	0.0088	0.1563	0.8060
TSHR	rs1035145	14	81445245	A	0.120	0.0114	0.0111	0.3164	0.4998	0.0133	0.0129	0.3148	0.5019
TSHR	rs5002906	14	81445299	C	0.358	-0.0058	0.0079	0.4686	0.3292	0.0057	0.0092	0.5456	0.2632
TSHR	rs77647068	14	81445576	C	0.358	-0.0063	0.0079	0.4390	0.3576	0.0042	0.0092	0.6573	0.1822
TSHR	rs72693068	14	81445738	T	0.354	-0.0068	0.0079	0.4030	0.3947	0.0050	0.0092	0.5932	0.2268
TSHR	rs1003150	14	81445835	T	0.094	-0.0165	0.0126	0.2018	0.6952	-0.0029	0.0147	0.8456	0.0728
TSHR	rs72693069	14	81445862	G	0.358	-0.0063	0.0079	0.4320	0.3645	0.0048	0.0092	0.6108	0.2141
TSHR	rs72693070	14	81445931	C	0.354	-0.0072	0.0079	0.3751	0.4258	0.0051	0.0092	0.5904	0.2289
TSHR	rs8003515	14	81446242	C	0.485	-0.0017	0.0075	0.8260	0.0830	0.0109	0.0087	0.2229	0.6520
TSHR	rs8003402	14	81446306	T	0.120	0.0095	0.0111	0.4001	0.3979	0.0133	0.0129	0.3147	0.5022
TSHR	rs72693072	14	81446407	T	0.354	-0.0070	0.0079	0.3878	0.4114	0.0054	0.0092	0.5688	0.2451
TSHR	rs72693073	14	81446557	A	0.354	-0.0068	0.0079	0.3983	0.3998	0.0054	0.0092	0.5704	0.2438
TSHR	rs72693075	14	81446568	A	0.261	-0.0070	0.0087	0.4290	0.3676	0.0101	0.0101	0.3298	0.4818

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs77932265	14	81446788	T	0.093	-0.0017	0.0128	0.8939	0.0487	-0.0082	0.0148	0.5877	0.2309
TSHR	rs2300516	14	81446908	G	0.483	-0.0021	0.0075	0.7809	0.1074	0.0117	0.0088	0.1931	0.7142
TSHR	rs2300517	14	81447745	C	0.127	0.0083	0.0106	0.4439	0.3527	0.0133	0.0124	0.2948	0.5305
TSHR	rs3783951	14	81448096	A	0.354	-0.0064	0.0079	0.4309	0.3656	0.0065	0.0092	0.4899	0.3099
TSHR	rs75488731	14	81450246	A	0.093	0.0012	0.0129	0.9258	0.0335	-0.0041	0.0149	0.7883	0.1033
TSHR	rs77542443	14	81450256	A	0.093	0.0006	0.0129	0.9641	0.0159	-0.0042	0.0149	0.7836	0.1059
TSHR	rs2284723	14	81450743	A	0.078	0.0130	0.0126	0.3117	0.5063	0.0230	0.0147	0.1255	0.9015
TSHR	rs12101255	14	81451052	T	0.339	-0.0017	0.0078	0.8350	0.0783	0.0176	0.0092	0.0607	1.2171
TSHR	rs74064796	14	81451102	A	0.261	-0.0069	0.0086	0.4377	0.3588	0.0117	0.0101	0.2549	0.5936
TSHR	rs12101261	14	81451229	T	0.339	-0.0010	0.0078	0.8975	0.0470	0.0183	0.0092	0.0504	1.2974
TSHR	rs59711583	14	81451330	G	0.261	-0.0076	0.0087	0.3916	0.4072	0.0107	0.0101	0.3006	0.5220
TSHR	rs190607719	14	81451548	T	0.077	0.0207	0.0129	0.1159	0.9361	0.0243	0.0150	0.1142	0.9425
TSHR	rs8003061	14	81451956	A	0.339	-0.0009	0.0079	0.9062	0.0428	0.0187	0.0092	0.0458	1.3388
TSHR	rs17111346	14	81452172	A	0.339	-0.0009	0.0079	0.9106	0.0407	0.0186	0.0092	0.0478	1.3208
TSHR	rs72693078	14	81453113	A	0.262	-0.0067	0.0086	0.4476	0.3491	0.0115	0.0101	0.2644	0.5778
TSHR	rs72693080	14	81453719	A	0.261	-0.0074	0.0087	0.4027	0.3950	0.0101	0.0101	0.3297	0.4819
TSHR	rs72693081	14	81453862	G	0.078	0.0118	0.0126	0.3610	0.4425	0.0230	0.0147	0.1259	0.8998
TSHR	rs2024427	14	81454236	T	0.261	-0.0081	0.0087	0.3593	0.4445	0.0097	0.0101	0.3499	0.4560
TSHR	rs2024428	14	81454436	C	0.094	-0.0156	0.0126	0.2278	0.6424	-0.0022	0.0147	0.8861	0.0525
TSHR	rs2284725	14	81454539	C	0.078	0.0135	0.0126	0.2916	0.5352	0.0246	0.0146	0.0993	1.0029
TSHR	rs34277709	14	81454564	T	0.135	-0.0006	0.0113	0.9556	0.0197	-0.0134	0.0131	0.3166	0.4995
TSHR	rs2284726	14	81454578	G	0.415	0.0073	0.0077	0.3523	0.4531	-0.0100	0.0089	0.2750	0.5606
TSHR	rs2284727	14	81454684	C	0.268	-0.0088	0.0085	0.3106	0.5078	0.0099	0.0099	0.3274	0.4850

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2284728	14	81454848	T	0.078	0.0137	0.0126	0.2870	0.5421	0.0253	0.0146	0.0905	1.0434
TSHR	rs36093037	14	81455306	T	0.136	0.0007	0.0113	0.9547	0.0201	-0.0122	0.0131	0.3605	0.4431
TSHR	rs7143071	14	81455409	T	0.094	-0.0172	0.0126	0.1823	0.7392	-0.0033	0.0147	0.8267	0.0827
TSHR	rs4903960	14	81455707	G	0.088	-0.0169	0.0132	0.2096	0.6786	-0.0032	0.0153	0.8408	0.0753
TSHR	rs58838870	14	81456605	C	0.078	0.0129	0.0127	0.3201	0.4947	0.0219	0.0147	0.1465	0.8342
TSHR	rs55945219	14	81456613	C	0.261	-0.0078	0.0087	0.3765	0.4242	0.0094	0.0101	0.3630	0.4401
TSHR	rs10145099	14	81456694	T	0.412	0.0078	0.0077	0.3222	0.4919	-0.0096	0.0089	0.2933	0.5328
TSHR	rs59103962	14	81456889	T	0.078	0.0124	0.0126	0.3376	0.4716	0.0227	0.0147	0.1298	0.8867
TSHR	rs59627467	14	81456897	C	0.078	0.0136	0.0126	0.2900	0.5375	0.0251	0.0146	0.0935	1.0290
TSHR	rs35523135	14	81457068	C	0.137	0.0010	0.0113	0.9283	0.0323	-0.0104	0.0131	0.4359	0.3606
TSHR	rs28414437	14	81457257	C	0.347	-0.0031	0.0078	0.6968	0.1569	0.0167	0.0091	0.0741	1.1301
TSHR	rs17544968	14	81457303	T	0.268	-0.0088	0.0085	0.3095	0.5093	0.0096	0.0099	0.3451	0.4621
TSHR	rs17111361	14	81457406	C	0.137	0.0007	0.0117	0.9503	0.0222	-0.0092	0.0130	0.4898	0.3100
TSHR	rs17545038	14	81457572	C	0.268	-0.0084	0.0085	0.3339	0.4764	0.0099	0.0099	0.3262	0.4865
TSHR	rs6574616	14	81457583	T	0.088	-0.0169	0.0132	0.2085	0.6809	-0.0007	0.0154	0.9637	0.0160
TSHR	rs6574617	14	81457615	A	0.412	0.0085	0.0080	0.2996	0.5235	-0.0108	0.0089	0.2388	0.6220
TSHR	rs2371463	14	81457788	A	0.476	-0.0007	0.0075	0.9292	0.0319	0.0112	0.0088	0.2117	0.6743
TSHR	rs724169	14	81457856	T	0.268	-0.0085	0.0085	0.3245	0.4888	0.0098	0.0099	0.3334	0.4770
TSHR	rs724170	14	81457940	A	0.476	-0.0011	0.0075	0.8887	0.0512	0.0112	0.0088	0.2132	0.6712
TSHR	rs2300518	14	81458516	T	0.078	0.0130	0.0126	0.3128	0.5047	0.0227	0.0147	0.1314	0.8815
TSHR	rs2300520	14	81459186	A	0.078	0.0139	0.0126	0.2778	0.5563	0.0249	0.0146	0.0958	1.0187
TSHR	rs72693090	14	81459753	G	0.268	-0.0084	0.0085	0.3319	0.4790	0.0099	0.0099	0.3287	0.4832
TSHR	rs72693091	14	81459840	G	0.078	0.0128	0.0126	0.3210	0.4935	0.0226	0.0147	0.1329	0.8766

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs11845052	14	81459924	T	0.268	-0.0086	0.0085	0.3185	0.4968	0.0106	0.0099	0.2939	0.5318
TSHR	rs8022899	14	81460128	A	0.078	0.0126	0.0126	0.3279	0.4843	0.0223	0.0147	0.1380	0.8603
TSHR	rs72693093	14	81460147	T	0.244	-0.0079	0.0087	0.3697	0.4322	0.0096	0.0101	0.3543	0.4506
TSHR	rs11159479	14	81460651	T	0.413	0.0074	0.0077	0.3448	0.4624	-0.0103	0.0090	0.2600	0.5850
TSHR	rs66487278	14	81461187	A	0.078	0.0126	0.0126	0.3274	0.4849	0.0234	0.0147	0.1198	0.9214
TSHR	rs7145701	14	81461348	A	0.094	-0.0160	0.0127	0.2177	0.6621	-0.0021	0.0148	0.8896	0.0508
TSHR	rs2160215	14	81461472	C	0.346	-0.0024	0.0078	0.7606	0.1188	0.0173	0.0091	0.0628	1.2021
TSHR	rs56389234	14	81461616	A	0.412	0.0072	0.0077	0.3590	0.4449	-0.0112	0.0090	0.2205	0.6565
TSHR	rs113713483	14	81461632	G	0.268	-0.0090	0.0085	0.3022	0.5197	0.0099	0.0099	0.3311	0.4801
TSHR	rs113036954	14	81461716	G	0.268	-0.0088	0.0085	0.3136	0.5037	0.0096	0.0099	0.3429	0.4648
TSHR	rs11850285	14	81461979	T	0.078	0.0132	0.0126	0.3061	0.5141	0.0246	0.0146	0.1008	0.9965
TSHR	rs1023586	14	81462283	C	0.346	-0.0024	0.0078	0.7671	0.1152	0.0174	0.0091	0.0619	1.2084
TSHR	rs12184983	14	81462556	C	0.135	-0.0003	0.0113	0.9816	0.0081	-0.0110	0.0131	0.4115	0.3857
TSHR	rs4903961	14	81462649	G	0.346	-0.0026	0.0078	0.7476	0.1263	0.0173	0.0091	0.0632	1.1992
TSHR	rs2268457	14	81462772	T	0.261	-0.0080	0.0087	0.3655	0.4371	0.0092	0.0101	0.3760	0.4248
TSHR	rs2268458	14	81462895	C	0.265	-0.0102	0.0085	0.2422	0.6158	0.0080	0.0100	0.4321	0.3644
TSHR	rs2268459	14	81463041	G	0.418	0.0088	0.0077	0.2626	0.5808	-0.0088	0.0090	0.3364	0.4731
TSHR	rs1990597	14	81463132	C	0.252	-0.0118	0.0089	0.1923	0.7160	0.0078	0.0104	0.4631	0.3343
TSHR	rs2268460	14	81463536	C	0.249	-0.0113	0.0089	0.2150	0.6675	0.0071	0.0104	0.5046	0.2970
TSHR	rs12437005	14	81463745	G	0.245	-0.0130	0.0089	0.1542	0.8119	0.0052	0.0104	0.6253	0.2039
TSHR	rs67391693	14	81463834	G	0.077	0.0112	0.0126	0.3841	0.4155	0.0225	0.0146	0.1337	0.8739
TSHR	rs12323356	14	81464279	G	0.449	-0.0043	0.0076	0.5800	0.2366	0.0094	0.0088	0.2994	0.5237
TSHR	rs12323699	14	81464286	C	0.081	0.0084	0.0119	0.4880	0.3116	0.0226	0.0138	0.1112	0.9540

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs56169819	14	81464471	C	0.081	0.0079	0.0120	0.5182	0.2855	0.0203	0.0139	0.1545	0.8111
TSHR	rs4903962	14	81464486	G	0.449	-0.0044	0.0076	0.5716	0.2429	0.0087	0.0088	0.3374	0.4718
TSHR	rs2284729	14	81464854	G	0.074	0.0101	0.0127	0.4346	0.3619	0.0185	0.0148	0.2203	0.6569
TSHR	rs2284730	14	81464901	C	0.462	-0.0032	0.0075	0.6763	0.1699	0.0095	0.0088	0.2910	0.5362
TSHR	rs2284731	14	81464955	C	0.074	0.0110	0.0127	0.3954	0.4029	0.0214	0.0147	0.1555	0.8081
TSHR	rs2284732	14	81465597	C	0.074	0.0114	0.0127	0.3796	0.4207	0.0218	0.0148	0.1488	0.8274
TSHR	rs7149900	14	81465845	T	0.074	0.0115	0.0127	0.3746	0.4265	0.0224	0.0147	0.1375	0.8617
TSHR	rs7154106	14	81465984	G	0.074	0.0110	0.0126	0.3935	0.4050	0.0220	0.0147	0.1435	0.8433
TSHR	rs58729405	14	81466368	C	0.074	0.0114	0.0127	0.3788	0.4216	0.0234	0.0147	0.1216	0.9151
TSHR	rs113850939	14	81466495	T	0.074	0.0111	0.0126	0.3907	0.4082	0.0223	0.0147	0.1393	0.8561
TSHR	rs11159480	14	81466662	G	0.140	0.0003	0.0111	0.9816	0.0081	0.0012	0.0125	0.9281	0.0324
TSHR	rs68104217	14	81466897	G	0.074	0.0105	0.0127	0.4162	0.3807	0.0221	0.0147	0.1434	0.8433
TSHR	rs67130762	14	81466980	A	0.074	0.0110	0.0126	0.3931	0.4055	0.0222	0.0147	0.1401	0.8534
TSHR	rs12896769	14	81467052	G	0.368	-0.0086	0.0079	0.2896	0.5382	0.0006	0.0093	0.9481	0.0232
TSHR	rs2268462	14	81467335	G	0.074	0.0109	0.0126	0.3992	0.3988	0.0220	0.0147	0.1437	0.8425
TSHR	rs2268463	14	81467450	G	0.074	0.0109	0.0126	0.4004	0.3975	0.0219	0.0147	0.1461	0.8353
TSHR	rs929630	14	81467458	T	0.368	-0.0085	0.0079	0.2922	0.5343	0.0008	0.0092	0.9297	0.0316
TSHR	rs2268464	14	81467594	A	0.074	0.0171	0.0156	0.2854	0.5445	0.0254	0.0173	0.1529	0.8155
TSHR	rs2268465	14	81467614	G	0.074	0.0110	0.0126	0.3947	0.4037	0.0222	0.0147	0.1394	0.8557
TSHR	rs8007809	14	81468235	T	0.072	0.0105	0.0127	0.4192	0.3776	0.0218	0.0148	0.1493	0.8259
TSHR	rs35472552	14	81468250	G	0.369	-0.0096	0.0079	0.2329	0.6329	0.0036	0.0092	0.7016	0.1539
TSHR	rs17111365	14	81468264	C	0.405	0.0083	0.0080	0.3075	0.5122	-0.0106	0.0090	0.2501	0.6019
TSHR	rs58417382	14	81468446	C	0.323	-0.0071	0.0079	0.3803	0.4199	0.0147	0.0092	0.1191	0.9241

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs35336887	14	81468463	T	0.119	0.0047	0.0118	0.6995	0.1552	-0.0080	0.0136	0.5644	0.2484
TSHR	rs58266067	14	81468476	C	0.324	-0.0074	0.0079	0.3573	0.4469	0.0145	0.0092	0.1242	0.9060
TSHR	rs58241131	14	81468579	A	0.324	-0.0072	0.0079	0.3756	0.4253	0.0149	0.0092	0.1152	0.9386
TSHR	rs60462373	14	81468655	C	0.323	-0.0072	0.0079	0.3729	0.4284	0.0153	0.0092	0.1058	0.9755
TSHR	rs4903964	14	81468954	A	0.325	-0.0075	0.0089	0.4135	0.3835	0.0132	0.0101	0.2040	0.6903
TSHR	rs7152373	14	81469592	C	0.324	-0.0098	0.0084	0.2570	0.5901	0.0151	0.0092	0.1091	0.9622
TSHR	rs55960644	14	81470024	G	0.325	-0.0076	0.0079	0.3489	0.4573	0.0154	0.0092	0.1028	0.9879
TSHR	rs55957493	14	81470054	A	0.325	-0.0073	0.0079	0.3672	0.4351	0.0155	0.0092	0.1011	0.9954
TSHR	rs917985	14	81470299	G	0.249	-0.0132	0.0087	0.1400	0.8538	0.0083	0.0102	0.4282	0.3684
TSHR	rs917986	14	81470655	C	0.226	0.0072	0.0090	0.4333	0.3632	0.0114	0.0101	0.2712	0.5667
TSHR	rs28440011	14	81470718	T	0.086	0.0127	0.0121	0.3035	0.5179	0.0223	0.0141	0.1213	0.9163
TSHR	rs75453896	14	81471085	G	0.131	0.0066	0.0122	0.5970	0.2240	-0.0074	0.0132	0.5860	0.2321
TSHR	rs17545310	14	81471139	C	0.376	-0.0068	0.0079	0.3990	0.3990	0.0037	0.0092	0.6944	0.1584
TSHR	rs71416856	14	81471235	T	0.119	0.0045	0.0118	0.7115	0.1478	-0.0082	0.0136	0.5572	0.2540
TSHR	rs3783944	14	81471277	G	0.074	0.0100	0.0127	0.4401	0.3564	0.0218	0.0147	0.1486	0.8279
TSHR	rs3783943	14	81471446	G	0.404	0.0065	0.0077	0.4048	0.3927	-0.0109	0.0090	0.2369	0.6255
TSHR	rs7154878	14	81471582	T	0.361	0.0169	0.0089	0.0621	1.2068	0.0031	0.0096	0.7495	0.1253
TSHR	rs10136511	14	81471589	A	0.075	0.0025	0.0166	0.8809	0.0551	0.0064	0.0180	0.7288	0.1374
TSHR	rs7155069	14	81471706	T	0.140	-0.0053	0.0108	0.6328	0.1988	-0.0021	0.0125	0.8723	0.0593
TSHR	rs72695026	14	81472030	T	0.178	-0.0156	0.0100	0.1279	0.8931	-0.0019	0.0117	0.8710	0.0600
TSHR	rs12897126	14	81472456	T	0.141	-0.0073	0.0115	0.5322	0.2739	0.0059	0.0138	0.6735	0.1717
TSHR	rs35554250	14	81472563	G	0.119	0.0039	0.0118	0.7443	0.1282	-0.0079	0.0136	0.5697	0.2444
TSHR	rs34146411	14	81472807	A	0.347	0.0041	0.0078	0.6062	0.2174	0.0048	0.0091	0.6038	0.2191

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs117917762	14	81472915	C	0.074	0.0095	0.0127	0.4653	0.3322	0.0206	0.0148	0.1736	0.7605
TSHR	rs12185020	14	81473078	G	0.214	0.0004	0.0088	0.9628	0.0165	0.0078	0.0103	0.4560	0.3411
TSHR	rs118186899	14	81473080	G	0.074	0.0087	0.0127	0.5008	0.3003	0.0193	0.0148	0.2022	0.6941
TSHR	rs113137098	14	81474619	A	0.181	-0.0200	0.0105	0.0617	1.2095	-0.0069	0.0123	0.5829	0.2344
TSHR	rs76759837	14	81474796	A	0.074	0.0052	0.0128	0.6898	0.1613	0.0152	0.0149	0.3198	0.4952
TSHR	rs72695035	14	81477015	C	0.067	0.0083	0.0135	0.5450	0.2636	0.0191	0.0157	0.2353	0.6284
TSHR	rs4903965	14	81477437	A	0.312	0.0049	0.0079	0.5420	0.2660	0.0057	0.0092	0.5437	0.2646
TSHR	rs72689904	14	81478278	G	0.286	-0.0131	0.0086	0.1338	0.8734	0.0006	0.0100	0.9549	0.0200
TSHR	rs12883673	14	81480822	G	0.119	0.0073	0.0117	0.5421	0.2659	-0.0045	0.0135	0.7438	0.1286
TSHR	rs2300521	14	81481332	C	0.270	-0.0217	0.0091	0.0189	1.7243	-0.0007	0.0102	0.9468	0.0237
TSHR	rs12890676	14	81481701	C	0.119	0.0066	0.0117	0.5833	0.2341	-0.0062	0.0135	0.6556	0.1833
TSHR	rs10873332	14	81481849	A	0.312	0.0052	0.0080	0.5228	0.2817	0.0070	0.0092	0.4579	0.3392
TSHR	rs72689907	14	81481886	A	0.067	0.0074	0.0135	0.5946	0.2258	0.0184	0.0158	0.2551	0.5934
TSHR	rs12436366	14	81481952	T	0.312	0.0054	0.0079	0.5068	0.2952	0.0064	0.0092	0.4969	0.3037
TSHR	rs59484155	14	81482108	A	0.312	0.0055	0.0079	0.4989	0.3020	0.0065	0.0092	0.4903	0.3096
TSHR	rs72689910	14	81482756	C	0.067	0.0071	0.0135	0.6042	0.2189	0.0185	0.0157	0.2491	0.6036
TSHR	rs12880945	14	81483881	A	0.119	0.0067	0.0117	0.5746	0.2406	-0.0051	0.0135	0.7102	0.1486
TSHR	rs12881268	14	81483897	A	0.119	0.0066	0.0117	0.5802	0.2365	-0.0052	0.0135	0.7091	0.1493
TSHR	rs7148630	14	81484459	C	0.112	-0.0022	0.0115	0.8509	0.0701	0.0037	0.0134	0.7887	0.1031
TSHR	rs4903967	14	81485149	G	0.179	0.0060	0.0096	0.5383	0.2690	0.0112	0.0108	0.3102	0.5083
TSHR	rs4899784	14	81487500	G	0.300	0.0060	0.0081	0.4734	0.3248	0.0070	0.0095	0.4713	0.3267
TSHR	rs34074777	14	81488262	T	0.119	0.0096	0.0120	0.4351	0.3614	-0.0044	0.0139	0.7580	0.1204
TSHR	rs35789100	14	81488416	T	0.119	0.0109	0.0120	0.3742	0.4269	-0.0036	0.0139	0.8023	0.0957

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs11159481	14	81490742	T	0.269	-0.0181	0.0089	0.0468	1.3293	-0.0030	0.0104	0.7804	0.1077
TSHR	rs11159482	14	81490842	T	0.066	-0.0119	0.0153	0.4478	0.3489	0.0141	0.0179	0.4421	0.3545
TSHR	rs2268467	14	81492606	C	0.192	-0.0002	0.0094	0.9835	0.0072	-0.0039	0.0109	0.7282	0.1377
TSHR	rs2268468	14	81492615	G	0.173	-0.0034	0.0097	0.7313	0.1359	-0.0040	0.0114	0.7321	0.1354
TSHR	rs10143800	14	81496342	G	0.222	-0.0040	0.0086	0.6480	0.1884	0.0063	0.0100	0.5382	0.2691
TSHR	rs2300522	14	81496640	T	0.231	-0.0051	0.0085	0.5546	0.2560	0.0046	0.0099	0.6484	0.1882
TSHR	rs2300523	14	81496820	G	0.231	-0.0052	0.0085	0.5529	0.2573	0.0043	0.0100	0.6754	0.1705
TSHR	rs2300524	14	81496936	G	0.231	-0.0050	0.0085	0.5647	0.2481	0.0047	0.0099	0.6419	0.1925
TSHR	rs2300525	14	81497393	C	0.231	-0.0054	0.0085	0.5383	0.2690	0.0041	0.0099	0.6837	0.1651
TSHR	rs2300526	14	81497467	G	0.222	-0.0040	0.0086	0.6450	0.1904	0.0064	0.0100	0.5328	0.2734
TSHR	rs12147797	14	81497634	T	0.231	-0.0052	0.0085	0.5506	0.2592	0.0045	0.0099	0.6597	0.1807
TSHR	rs17628249	14	81497980	C	0.231	-0.0057	0.0085	0.5125	0.2903	0.0043	0.0099	0.6709	0.1733
TSHR	rs17545722	14	81498002	C	0.231	-0.0052	0.0085	0.5516	0.2584	0.0045	0.0099	0.6600	0.1805
TSHR	rs2110697	14	81498066	T	0.454	0.0075	0.0080	0.3608	0.4427	-0.0012	0.0087	0.8903	0.0505
TSHR	rs61978723	14	81498125	T	0.231	-0.0050	0.0085	0.5640	0.2488	0.0045	0.0100	0.6578	0.1819
TSHR	rs61978724	14	81498303	C	0.231	-0.0053	0.0085	0.5431	0.2651	0.0044	0.0099	0.6627	0.1787
TSHR	rs2268469	14	81498779	T	0.221	-0.0042	0.0086	0.6364	0.1963	0.0058	0.0100	0.5753	0.2401
TSHR	rs2268472	14	81500146	C	0.231	-0.0050	0.0085	0.5642	0.2486	0.0047	0.0099	0.6437	0.1913
TSHR	rs28416942	14	81500309	T	0.231	-0.0051	0.0085	0.5575	0.2537	0.0041	0.0099	0.6850	0.1643
TSHR	rs28478356	14	81500378	T	0.231	-0.0053	0.0085	0.5465	0.2624	0.0040	0.0099	0.6940	0.1587
TSHR	rs2268473	14	81500396	G	0.124	-0.0034	0.0086	0.6979	0.1562	0.0078	0.0101	0.4515	0.3453
TSHR	rs28448639	14	81500397	G	0.121	-0.0036	0.0086	0.6799	0.1675	0.0075	0.0101	0.4684	0.3293
TSHR	rs12323621	14	81500598	T	0.231	-0.0041	0.0085	0.6411	0.1930	0.0032	0.0099	0.7564	0.1213

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs10873333	14	81500813	C	0.231	-0.0050	0.0085	0.5633	0.2493	0.0051	0.0099	0.6158	0.2106
TSHR	rs726627	14	81500884	T	0.231	-0.0066	0.0129	0.6160	0.2105	0.0124	0.0152	0.4276	0.3690
TSHR	rs726626	14	81501114	T	0.230	-0.0054	0.0085	0.5367	0.2703	0.0039	0.0099	0.7012	0.1542
TSHR	rs726625	14	81501149	T	0.231	-0.0053	0.0085	0.5392	0.2682	0.0039	0.0099	0.6997	0.1551
TSHR	rs726628	14	81501199	A	0.231	-0.0052	0.0085	0.5526	0.2576	0.0044	0.0099	0.6634	0.1782
TSHR	rs11159483	14	81501311	T	0.231	-0.0053	0.0085	0.5390	0.2685	0.0041	0.0099	0.6883	0.1622
TSHR	rs61978725	14	81501722	G	0.231	-0.0052	0.0085	0.5503	0.2594	0.0041	0.0099	0.6864	0.1634
TSHR	rs1005292	14	81501957	T	0.191	-0.0033	0.0098	0.7414	0.1300	-0.0027	0.0110	0.8138	0.0895
TSHR	rs12323481	14	81502046	C	0.231	-0.0055	0.0085	0.5266	0.2785	0.0040	0.0099	0.6932	0.1591
TSHR	rs12323785	14	81502070	G	0.231	-0.0052	0.0085	0.5509	0.2589	0.0041	0.0099	0.6899	0.1612
TSHR	rs12323790	14	81502277	T	0.231	-0.0052	0.0085	0.5491	0.2603	0.0041	0.0099	0.6886	0.1621
TSHR	rs12323799	14	81502527	T	0.231	-0.0049	0.0085	0.5719	0.2426	0.0041	0.0099	0.6893	0.1616
TSHR	rs12323491	14	81502677	C	0.231	-0.0052	0.0085	0.5485	0.2608	0.0035	0.0099	0.7273	0.1383
TSHR	rs59741121	14	81502778	C	0.183	-0.0116	0.0101	0.2612	0.5831	-0.0028	0.0110	0.8023	0.0957
TSHR	rs11159484	14	81503553	T	0.231	-0.0060	0.0085	0.4892	0.3105	0.0036	0.0100	0.7234	0.1406
TSHR	rs12323893	14	81503653	A	0.231	-0.0052	0.0086	0.5546	0.2560	0.0039	0.0100	0.7010	0.1543
TSHR	rs72689920	14	81503708	T	0.094	-0.0100	0.0098	0.3180	0.4975	0.0001	0.0115	0.9913	0.0038
TSHR	rs12323890	14	81503752	A	0.214	-0.0110	0.0100	0.2808	0.5516	0.0026	0.0110	0.8169	0.0878
TSHR	rs2888047	14	81504097	C	0.192	0.0006	0.0094	0.9527	0.0210	-0.0020	0.0110	0.8556	0.0677
TSHR	rs11159485	14	81504119	G	0.230	-0.0114	0.0100	0.2660	0.5751	0.0005	0.0110	0.9624	0.0167
TSHR	rs11159486	14	81504124	T	0.230	-0.0102	0.0100	0.3184	0.4970	0.0014	0.0110	0.9003	0.0456
TSHR	rs11159487	14	81504156	G	0.231	-0.0101	0.0097	0.3098	0.5089	0.0018	0.0107	0.8694	0.0608
TSHR	rs11159488	14	81504159	A	0.231	-0.0101	0.0097	0.3102	0.5084	0.0011	0.0107	0.9235	0.0346

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs13353102	14	81504267	A	0.222	-0.0033	0.0088	0.7128	0.1470	0.0032	0.0103	0.7643	0.1167
TSHR	rs13353103	14	81504375	T	0.231	-0.0046	0.0085	0.5981	0.2233	0.0041	0.0100	0.6897	0.1614
TSHR	rs13353125	14	81504423	C	0.231	-0.0046	0.0085	0.5947	0.2257	0.0040	0.0099	0.6916	0.1602
TSHR	rs13353104	14	81504551	T	0.232	-0.0049	0.0085	0.5720	0.2426	0.0038	0.0100	0.7062	0.1511
TSHR	rs12323355	14	81504860	A	0.231	-0.0041	0.0086	0.6425	0.1921	0.0044	0.0100	0.6633	0.1783
TSHR	rs12323350	14	81504932	A	0.231	-0.0048	0.0086	0.5843	0.2334	0.0046	0.0101	0.6576	0.1821
TSHR	rs12323693	14	81504957	G	0.231	-0.0055	0.0087	0.5378	0.2694	0.0053	0.0101	0.6067	0.2170
TSHR	rs12323422	14	81504973	T	0.222	-0.0042	0.0087	0.6353	0.1971	0.0063	0.0102	0.5488	0.2606
TSHR	rs12323762	14	81505089	C	0.231	-0.0051	0.0086	0.5596	0.2521	0.0042	0.0100	0.6783	0.1686
TSHR	rs61978742	14	81505367	A	0.231	-0.0055	0.0086	0.5347	0.2719	0.0034	0.0100	0.7396	0.1310
TSHR	rs61978743	14	81505391	A	0.231	-0.0054	0.0086	0.5390	0.2684	0.0039	0.0100	0.7047	0.1520
TSHR	rs12184961	14	81505551	G	0.231	-0.0043	0.0085	0.6221	0.2062	0.0049	0.0099	0.6311	0.1999
TSHR	rs12185035	14	81505679	C	0.231	-0.0045	0.0085	0.6028	0.2198	0.0035	0.0100	0.7311	0.1360
TSHR	rs12184963	14	81505737	T	0.231	-0.0044	0.0085	0.6123	0.2131	0.0033	0.0100	0.7470	0.1267
TSHR	rs12100732	14	81506485	C	0.174	-0.0096	0.0102	0.3576	0.4467	-0.0007	0.0112	0.9505	0.0220
TSHR	rs4903968	14	81507724	A	0.191	0.0008	0.0095	0.9361	0.0287	-0.0028	0.0110	0.8062	0.0936
TSHR	rs2110698	14	81510740	T	0.191	0.0001	0.0095	0.9919	0.0035	-0.0036	0.0110	0.7489	0.1256
TSHR	rs112548722	14	81510856	G	0.231	-0.0047	0.0085	0.5881	0.2306	0.0038	0.0100	0.7130	0.1469
TSHR	rs10147243	14	81511178	A	0.263	-0.0052	0.0083	0.5413	0.2665	0.0044	0.0097	0.6597	0.1806
TSHR	rs61978744	14	81511484	C	0.183	-0.0108	0.0101	0.2965	0.5279	-0.0035	0.0111	0.7589	0.1198
TSHR	rs61978745	14	81515284	A	0.173	-0.0096	0.0103	0.3608	0.4427	-0.0029	0.0112	0.7981	0.0980
TSHR	rs2024422	14	81516937	T	0.219	-0.0043	0.0087	0.6262	0.2033	0.0051	0.0101	0.6222	0.2060
TSHR	rs10131847	14	81517478	T	0.219	-0.0046	0.0087	0.6026	0.2200	0.0050	0.0101	0.6290	0.2014

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs72689928	14	81518033	C	0.219	-0.0048	0.0087	0.5891	0.2298	0.0050	0.0101	0.6293	0.2011
TSHR	rs2888048	14	81518074	A	0.195	0.0019	0.0094	0.8423	0.0745	-0.0022	0.0109	0.8412	0.0751
TSHR	rs55947533	14	81518826	T	0.173	-0.0095	0.0103	0.3647	0.4381	-0.0017	0.0112	0.8844	0.0534
TSHR	rs7158224	14	81519207	C	0.260	-0.0071	0.0084	0.4040	0.3936	0.0037	0.0097	0.7091	0.1493
TSHR	rs10138781	14	81519862	T	0.260	-0.0071	0.0084	0.4087	0.3886	0.0034	0.0098	0.7365	0.1328
TSHR	rs4619328	14	81519920	A	0.219	-0.0045	0.0087	0.6098	0.2148	0.0052	0.0101	0.6175	0.2094
TSHR	rs2024423	14	81520260	T	0.195	0.0016	0.0094	0.8695	0.0607	-0.0025	0.0109	0.8215	0.0854
TSHR	rs2024424	14	81520379	C	0.222	-0.0046	0.0087	0.6012	0.2210	0.0052	0.0101	0.6175	0.2093
TSHR	rs28855991	14	81520562	C	0.219	-0.0046	0.0087	0.6058	0.2177	0.0054	0.0101	0.6046	0.2185
TSHR	rs10150381	14	81521033	A	0.219	-0.0047	0.0087	0.5957	0.2249	0.0052	0.0101	0.6154	0.2108
TSHR	rs28750397	14	81521399	C	0.219	-0.0037	0.0087	0.6725	0.1723	0.0059	0.0101	0.5666	0.2467
TSHR	rs2371467	14	81521432	T	0.173	-0.0095	0.0103	0.3683	0.4338	-0.0018	0.0112	0.8781	0.0564
TSHR	rs10150860	14	81521552	C	0.219	-0.0045	0.0087	0.6075	0.2164	0.0055	0.0101	0.5969	0.2241
TSHR	rs2215982	14	81522110	T	0.174	-0.0096	0.0103	0.3621	0.4412	-0.0016	0.0112	0.8864	0.0523
TSHR	rs61978747	14	81523051	A	0.173	-0.0097	0.0103	0.3556	0.4490	-0.0021	0.0112	0.8550	0.0680
TSHR	rs4424851	14	81523082	A	0.192	0.0008	0.0095	0.9365	0.0285	-0.0022	0.0111	0.8436	0.0739
TSHR	rs17111394	14	81523128	C	0.174	-0.0091	0.0103	0.3837	0.4160	-0.0014	0.0112	0.9013	0.0451
TSHR	rs28675993	14	81523742	G	0.222	-0.0038	0.0086	0.6641	0.1778	0.0055	0.0101	0.5935	0.2266
TSHR	rs10134487	14	81523886	C	0.262	-0.0061	0.0084	0.4758	0.3225	0.0044	0.0098	0.6628	0.1786
TSHR	rs17111396	14	81524054	A	0.219	-0.0046	0.0087	0.6050	0.2183	0.0058	0.0101	0.5762	0.2394
TSHR	rs17111398	14	81524255	C	0.228	-0.0046	0.0086	0.6021	0.2203	0.0057	0.0101	0.5826	0.2347
TSHR	rs2268474	14	81524407	C	0.228	-0.0046	0.0086	0.6003	0.2216	0.0056	0.0100	0.5886	0.2302
TSHR	rs7147357	14	81526452	C	0.262	-0.0062	0.0084	0.4687	0.3291	0.0051	0.0098	0.6147	0.2113

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs72689940	14	81528119	A	0.093	0.0017	0.0131	0.8989	0.0463	0.0178	0.0152	0.2551	0.5933
TSHR	rs17546166	14	81530202	C	0.069	-0.0072	0.0150	0.6390	0.1945	0.0107	0.0176	0.5538	0.2567
TSHR	rs12372891	14	81531392	C	0.184	-0.0021	0.0097	0.8338	0.0789	-0.0064	0.0112	0.5786	0.2376
TSHR	rs11845164	14	81531754	C	0.122	-0.0210	0.0111	0.0625	1.2039	-0.0056	0.0128	0.6683	0.1750
TSHR	rs80043258	14	81533379	G	0.052	-0.0370	0.0187	0.0532	1.2742	-0.0068	0.0219	0.7618	0.1182
TSHR	rs11159490	14	81534440	T	0.376	-0.0108	0.0077	0.1723	0.7637	-0.0026	0.0090	0.7793	0.1083
TSHR	rs61978750	14	81536262	C	0.115	-0.0184	0.0113	0.1125	0.9489	-0.0011	0.0132	0.9361	0.0287
TSHR	rs77425375	14	81536698	T	0.098	-0.0165	0.0124	0.1945	0.7110	-0.0132	0.0145	0.3728	0.4285
TSHR	rs10148749	14	81536799	C	0.122	-0.0202	0.0110	0.0731	1.1361	-0.0037	0.0128	0.7805	0.1076
TSHR	rs10151660	14	81537484	C	0.122	-0.0205	0.0110	0.0683	1.1654	-0.0043	0.0128	0.7423	0.1294
TSHR	rs7161244	14	81537685	G	0.122	-0.0207	0.0110	0.0660	1.1802	-0.0044	0.0128	0.7384	0.1317
TSHR	rs12147099	14	81538927	C	0.071	0.0001	0.0168	0.9955	0.0020	0.0116	0.0187	0.5433	0.2650
TSHR	rs12887103	14	81539214	A	0.378	-0.0014	0.0137	0.9222	0.0352	-0.0125	0.0160	0.4448	0.3518
TSHR	rs2160213	14	81540075	T	0.184	-0.0030	0.0096	0.7642	0.1168	-0.0053	0.0112	0.6434	0.1915
TSHR	rs7145101	14	81540332	T	0.121	-0.0208	0.0111	0.0664	1.1780	-0.0047	0.0129	0.7199	0.1427
TSHR	rs7145290	14	81540422	T	0.122	-0.0183	0.0118	0.1275	0.8943	-0.0023	0.0128	0.8595	0.0657
TSHR	rs117641695	14	81542726	A	0.058	0.0162	0.0186	0.3922	0.4065	-0.0014	0.0217	0.9483	0.0231
TSHR	rs6574622	14	81546486	T	0.122	-0.0199	0.0110	0.0775	1.1109	-0.0042	0.0128	0.7504	0.1247
TSHR	rs75235317	14	81547827	A	0.071	-0.0035	0.0163	0.8346	0.0785	0.0114	0.0188	0.5537	0.2567
TSHR	rs7151543	14	81548766	G	0.120	-0.0194	0.0111	0.0886	1.0527	-0.0033	0.0130	0.8035	0.0950
TSHR	rs6574625	14	81549533	A	0.122	-0.0218	0.0110	0.0538	1.2692	-0.0072	0.0128	0.5855	0.2325
TSHR	rs8019570	14	81549595	A	0.122	-0.0217	0.0111	0.0548	1.2610	-0.0071	0.0129	0.5921	0.2276
TSHR	rs2300527	14	81550888	G	0.115	-0.0188	0.0113	0.1053	0.9777	-0.0012	0.0132	0.9306	0.0312

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2300528	14	81551260	A	0.122	-0.0209	0.0111	0.0639	1.1948	-0.0062	0.0129	0.6377	0.1954
TSHR	rs2284733	14	81552204	C	0.120	-0.0197	0.0111	0.0842	1.0746	-0.0041	0.0130	0.7563	0.1213
TSHR	rs2284734	14	81553733	G	0.307	-0.0141	0.0083	0.0964	1.0159	-0.0053	0.0093	0.5793	0.2371
TSHR	rs2284735	14	81553786	A	0.378	-0.0132	0.0080	0.1067	0.9718	-0.0022	0.0090	0.8149	0.0889
TSHR	rs2075173	14	81554617	G	0.115	-0.0185	0.0114	0.1115	0.9528	-0.0017	0.0132	0.9012	0.0452
TSHR	rs28654442	14	81556979	A	0.121	-0.0185	0.0112	0.1051	0.9785	-0.0037	0.0130	0.7831	0.1062
TSHR	rs10083503	14	81557084	G	0.184	-0.0048	0.0100	0.6376	0.1955	-0.0043	0.0112	0.7047	0.1520
TSHR	rs28701517	14	81557109	A	0.121	-0.0184	0.0112	0.1080	0.9664	-0.0016	0.0130	0.9037	0.0440
TSHR	rs2075174	14	81558505	A	0.120	-0.0189	0.0111	0.0972	1.0124	-0.0041	0.0130	0.7559	0.1215
TSHR	rs2075177	14	81559221	A	0.121	-0.0195	0.0112	0.0877	1.0570	-0.0029	0.0130	0.8246	0.0837
TSHR	rs2241120	14	81559431	A	0.122	-0.0209	0.0110	0.0636	1.1967	-0.0041	0.0128	0.7549	0.1221
TSHR	rs60447919	14	81559600	T	0.122	-0.0209	0.0110	0.0635	1.1974	-0.0041	0.0128	0.7580	0.1203
TSHR	rs7158747	14	81560007	G	0.123	-0.0207	0.0111	0.0672	1.1728	-0.0041	0.0129	0.7563	0.1213
TSHR	rs17111431	14	81560134	G	0.122	-0.0218	0.0111	0.0545	1.2639	-0.0065	0.0129	0.6228	0.2057
TSHR	rs28417017	14	81560286	A	0.121	-0.0188	0.0111	0.0984	1.0069	-0.0024	0.0130	0.8552	0.0679
TSHR	rs7159477	14	81560292	T	0.122	-0.0194	0.0118	0.1065	0.9729	-0.0044	0.0128	0.7373	0.1324
TSHR	rs7160204	14	81560504	A	0.122	-0.0213	0.0110	0.0589	1.2297	-0.0042	0.0129	0.7475	0.1264
TSHR	rs7143259	14	81560994	G	0.123	-0.0213	0.0111	0.0608	1.2161	-0.0039	0.0129	0.7709	0.1130
TSHR	rs7143593	14	81561116	T	0.122	-0.0211	0.0110	0.0616	1.2107	-0.0039	0.0128	0.7688	0.1142
TSHR	rs7145351	14	81561389	A	0.122	-0.0212	0.0111	0.0605	1.2183	-0.0047	0.0129	0.7232	0.1407
TSHR	rs10142999	14	81561425	A	0.122	-0.0210	0.0111	0.0635	1.1972	-0.0047	0.0129	0.7210	0.1421
TSHR	rs10143087	14	81561557	C	0.122	-0.0215	0.0110	0.0567	1.2463	-0.0047	0.0128	0.7207	0.1422
TSHR	rs10142959	14	81561643	G	0.122	-0.0217	0.0110	0.0548	1.2612	-0.0055	0.0128	0.6731	0.1719

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs28599787	14	81561681	A	0.121	-0.0205	0.0112	0.0722	1.1413	-0.0034	0.0130	0.7960	0.0991
TSHR	rs7150193	14	81562442	G	0.122	-0.0209	0.0111	0.0643	1.1915	-0.0044	0.0129	0.7405	0.1305
TSHR	rs10146192	14	81562581	T	0.122	-0.0209	0.0110	0.0639	1.1944	-0.0040	0.0128	0.7632	0.1173
TSHR	rs10146203	14	81562623	T	0.122	-0.0209	0.0111	0.0640	1.1939	-0.0033	0.0129	0.8025	0.0955
TSHR	rs10149740	14	81563831	T	0.121	-0.0205	0.0113	0.0740	1.1309	-0.0025	0.0131	0.8517	0.0697
TSHR	rs10149807	14	81563860	T	0.121	-0.0205	0.0112	0.0743	1.1288	-0.0027	0.0131	0.8388	0.0763
TSHR	rs10149739	14	81563871	G	0.121	-0.0211	0.0113	0.0668	1.1750	-0.0029	0.0131	0.8273	0.0823
TSHR	rs10149992	14	81563900	A	0.121	-0.0186	0.0112	0.1021	0.9908	-0.0022	0.0130	0.8706	0.0602
TSHR	rs10141582	14	81564185	C	0.121	-0.0195	0.0112	0.0881	1.0550	-0.0025	0.0130	0.8484	0.0714
TSHR	rs10129380	14	81564339	T	0.122	-0.0212	0.0111	0.0606	1.2179	-0.0051	0.0129	0.6973	0.1566
TSHR	rs10141777	14	81564374	C	0.122	-0.0211	0.0111	0.0622	1.2061	-0.0050	0.0129	0.7050	0.1518
TSHR	rs2300529	14	81564505	A	0.122	-0.0210	0.0111	0.0631	1.1998	-0.0051	0.0129	0.6990	0.1555
TSHR	rs2300530	14	81564994	A	0.122	-0.0219	0.0111	0.0527	1.2779	-0.0061	0.0128	0.6410	0.1932
TSHR	rs2300531	14	81565058	A	0.121	-0.0213	0.0111	0.0596	1.2251	-0.0049	0.0129	0.7113	0.1480
TSHR	rs2300532	14	81565125	G	0.122	-0.0209	0.0111	0.0639	1.1944	-0.0048	0.0129	0.7132	0.1468
TSHR	rs17111471	14	81565762	G	0.122	-0.0213	0.0111	0.0599	1.2224	-0.0053	0.0129	0.6846	0.1646
TSHR	rs10133458	14	81565918	A	0.122	-0.0209	0.0111	0.0644	1.1914	-0.0054	0.0129	0.6842	0.1648
TSHR	rs10147921	14	81566059	G	0.122	-0.0214	0.0111	0.0588	1.2305	-0.0060	0.0129	0.6466	0.1893
TSHR	rs10136213	14	81566362	A	0.122	-0.0208	0.0111	0.0657	1.1827	-0.0038	0.0129	0.7735	0.1115
TSHR	rs2300533	14	81566475	T	0.122	-0.0210	0.0111	0.0633	1.1989	-0.0048	0.0129	0.7170	0.1445
TSHR	rs6574626	14	81567060	A	0.181	-0.0060	0.0101	0.5623	0.2501	-0.0051	0.0113	0.6629	0.1786
TSHR	rs2300534	14	81567080	A	0.148	-0.0108	0.0109	0.3293	0.4824	0.0034	0.0122	0.7860	0.1046
TSHR	rs2300535	14	81567248	A	0.129	-0.0139	0.0117	0.2478	0.6060	0.0061	0.0128	0.6433	0.1916

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs11625902	14	81568441	G	0.361	-0.0064	0.0083	0.4539	0.3431	0.0042	0.0091	0.6472	0.1890
TSHR	rs7143914	14	81568600	G	0.172	0.0001	0.0100	0.9918	0.0036	0.0172	0.0116	0.1498	0.8246
TSHR	rs75382066	14	81569562	C	0.053	-0.0143	0.0200	0.4847	0.3145	-0.0134	0.0236	0.5795	0.2369
TSHR	rs1017141	14	81569678	G	0.181	-0.0063	0.0098	0.5256	0.2793	-0.0073	0.0113	0.5272	0.2780
TSHR	rs1861272	14	81570150	T	0.354	-0.0031	0.0078	0.7010	0.1543	0.0058	0.0091	0.5315	0.2745
TSHR	rs7150670	14	81571088	T	0.495	0.0047	0.0077	0.5487	0.2607	-0.0068	0.0090	0.4578	0.3393
TSHR	rs7151769	14	81571659	C	0.367	-0.0010	0.0078	0.9009	0.0453	0.0080	0.0091	0.3916	0.4072
TSHR	rs2268475	14	81572310	C	0.426	0.0030	0.0076	0.7036	0.1527	-0.0063	0.0089	0.4878	0.3118
TSHR	rs1990595	14	81572386	A	0.348	-0.0014	0.0078	0.8642	0.0634	0.0082	0.0091	0.3777	0.4229
TSHR	rs1990596	14	81572534	T	0.348	-0.0015	0.0078	0.8558	0.0676	0.0077	0.0091	0.4072	0.3902
TSHR	rs2371468	14	81572865	A	0.348	-0.0016	0.0078	0.8397	0.0759	0.0079	0.0091	0.3982	0.3999
TSHR	rs11159491	14	81572939	T	0.349	-0.0010	0.0078	0.9025	0.0446	0.0088	0.0091	0.3454	0.4617
TSHR	rs7141675	14	81573148	C	0.426	0.0033	0.0076	0.6752	0.1706	-0.0064	0.0089	0.4822	0.3168
TSHR	rs2024425	14	81573437	T	0.348	-0.0016	0.0078	0.8402	0.0756	0.0077	0.0091	0.4085	0.3888
TSHR	rs61980862	14	81573539	T	0.171	0.0023	0.0100	0.8217	0.0853	0.0180	0.0117	0.1321	0.8791
TSHR	rs2024426	14	81573616	T	0.348	-0.0015	0.0078	0.8487	0.0712	0.0076	0.0091	0.4148	0.3821
TSHR	rs7147527	14	81574038	G	0.349	-0.0012	0.0078	0.8823	0.0544	0.0076	0.0091	0.4164	0.3805
TSHR	rs12884734	14	81574150	C	0.407	-0.0013	0.0078	0.8707	0.0601	0.0086	0.0091	0.3589	0.4451
TSHR	rs12884578	14	81574151	A	0.414	0.0001	0.0079	0.9858	0.0062	0.0090	0.0092	0.3371	0.4723
TSHR	rs11845715	14	81574283	T	0.177	-0.0045	0.0099	0.6563	0.1829	-0.0054	0.0114	0.6440	0.1911
TSHR	rs12885526	14	81574429	G	0.347	-0.0031	0.0081	0.7139	0.1463	0.0077	0.0091	0.4099	0.3873
TSHR	rs2080305	14	81575419	C	0.424	0.0044	0.0079	0.5886	0.2302	-0.0094	0.0089	0.3023	0.5196
TSHR	rs139622705	14	81575644	G	0.107	0.0180	0.0145	0.2259	0.6461	0.0054	0.0159	0.7411	0.1301

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs2371469	14	81575653	C	0.352	-0.0034	0.0078	0.6704	0.1736	0.0082	0.0091	0.3756	0.4253
TSHR	rs8017199	14	81575811	G	0.176	-0.0049	0.0099	0.6247	0.2044	-0.0054	0.0115	0.6471	0.1890
TSHR	rs2080306	14	81576139	C	0.345	-0.0023	0.0079	0.7774	0.1094	0.0115	0.0091	0.2176	0.6623
TSHR	rs7160420	14	81576332	G	0.346	-0.0026	0.0079	0.7500	0.1249	0.0096	0.0091	0.3061	0.5142
TSHR	rs7160596	14	81576426	G	0.345	-0.0019	0.0079	0.8153	0.0887	0.0109	0.0091	0.2426	0.6150
TSHR	rs12878605	14	81576888	T	0.344	-0.0018	0.0079	0.8204	0.0860	0.0098	0.0091	0.2934	0.5326
TSHR	rs12881644	14	81577134	A	0.344	-0.0022	0.0079	0.7829	0.1063	0.0099	0.0091	0.2922	0.5343
TSHR	rs12883448	14	81577442	T	0.345	-0.0021	0.0079	0.7911	0.1018	0.0105	0.0091	0.2630	0.5801
TSHR	rs10144209	14	81577831	T	0.345	-0.0018	0.0079	0.8196	0.0864	0.0106	0.0091	0.2576	0.5891
TSHR	rs10146801	14	81578212	T	0.344	-0.0019	0.0079	0.8094	0.0918	0.0114	0.0091	0.2240	0.6498
TSHR	rs10146811	14	81578238	T	0.345	-0.0015	0.0079	0.8511	0.0700	0.0111	0.0091	0.2366	0.6260
TSHR	rs2888049	14	81578305	A	0.345	-0.0027	0.0079	0.7341	0.1342	0.0088	0.0091	0.3478	0.4587
TSHR	rs917983	14	81578543	G	0.347	-0.0012	0.0079	0.8845	0.0533	0.0124	0.0092	0.1860	0.7305
TSHR	rs917984	14	81578702	C	0.349	-0.0028	0.0082	0.7394	0.1311	0.0128	0.0092	0.1722	0.7638
TSHR	rs12888772	14	81578926	A	0.171	-0.0040	0.0102	0.7049	0.1519	-0.0032	0.0119	0.7900	0.1024
TSHR	rs34082357	14	81579289	A	0.071	0.0045	0.0159	0.7795	0.1082	0.0143	0.0186	0.4540	0.3429
TSHR	rs74587938	14	81579335	G	0.059	-0.0224	0.0188	0.2431	0.6142	-0.0164	0.0220	0.4673	0.3304
TSHR	rs2300536	14	81580189	T	0.350	0.0115	0.0078	0.1513	0.8203	-0.0033	0.0091	0.7192	0.1432
TSHR	rs11159492	14	81580501	A	0.215	0.0120	0.0089	0.1898	0.7217	-0.0105	0.0104	0.3213	0.4930
TSHR	rs10131259	14	81580566	G	0.215	0.0055	0.0097	0.5763	0.2393	-0.0143	0.0105	0.1860	0.7305
TSHR	rs4903970	14	81580670	T	0.265	-0.0015	0.0135	0.9121	0.0400	0.0115	0.0157	0.4757	0.3227
TSHR	rs4903971	14	81580710	A	0.079	-0.0096	0.0212	0.6586	0.1814	-0.0077	0.0241	0.7564	0.1212
TSHR	rs12586613	14	81580765	T	0.170	0.0070	0.0099	0.4913	0.3086	-0.0054	0.0115	0.6455	0.1901

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs35080161	14	81580804	T	0.170	0.0071	0.0099	0.4809	0.3180	-0.0058	0.0115	0.6242	0.2047
TSHR	rs149396989	14	81582351	T	0.214	0.0410	0.0158	0.0111	1.9564	0.0134	0.0170	0.4386	0.3579
TSHR	rs12895445	14	81586172	A	0.254	0.0018	0.0158	0.9107	0.0406	0.0082	0.0171	0.6402	0.1937
TSHR	rs12896284	14	81586182	A	0.207	-0.0067	0.0140	0.6394	0.1942	-0.0040	0.0154	0.7992	0.0974
TSHR	rs8020969	14	81586674	T	0.215	0.0119	0.0089	0.1919	0.7170	-0.0100	0.0103	0.3438	0.4637
TSHR	rs2284736	14	81586721	G	0.352	0.0124	0.0078	0.1179	0.9287	-0.0036	0.0090	0.6940	0.1586
TSHR	rs2284738	14	81586934	C	0.215	0.0116	0.0089	0.2030	0.6926	-0.0114	0.0103	0.2819	0.5499
TSHR	rs2284739	14	81587002	C	0.215	0.0115	0.0089	0.2087	0.6804	-0.0101	0.0104	0.3402	0.4682
TSHR	rs2284740	14	81587006	T	0.215	0.0116	0.0089	0.2045	0.6893	-0.0098	0.0104	0.3550	0.4497
TSHR	rs72691609	14	81587243	A	0.170	0.0071	0.0098	0.4772	0.3213	-0.0039	0.0114	0.7400	0.1308
TSHR	rs7143719	14	81587649	A	0.215	0.0124	0.0089	0.1733	0.7612	-0.0104	0.0103	0.3233	0.4904
TSHR	rs7144198	14	81587866	T	0.214	0.0123	0.0089	0.1790	0.7471	-0.0115	0.0104	0.2787	0.5548
TSHR	rs7144061	14	81587887	C	0.215	0.0120	0.0089	0.1879	0.7260	-0.0104	0.0103	0.3224	0.4916
TSHR	rs28373271	14	81587924	G	0.215	0.0119	0.0089	0.1896	0.7222	-0.0106	0.0103	0.3133	0.5040
TSHR	rs2888050	14	81588015	T	0.214	0.0119	0.0089	0.1938	0.7126	-0.0118	0.0104	0.2654	0.5761
TSHR	rs67428672	14	81588054	G	0.215	0.0112	0.0089	0.2182	0.6611	-0.0101	0.0104	0.3417	0.4664
TSHR	rs67045633	14	81588175	G	0.213	0.0119	0.0089	0.1920	0.7167	-0.0120	0.0104	0.2599	0.5852
TSHR	rs76956096	14	81588245	G	0.215	0.0127	0.0089	0.1635	0.7865	-0.0094	0.0103	0.3750	0.4260
TSHR	rs113866322	14	81588469	C	0.352	0.0115	0.0078	0.1470	0.8326	-0.0034	0.0090	0.7125	0.1472
TSHR	rs56369010	14	81588915	G	0.216	0.0122	0.0089	0.1780	0.7497	-0.0105	0.0103	0.3212	0.4932
TSHR	rs55993259	14	81588958	C	0.215	0.0118	0.0089	0.1954	0.7090	-0.0106	0.0103	0.3135	0.5037
TSHR	rs56306987	14	81588995	C	0.215	0.0116	0.0089	0.1997	0.6995	-0.0109	0.0103	0.3008	0.5217
TSHR	rs8019356	14	81589806	C	0.216	0.0120	0.0089	0.1860	0.7305	-0.0100	0.0103	0.3432	0.4645

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs8012915	14	81590016	A	0.215	0.0093	0.0092	0.3216	0.4927	-0.0102	0.0103	0.3327	0.4780
TSHR	rs28559861	14	81590918	G	0.215	0.0126	0.0089	0.1663	0.7791	-0.0102	0.0103	0.3347	0.4754
TSHR	rs67915209	14	81591037	T	0.214	0.0115	0.0089	0.2078	0.6825	-0.0108	0.0104	0.3089	0.5102
TSHR	rs72691624	14	81591396	T	0.214	0.0127	0.0089	0.1634	0.7868	-0.0112	0.0104	0.2920	0.5346
TSHR	rs7158881	14	81591754	C	0.296	0.0112	0.0082	0.1782	0.7492	-0.0030	0.0095	0.7530	0.1232
TSHR	rs71416860	14	81592167	T	0.056	0.0065	0.0148	0.6687	0.1748	-0.0011	0.0173	0.9527	0.0211
TSHR	rs2268476	14	81592717	G	0.216	0.0097	0.0092	0.3047	0.5161	-0.0098	0.0103	0.3510	0.4547
TSHR	rs7143580	14	81592857	C	0.079	0.0032	0.0149	0.8318	0.0800	0.0184	0.0172	0.2968	0.5275
TSHR	rs66996522	14	81593018	G	0.215	0.0112	0.0089	0.2204	0.6567	-0.0117	0.0104	0.2688	0.5705
TSHR	rs79305847	14	81593371	C	0.079	0.0051	0.0150	0.7366	0.1328	0.0178	0.0173	0.3141	0.5029
TSHR	rs9652304	14	81593982	C	0.295	0.0113	0.0082	0.1789	0.7473	-0.0030	0.0095	0.7598	0.1193
TSHR	rs7152963	14	81594028	A	0.215	0.0123	0.0089	0.1759	0.7547	-0.0096	0.0103	0.3620	0.4413
TSHR	rs59334515	14	81594143	T	0.214	0.0122	0.0089	0.1807	0.7431	-0.0118	0.0104	0.2687	0.5707
TSHR	rs3783938	14	81594380	T	0.081	0.0044	0.0146	0.7666	0.1155	0.0185	0.0168	0.2819	0.5499
TSHR	rs58884826	14	81594750	A	0.079	0.0032	0.0150	0.8340	0.0788	0.0178	0.0172	0.3120	0.5058
TSHR	rs57632490	14	81595110	T	0.123	0.0117	0.0116	0.3235	0.4901	-0.0049	0.0134	0.7218	0.1416
TSHR	rs8022675	14	81595359	C	0.295	0.0112	0.0082	0.1792	0.7466	-0.0035	0.0095	0.7183	0.1437
TSHR	rs8021423	14	81595369	T	0.294	0.0111	0.0085	0.2016	0.6955	-0.0045	0.0095	0.6441	0.1910
TSHR	rs60832047	14	81595628	T	0.294	0.0121	0.0082	0.1520	0.8183	-0.0043	0.0095	0.6613	0.1796
TSHR	rs59395915	14	81595671	G	0.294	0.0111	0.0082	0.1863	0.7298	-0.0043	0.0095	0.6593	0.1809
TSHR	rs10140322	14	81595928	C	0.352	0.0120	0.0078	0.1330	0.8762	-0.0037	0.0090	0.6891	0.1617
TSHR	rs57548236	14	81596270	T	0.294	0.0120	0.0082	0.1555	0.8083	-0.0042	0.0095	0.6653	0.1770
TSHR	rs11848926	14	81596553	G	0.056	0.0006	0.0153	0.9716	0.0125	-0.0050	0.0171	0.7735	0.1115

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs59500227	14	81597547	C	0.124	0.0134	0.0115	0.2549	0.5936	-0.0031	0.0133	0.8185	0.0870
TSHR	rs78851612	14	81597714	A	0.079	0.0043	0.0150	0.7800	0.1079	0.0204	0.0173	0.2477	0.6061
TSHR	rs57800782	14	81598055	T	0.175	0.0094	0.0098	0.3498	0.4561	0.0063	0.0114	0.5909	0.2285
TSHR	rs7157307	14	81598096	C	0.063	-0.0022	0.0146	0.8817	0.0547	-0.0083	0.0164	0.6229	0.2056
TSHR	rs34871525	14	81598677	C	0.071	0.0004	0.0132	0.9769	0.0102	-0.0149	0.0155	0.3447	0.4625
TSHR	rs930099	14	81599511	A	0.155	0.0000	0.0101	0.9996	0.0002	-0.0034	0.0117	0.7804	0.1077
TSHR	rs66489957	14	81600204	C	0.255	0.0081	0.0087	0.3657	0.4369	0.0095	0.0101	0.3585	0.4455
TSHR	rs7157900	14	81600351	A	0.227	0.0064	0.0087	0.4758	0.3226	-0.0177	0.0102	0.0882	1.0546
TSHR	rs35933410	14	81601930	T	0.071	0.0021	0.0131	0.8773	0.0568	-0.0112	0.0153	0.4735	0.3247
TSHR	rs12891336	14	81603033	A	0.071	0.0025	0.0131	0.8506	0.0703	-0.0103	0.0153	0.5109	0.2917
TSHR	rs1957547	14	81604138	G	0.371	0.0119	0.0079	0.1424	0.8464	-0.0021	0.0088	0.8135	0.0897
TSHR	rs2300538	14	81607233	G	0.360	0.0070	0.0077	0.3788	0.4216	-0.0022	0.0090	0.8075	0.0929
TSHR	rs2300539	14	81607364	G	0.365	0.0059	0.0077	0.4580	0.3392	-0.0051	0.0090	0.5771	0.2387
TSHR	rs733235	14	81607494	G	0.288	0.0066	0.0083	0.4348	0.3617	0.0007	0.0096	0.9460	0.0241
TSHR	rs733234	14	81607661	C	0.290	0.0062	0.0083	0.4653	0.3323	0.0003	0.0096	0.9739	0.0115
TSHR	rs733236	14	81607707	C	0.290	0.0066	0.0083	0.4349	0.3616	0.0003	0.0096	0.9725	0.0121
TSHR	rs2300540	14	81607731	A	0.290	0.0066	0.0083	0.4380	0.3585	0.0004	0.0096	0.9681	0.0141
TSHR	rs2300541	14	81607830	T	0.177	0.0080	0.0101	0.4364	0.3601	0.0055	0.0113	0.6361	0.1965
TSHR	rs2300542	14	81607930	C	0.290	0.0065	0.0083	0.4416	0.3550	0.0003	0.0096	0.9751	0.0109
TSHR	rs17630128	14	81611128	C	0.301	0.0016	0.0086	0.8549	0.0681	0.0021	0.0097	0.8318	0.0800
TSHR	rs2288493	14	81611606	T	0.193	-0.0003	0.0099	0.9740	0.0114	0.0000	0.0110	0.9986	0.0006
TSHR	rs2288495	14	81611919	C	0.494	-0.0089	0.0075	0.2429	0.6146	0.0041	0.0087	0.6435	0.1914
TSHR	rs2288496	14	81612114	C	0.494	-0.0064	0.0077	0.4161	0.3808	0.0053	0.0087	0.5479	0.2613

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs8022931	14	81613138	G	0.484	-0.0140	0.0075	0.0662	1.1790	0.0029	0.0087	0.7470	0.1267
TSHR	rs73342247	14	81613418	T	0.075	0.0056	0.0131	0.6763	0.1698	-0.0140	0.0153	0.3733	0.4280
TSHR	rs12883574	14	81614148	C	0.075	0.0036	0.0132	0.7892	0.1028	-0.0142	0.0154	0.3683	0.4338
TSHR	rs12884573	14	81614177	A	0.076	0.0048	0.0132	0.7209	0.1421	-0.0126	0.0154	0.4245	0.3721
TSHR	rs36022732	14	81614486	A	0.075	0.0062	0.0132	0.6478	0.1885	-0.0121	0.0155	0.4447	0.3519
TSHR	rs12883801	14	81614514	G	0.490	-0.0148	0.0074	0.0520	1.2841	0.0024	0.0087	0.7886	0.1032
TSHR	rs11846779	14	81615734	T	0.268	-0.0021	0.0088	0.8143	0.0892	0.0038	0.0098	0.7059	0.1512
TSHR	rs72691643	14	81616471	G	0.111	0.0143	0.0127	0.2693	0.5697	0.0102	0.0147	0.4977	0.3031
TSHR	rs11622435	14	81617996	A	0.055	0.0054	0.0189	0.7814	0.1071	0.0122	0.0218	0.5855	0.2324
TSHR	rs55893992	14	81618618	A	0.055	0.0031	0.0189	0.8732	0.0589	0.0133	0.0218	0.5507	0.2591
TSHR	rs2371562	14	81619474	A	0.232	-0.0001	0.0087	0.9890	0.0048	0.0074	0.0102	0.4801	0.3187
TSHR	rs741651	14	81619569	C	0.055	0.0003	0.0187	0.9881	0.0052	0.0155	0.0215	0.4813	0.3176
TSHR	rs12893151	14	81619945	A	0.204	0.0162	0.0093	0.0884	1.0538	0.0085	0.0108	0.4434	0.3532
TSHR	rs7150551	14	81620453	A	0.264	0.0005	0.0084	0.9580	0.0186	0.0046	0.0098	0.6460	0.1897
TSHR	rs28441485	14	81620883	T	0.475	-0.0110	0.0076	0.1569	0.8043	-0.0109	0.0088	0.2272	0.6436
TSHR	rs12590557	14	81621664	C	0.267	0.0000	0.0084	0.9981	0.0008	0.0048	0.0098	0.6290	0.2013
TSHR	rs11620837	14	81622342	T	0.475	-0.0115	0.0076	0.1394	0.8558	-0.0124	0.0088	0.1703	0.7687
TSHR	rs61980878	14	81622650	A	0.475	-0.0109	0.0076	0.1608	0.7936	-0.0108	0.0088	0.2303	0.6377
TSHR	rs10130445	14	81622935	G	0.267	0.0007	0.0084	0.9354	0.0290	0.0055	0.0097	0.5798	0.2367
TSHR	rs58236569	14	81624520	C	0.055	0.0033	0.0189	0.8657	0.0626	0.0140	0.0218	0.5312	0.2748
TSHR	rs77435835	14	81625045	G	0.055	0.0044	0.0190	0.8222	0.0850	0.0145	0.0218	0.5158	0.2875
TSHR	rs11844076	14	81629000	A	0.475	-0.0122	0.0076	0.1146	0.9410	-0.0110	0.0088	0.2223	0.6530
TSHR	rs1885602	14	81629996	T	0.230	-0.0024	0.0087	0.7834	0.1060	0.0004	0.0101	0.9670	0.0146

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs12372876	14	81630194	T	0.475	-0.0109	0.0075	0.1568	0.8047	-0.0104	0.0088	0.2460	0.6090
TSHR	rs72695720	14	81635105	C	0.060	0.0059	0.0171	0.7367	0.1327	-0.0276	0.0199	0.1766	0.7529
TSHR	rs10131728	14	81635323	T	0.077	0.0142	0.0125	0.2661	0.5749	-0.0074	0.0146	0.6217	0.2064
TSHR	rs57436191	14	81635329	A	0.112	0.0130	0.0123	0.2999	0.5231	0.0145	0.0142	0.3182	0.4973
TSHR	rs9646167	14	81635888	T	0.450	-0.0105	0.0076	0.1723	0.7637	-0.0088	0.0088	0.3273	0.4850
TSHR	rs12883532	14	81635945	T	0.077	0.0136	0.0125	0.2872	0.5417	-0.0082	0.0146	0.5833	0.2341
TSHR	rs1864167	14	81637074	A	0.445	-0.0082	0.0075	0.2879	0.5408	-0.0067	0.0088	0.4530	0.3439
TSHR	rs11159493	14	81639159	T	0.443	-0.0081	0.0075	0.2954	0.5295	-0.0063	0.0088	0.4839	0.3153
TSHR	rs1957546	14	81639984	C	0.220	-0.0036	0.0090	0.6950	0.1580	0.0016	0.0105	0.8794	0.0558
TSHR	rs7143837	14	81640722	T	0.111	0.0110	0.0122	0.3769	0.4238	0.0120	0.0141	0.4050	0.3925
TSHR	rs1885601	14	81641210	T	0.452	-0.0103	0.0075	0.1809	0.7426	-0.0062	0.0087	0.4914	0.3085
TSHR	rs8012466	14	81641464	A	0.111	0.0126	0.0122	0.3144	0.5025	0.0107	0.0141	0.4596	0.3376
TSHR	rs10483974	14	81642996	C	0.073	-0.0013	0.0151	0.9335	0.0299	0.0159	0.0178	0.3814	0.4186
TSHR	rs12878503	14	81643053	C	0.089	0.0169	0.0117	0.1562	0.8065	-0.0082	0.0136	0.5565	0.2545
TSHR	rs12878339	14	81643692	C	0.089	0.0168	0.0117	0.1594	0.7976	-0.0077	0.0136	0.5802	0.2364
TSHR	rs4899786	14	81643800	T	0.219	-0.0001	0.0095	0.9928	0.0031	0.0031	0.0109	0.7791	0.1084
TSHR	rs67933866	14	81647254	C	0.111	0.0125	0.0122	0.3172	0.4987	0.0116	0.0141	0.4217	0.3750
TSHR	rs8007841	14	81647878	T	0.309	0.0055	0.0079	0.4997	0.3013	-0.0019	0.0092	0.8443	0.0735
TSHR	rs17630746	14	81648560	A	0.089	0.0172	0.0117	0.1502	0.8232	-0.0072	0.0136	0.6082	0.2160
TSHR	rs61980891	14	81652878	T	0.111	0.0127	0.0122	0.3095	0.5093	0.0113	0.0141	0.4326	0.3639
TSHR	rs12147118	14	81652975	C	0.311	0.0052	0.0079	0.5227	0.2818	-0.0021	0.0092	0.8254	0.0833
TSHR	rs61980892	14	81653897	C	0.111	0.0126	0.0122	0.3136	0.5037	0.0125	0.0141	0.3856	0.4139
TSHR	rs61980893	14	81653951	C	0.111	0.0128	0.0122	0.3035	0.5178	0.0121	0.0141	0.4037	0.3940

Supplementary Table 1. Continued.

Gene	SNP	Chrom	Position	Minor allele	MAF	Femoral neck BMD				Lumbar spine BMD			
						Beta	SE	P-value	-log (P-value)	Beta	SE	P-value	-log (P-value)
TSHR	rs2122253	14	81127338	G	0.149	-0.0133	0.0108	0.2290	0.6401	-0.0057	0.0126	0.6620	0.1792
TSHR	rs12891828	14	81654524	C	0.089	0.0173	0.0117	0.1473	0.8317	-0.0085	0.0136	0.5422	0.2659
TSHR	rs8016352	14	81654875	C	0.220	-0.0034	0.0090	0.7120	0.1475	0.0021	0.0105	0.8485	0.0714
TSHR	rs111974404	14	81656011	C	0.111	0.0133	0.0122	0.2841	0.5466	0.0123	0.0141	0.3935	0.4051
TSHR	rs61980894	14	81656376	G	0.111	0.0124	0.0122	0.3192	0.4959	0.0119	0.0141	0.4104	0.3868
TSHR	rs7144005	14	81656437	C	0.219	-0.0039	0.0090	0.6731	0.1719	0.0021	0.0105	0.8456	0.0728
TSHR	rs7149672	14	81657336	A	0.309	0.0053	0.0079	0.5158	0.2875	-0.0027	0.0092	0.7729	0.1119
TSHR	rs8014406	14	81657760	T	0.219	-0.0031	0.0090	0.7317	0.1356	0.0025	0.0105	0.8179	0.0873
TSHR	rs2288497	14	81659731	A	0.454	-0.0102	0.0075	0.1832	0.7370	-0.0050	0.0087	0.5799	0.2366
TSHR	rs2288498	14	81660710	T	0.219	-0.0037	0.0090	0.6836	0.1652	0.0023	0.0105	0.8333	0.0792
TSHR	rs17111574	14	81660837	G	0.111	0.0119	0.0122	0.3391	0.4697	0.0110	0.0141	0.4466	0.3501
TSHR	rs2288499	14	81660997	T	0.453	-0.0096	0.0075	0.2103	0.6771	-0.0050	0.0087	0.5774	0.2386
TSHR	rs12879576	14	81661239	A	0.089	0.0166	0.0117	0.1636	0.7862	-0.0097	0.0136	0.4853	0.3140
TSHR	rs12896266	14	82190689	T	0.230	0.0072	0.0081	0.3823	0.4176	0.0080	0.0094	0.4059	0.3916
TSHR	rs12881438	14	82267267	G	0.205	0.0060	0.0085	0.4860	0.3134	0.0062	0.0099	0.5385	0.2688
TSHR	rs71416876	14	82273645	T	0.205	0.0054	0.0085	0.5364	0.2705	0.0058	0.0099	0.5667	0.2466
TSHR	rs12893820	14	82290191	T	0.322	0.0068	0.0078	0.3908	0.4080	0.0080	0.0090	0.3848	0.4148

Abbreviations: SNP, single nucleotide polymorphism; Chrom, chromosome, MAF, minor allele frequency; BMD, bone mineral density; SE, standard error.
Data presented as beta coefficients per minor allele.