3

Analysis of Tap Water Data

3.1 Methods

Here and throughout this report, the statistical summaries from the Exposure Factors Handbook (EFH) are analyzed. No attempt was made to obtain raw data from investigators.

The key studies identified in the EFH are Canadian Ministry of National Health and Welfare (1981) and Ershow and Cantor (1989). Since the first dataset is Canadian, is older, and involves a much smaller sample size, it was decided to base the analysis only on the second dataset. Specifically, the focus was on the six age groups at the bottom part of Table 3-7 in the EFH, which has age categories for infants (age <1), children (ages 1-10), teens (ages 11-19), younger adults (ages 20-64), and older adults (ages 65+), as well as all ages. The EFH Table 3-7 data summaries analyzed here consist of nine estimated percentiles for total daily tap water intake in dL/kg/day. (EFH Table 3-7 units are mL/kg/day; these were rescaled to dL/kg/day to obtain better convergence properties for numerical optimization routines.) The tabulated percentiles from EFH Table 3-7 are reproduced in this report in Table 3-5, columns labeled "X_p = Data Qtile" and "Nom p" (for "Data Quantile" and "Nominal p"). These percentiles correspond to probabilities of 0.01, 0.05, 0.10, 0.25, 0.50, 0.75, 0.90, 0.95, and 0.99. That is, Xp is the tap water consumption value such that 100p% of the population consumes Xp or less daily, or the tap water consumption value such that the cumulative distribution function (CDF) value is p at Xp, F(Xp)=p. For example, referring to Table 3-5, the 25th percentile for adults of ages 20-64 is 0.124, so that approximately one-fourth of adults between ages 20 and 64 consume 12.4 mL/kg/day or less of tap water. Only six percentiles are shown for infants because the 1st, 5th, and 10th percentiles are all zero for infants. This motivates the inclusion of a point mass at zero in probability models as discussed in Section 1.

The 12 models of the generalized F hierarchy were fit to each of the six tap water datasets from the bottom of EFH Table 3-7 using three different estimation criteria—maximum likelihood estimation (MLE), minimum chi-square (MCS) estimation, and weighted least squares (WLS). The Pearson chi-square tests and likelihood ratio tests (LRTs) of goodness-of-fit (GOF) were used. These models, estimation criteria, and GOF tests are discussed in Section 2.

Because the sample size was quite large, the asymptotic normality approach was used to obtain parameter uncertainty distributions. The two-step simulation process was applied 10,000 times to obtain simulated distributions of drinking water values for each age group. Quantiles corresponding to the same nine nominal probability values (0.01, 0.05, . . ., 0.99) were determined from the simulated drinking water distributions. Models were fit to these simulated quantiles using the same MLE technique that was applied to the empirical percentiles. Model-based averages, standard deviations, and quantiles were estimated from the simulated data and compared with those estimated from the percentile data.

3.2 Results

The three methods of estimation (MLE, MCS, and WLS) and two methods of testing fit (chi-square and LRT) led to essentially the same conclusions regarding fit of the different models. Therefore, only results from the chi-square GOF test based on the MLE are shown.

Values of the chi-square statistic and associated *p*-values for chi-square GOF tests are provided in Tables 3-1a and 3-1b. In each case, the null hypothesis tested is that the data arose from the given type of model. A low p-value casts doubt on the null hypothesis. Clearly, the only model that appears to fit most of the datasets is the five-parameter generalized F distribution with a point mass at zero, referred to as GenF5. This point is illustrated graphically via probability-probability (P-P), quantile-quantile (Q-Q), and percent error plots in Figures 3-1 and 3-2 (figures are at the end of Section 3).

P-P plots are made by plotting model-based estimates of probability on the vertical axis versus nominal probability on the horizontal axis. Both axes therefore go from 0 to 1. For the tap water data, the nominal probabilities are 0.01, 0.05, 0.10, etc. Q-Q plots show the model-based quantile estimates on the vertical axis versus empirical quantiles (Xp values) on the horizontal axis. For the tap water data for adults between ages 20 and 64, the empirical quantiles corresponding to nominal probabilities of 0.01 and 0.05 are 0.022 and 0.059. In addition to P-P and Q-Q plots, Figures 3-1 and 3-2 also show the corresponding percent error plots, that is, plots of ($\hat{P}$-P)/P versus P and plots of ($\hat{Q}$-Q)/Q versus Q. As explained in Section 2.3.1, the region of interest in P-P and Q-Q plots is near the main diagonal, and percent error plots are more informative because they transform and magnify this region. The term percent error is used loosely, because the plotted quantities are error fractions as opposed to percents (e.g., 1.5 and -1.5 are plotted to represent 150% and -150%).

If possible, it is desirable to use one of the standard two-parameter models (gamma, lognormal, Weibull), unless there is strong evidence that a model with more parameters is required. Results of this analysis have shown, in fact, that the five-parameter generalized F distribution with a point mass at zero provides considerably better fit to the tap water data than any of these two-parameter models. However, risk assessors might still prefer to use the two-parameter models, on grounds of simplicity and familiarity.

According to Table 3-1a, the gamma model provides the best fit (smallest chi-square) of the two-parameter models to the data for each of the five individual age groups. For the group with all ages pooled, the log-logistic and gamma are the best and second-best fitting two-parameter models.

Table 3-2 summarizes several additional aspects of interest for the tap water populations.
Within each age group, the first row (SOURCE=data) is basically a data summary. Within the top row, the columns labeled N, MEAN, and SDEV contain the sample size, the sample mean, and the sample standard deviation. Within the top row, the columns labeled P01, P05, . . ., P99 contain the nominal probabilities 0.01, 0.05, . . ., 0.99. The values in the top row for MEAN, SDEV, and the nine nominal probabilities can be thought of as 11 targets that the models are trying to hit.

In Table 3-2, the other five rows (second through sixth rows) within each age group contain results from fitting four models, including gamma, lognormal, and Weibull, using selected estimation criteria. The model and estimation criteria are indicated by the variable SOURCE. For instance, SOURCE=gammle indicates the two-parameter gamma model fit using MLE. The model gf5 is the five-parameter generalized F with a point mass at zero. The infants group does not contain results from the five-parameter generalized F because the model selected had infinite variance. For the gamma and Weibull models, there was little difference between the three estimation criteria, and the MLE performed best overall. For the lognormal model, results from the WLS estimation criterion are shown in addition to the MLE. These will be contrasted below.

The last two columns contain summary GOF measures. ADJCHI is the value of the chi-square statistic divided by its degrees of freedom. The methods are ordered with respect to this ADJCHI measure. ADJCHI is more comparable across cases involving different degrees of freedom than is the chi-square statistic. PGOF is the *p*-value for model GOF based on the chi-square test. Low-values of PGOF, such as PGOF<0.05, cast doubt on the null hypothesis that the given type of model is correct.

Note that MLE performed much worse for the lognormal model than the WLS method of estimation, as determined by ADJCHI and PGOF measures.

If a two-parameter model must be used for tap water consumption, then the gamma model with parameters estimated by maximum likelihood is recommended. The five-parameter generalized F distribution could be used for sensitivity analyses.

The age effect seems sufficiently strong to justify the use of separate age groups in risk assessment. Note, however, that the lognormal model with parameters estimated by WLS provides the best fit among the two-parameter models, as determined by ADJCHI, when all age groups are pooled.

3.3 Uncertainty Analysis

Table 3-3 contains information on the uncertainty distribution parameters of the best fitting two-parameter distributions, namely, the gamma distributions. The parameter estimates log α and log β are the MLEs of the natural logs of the usual gamma parameters α and β. The variables SELα and SELβ are the standard errors of these estimates, and CORR is the estimated correlation between the parameter estimates. To generate values for the gamma parameters, first values for the logarithms of α and β are generated by sampling from a bivariate normal distribution with mean parameters log α and log β, with standard deviations SELα and SELβ, and correlation CORR. The generated values of log α and log β are then exponentiated to obtain values for α and β.

Because the underlying sample sizes are quite large, these parameter uncertainty distributions based on asymptotic normality are probably adequate. Comparisons with bootstrap and likelihood methods via simulation studies could shed light on this issue.

Tables 3-4 and 3-5 contain results from the original data analysis and from the two-step simulation process based on asymptotic normality, using the bivariate normal distributions summarized in Table 3-3 to represent distributions of parameter uncertainty. For each age group, 10,000 drinking water values were generated by first drawing a parameter pair ($\log\alpha$ and $\log\beta$) from the bivariate normal distribution of Table 3-3, then generating a drinking water value from the selected gamma distribution. Next, the nine nonparametric quantiles were estimated for each age group from the samples of size 10,000. Gamma distributions were fit to these quantiles using the same maximum likelihood method that was applied in the original analysis described in Section 3.2.

Tables 3-4 and 3-5 show that the results of the two-step process are very similar to the original fitted gamma distributions. Table 3-4 contains data means and standard deviations as well as MLEs of the means and standard deviations from the original analysis of the data (MLE Mean and MLE Sdev) and from the analysis of the simulated data from the two-step process (MLE2 Mean and MLE2 Sdev). In all cases, except infants, MLE and MLE2 agree to within 0.002.

Table 3-5 contains several estimates of quantiles as well as two estimates of the CDF evaluated at the pth quantile, $F(x_p)$. As before, X_p denotes the original empirical pth quantile from EFH Table 3-7. (In theory, if x_p were the true quantile, then $F(x_p)=p$.) The other quantile estimates are the MLE from the original data analysis (MLE Qtile), the nonparametric quantiles from the simulated data (two-step Empl Qtile) that incorporate parameter uncertainty, and the MLE for the simulated data (MLE2 Qtile). The last two columns contain MLEs of $F(x_p)$ from the original data analysis and from the simulated data. Except for the teens group, these MLES of $F(x_p)$ always agree to within 0.004.

In general, the values of the MLEs of quantities estimated from the original analysis of the raw data and from the simulated data reflecting parameter uncertainty are very close. Presumably, this is a consequence of the large sample sizes underlying the raw data.

3.4 Conclusions

The tap water data from EFH Table 3-7 force a difficult question: How good does the fit need to be? Among two-parameter models, the gamma distribution fits best. The two-parameter gamma model may fit well enough for most purposes. However, it is also true that this model fails to pass the chi-square GOF test, while the five-parameter generalized F distribution passes at the 0.05 level in four of six cases.

If the situation warrants a more sophisticated model, the generalized F may be used. However, the uncertainty analysis for the five-parameter model could be complicated. The five-parameter model entails very highly correlated parameters. Contours of the likelihood in five-space might be highly nonelliptical. One would not be comfortable with an uncertainty analysis for the five-parameter model

based on asymptotic normality without investigating its behavior by additional simulation studies. Another possibility worth investigating would be uncertainty analysis for the five-parameter model based on bootstrapping. According to Efron and Tibshirani (1993), the parametric bootstrap will automatically endow the right shape to the simulated distribution for the parameters, although bias correction may be needed if the simulated distribution is not centered at the original parameter estimates.

The distributions presented in this section for tap water intake were derived based on data of Ershow and Cantor (1989). These data were obtained from the U.S. Department of Agriculture 1977-78 Nationwide Food Consumption Survey (USDA, 1984). The main limitations of the data are that they are old and do not reflect the expected increase in the consumption of bottled water and soft drinks. The survey has, however, a large sample size (26,466 individuals), and it is a representative sample of the U.S. population with respect to age distribution, sex, racial composition, and regions. Therefore, these distributions are applicable to cases where the national tap water consumption is the factor of interest or it can reasonably be assumed that the population of interest will have consumption rates similar to the national U.S. population.

Table 3-1a. Chi-Square GOF Statistics for 12 Age-Specific Models, Fit to Tap Water Data, Based on Maximum Likelihood Method of Parameter Estimation[a]

Age Group	CHI Gam2	CHI Log2	CHI Tic2	CHI Wei2	CHI Ggam3	CHI GenF4	CHI Gam3	CHI Log3	CHI Tic3	CHI Wei3	CHI Ggam4	CHI GenF5
Infants (<1)	19.8	26.6	39.4	20.6	18.1	10.6	19.8	13.7	10.8	20.6	18.1	8.10
Children (1-10)	84.5	315	295	198	84.7	40.3	46.6	129	195	198	27.5	15.2
Teens (11-19)	89.5	606	557	125	81.4	38.4	23.4	286	377	110	23.1	7.88
Adults 1 (20-64)	144	734	719	319	139	38.8	42.8	354	491	319	42.1	3.96
Adults 2 (65+)	19.2	83.3	101	107	20.2	9.72	5.08	30.1	73.0	107	2.16	1.24
All	847	1180	597	1807	780	154	550	473	251	1807	313	6.36

[a]Prefix indicates model type: Gam = gamma, Log = lognormal, Tic = log-logistic, Wei = Weibull, Ggam = generalized gamma, GenF = generalized F.

Numeric model suffix indicates number of free or adjustable parameters.

Degrees of freedom for X^2GOF=number of quantile categories – number of model parameters.

Table 3-1b. P-Values for Chi-Square GOF Tests of 12 Age-Specific Models, Tap Water Data[a]

Age Group	PGOF Gam2	PGOF Log2	PGOF Tic2	PGOF Wei2	PGOF Ggam3	PGOF GenF4	PGOF Gam3	PGOF Log3	PGOF Tic3	PGOF Wei3	PGOF Ggam4	PGOF GenF5
Infants (<1)	0.001	0.000	0.000	0.000	0.000	0.005	0.000	0.003	0.013	0.000	0.000	0.013
Children (1-10)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Teens (11-19)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.096
Adults 1 (20-64)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.412
Adults 2 (65+)	0.008	0.000	0.000	0.000	0.003	0.084	0.533	0.000	0.000	0.000	0.827	0.871
All	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.174

[a]Prefix indicates model type: Gam = gamma, Log = lognormal, Tic = log-logistic, Wei = Weibull, Ggam = generalized gamma, GenF = generalized F.

Model suffix indicates number of free or adjustable parameters.

Table 3-2. Results of Statistical Modeling of Tap Water Data Using Five-Parameter Generalized F and Two-Parameter Gamma, Lognormal, and Weibull Models[a]

SOURCE	N	P01	P05	P10	P25	P50	P75	P90	P95	P99	MEAN	SDEV	CHIDF	PGOF
							INFANTS (Age <1)							
data	403	.010	.050	.100	.250	.500	.750	.900	.950	.990	.435	.425		
gammle					.252	.526	.702	.908	.951	.996	.448	.410	4.945	.0006
weimle					.260	.526	.699	.906	.950	.996	.447	.412	5.145	.0004
logmle					.227	.561	.735	.903	.937	.984	.470	.548	6.660	.0000
logwls					.216	.559	.738	.908	.942	.986	.462	.512	6.974	.0000
							CHILDREN (Ages 1-10)							
data	5605	.010	.050	.100	.250	.500	.750	.900	.950	.990	.355	.229		
gf5mle		.010	.047	.106	.250	.495	.752	.900	.952	.989	.356	.234	3.792	.0044
gammle		.004	.052	.118	.263	.492	.738	.895	.953	.993	.355	.224	12.07	.0000
logwls		.000	.024	.091	.266	.529	.765	.895	.943	.984	.356	.250	27.18	.0000
weimle		.011	.070	.134	.264	.474	.721	.894	.959	.997	.355	.218	28.34	.0000
logmle		.000	.036	.113	.288	.532	.750	.878	.929	.977	.366	.286	45.07	.0000
							TEENS (Ages 11-19)							
data	5801	.010	.050	.100	.250	.500	.750	.900	.950	.990	.182	.108		
gf5mle		.010	.048	.103	.253	.498	.747	.902	.953	.989	.182	.110	1.969	.0962
gammle		.002	.046	.110	.274	.511	.740	.891	.947	.989	.182	.111	12.79	.0000
weimle		.006	.061	.122	.267	.487	.725	.895	.957	.995	.182	.106	17.86	.0000
logwls		.000	.017	.076	.270	.544	.768	.896	.942	.981	.182	.119	45.35	.0000
logmle		.000	.032	.108	.303	.548	.747	.871	.920	.968	.189	.144	86.56	.0000
							ADULTS 1 (Ages 20-64)							
data	11731	.010	.050	.100	.250	.500	.750	.900	.950	.990	.199	.108		
gf5mle		.010	.051	.098	.251	.501	.748	.901	.951	.990	.199	.110	0.990	.4116
gammle		.003	.049	.105	.270	.510	.738	.891	.947	.992	.199	.109	20.50	.0000
weimle		.010	.069	.122	.267	.484	.719	.893	.957	.997	.199	.105	45.54	.0000
logwls		.000	.024	.079	.273	.542	.762	.893	.941	.984	.199	.116	69.20	.0000
logmle		.000	.037	.100	.295	.543	.747	.875	.925	.976	.203	.132	104.9	.0000

Table 3-2. Results of Statistical Modeling of Tap Water Data Using Five Parameter Generalized F and Two-Parameter Gamma, Lognormal, and Weibull Models[a] (continued)

SOURCE	N	P01	P05	P10	P25	P50	P75	P90	P95	P99	MEAN	SDEV	ADJCHI	PGOF
							ADULTS 2 (Ages 65+)							
data	2541	.010	.050	.100	.250	.500	.750	.900	.950	.990	.218	.098		
logwls		.000	.032	.090	.267	.524	.762	.898	.944	.984	.218	.102	0.237	.0000
gf5mle		.010	.049	.101	.253	.496	.750	.902	.951	.989	.218	.098	0.310	.8715
logmle		.001	.041	.104	.280	.525	.751	.886	.934	.979	.220	.109	1.900	.0000
gammle		.004	.052	.109	.263	.497	.742	.898	.950	.991	.218	.098	2.746	.0075
weimle		.017	.079	.132	.262	.467	.717	.898	.960	.997	.218	.097	15.270	.0000
							ALL							
data	26081	.010	.050	.100	.250	.500	.750	.900	.950	.990	.226	.154		
gf5mle		.010	.050	.099	.252	.499	.749	.902	.951	.989	.227	.168	1.589	.1740
logwls		.000	.029	.091	.278	.524	.744	.890	.945	.991	.226	.154	113.400	.0000
gammle		.003	.058	.118	.274	.491	.718	.890	.955	.997	.225	.138	121.000	.0000
logmle		.000	.041	.112	.299	.529	.734	.875	.932	.986	.231	.173	168.600	.0000
weimle		.011	.081	.141	.281	.476	.698	.885	.958	.999	.225	.137	258.100	.0000

[a]Within each age group, the first row (SOURCE=data) is basically a data summary. Within the top row, the columns labeled N, MEAN, and SDEV contain the sample size, the sample mean, and the sample standard deviation. Within the top row, the columns labeled P01, P05, . . . , P99 contain the nominal probabilities 0.01, 0.05, . . . , 0.99. The values in the top row for MEAN, SDEV, and the nine nominal probabilities can be thought of as 11 targets that the models are trying to hit. The other five rows (second through sixth rows) within each age group contain results from fitting four models using selected estimation criteria. The model and estimation criterion are indicated by the variable SOURCE: gf5mle denotes the five-parameter generalized F distribution with a point mass at zero fit by maximum likelihood; gammle, logmle, weimle denote the two-parameter gamma, lognormal, and Weibull distributions fit by MLE; and logwls denotes the lognormal distribution fit by WLS. The last two columns contain summary GOF measures. CHIDF is the value of the chi-square statistic divided by its degrees of freedom. CHIDF is more comparable across cases involving different degrees of freedom than is the chi-square statistic. PGOF is the p-value for model GOF based on the chi-square test. Low-values of PGOF, such as PGOF <0.05, cast doubt on the null hypothesis that the given type of model is correct. Results for the generalized F distribution are not shown for infants because the estimated model had infinite variance.

Table 3-3. Uncertainty Distribution of Gamma Parameters Estimated from Tap Water Data[a]

Age Group	log (")	log ($)	Std. Err. Log (")	Std. Err. Log ($)	CORR (",$)
Infants (<1)	0.1744	-0.9767	0.1738	0.2005	-0.8663
Children (1-10)	0.9221	-1.9585	0.0684	0.0757	-0.9087
Teens (11-19)	0.9889	-2.6920	0.0980	0.1077	-0.9150
Adults 1 (20-64)	1.2067	-2.8214	0.0782	0.0843	-0.9310
Adults 2 (65+)	1.6089	-3.1316	0.0555	0.0584	-0.9533
All	0.9715	-2.4653	0.1167	0.1287	-0.9143

[a]Log (") and log ($) are MLEs of the natural logs of the gamma parameters α and β. CORR(",$) is the estimated correlation between log (") and log ($).

Table 3-4. Results of Two-Step Simulation Process to Incorporate Uncertainty Into Drinking Water Distributions Using Asymptotic Normality[a]

Age Group	Data Mean	MLE Mean	MLE2 Mean	Data Sdev	MLE Sdev	MLE2 Sdev
Infants (<1)	.435	.448	.451	.425	.411	.417
Children (1-10)	.355	.355	.356	.229	.224	.225
Teens (11-19)	.182	.182	.184	.108	.111	.112
Adults1 (20-64)	.199	.199	.200	.108	.109	.109
Adults2 (65+)	.218	.218	.218	.098	.098	.099
All	.226	.225	.224	.154	.138	.138

[a]MLE Mean and Sdev are MLEs of the two-parameter gamma mean and standard deviation from the original analysis.

MLE2 Mean and MLE2 Sdev are the result of the following process: generate 10,000 (α,$) pairs using the distribution of Table 3-3; for each pair, generate a drinking water value from the specified gamma distribution; calculate the nine quantiles for the resulting 10,000 drinking water values; fit a gamma distribution to the quantiles using maximum likelihood, and determine its mean and standard deviation.

Table 3-5. Uncertainty Analysis Based on Asymptotic Normality Using Two-Step Simulation Process for Two-Parameter Gamma Distributions

Age Group	X_p = Data Qtile	MLE Qtile	Empl Qtile	MLE2 Qtile	Nom p	MLE $F(x_p)$	MLE2 $F(x_p)$
Infants (<1)	.153	.152	.151	.151	.25	.252	.254
Infants	.353	.331	.332	.331	.50	.525	.525
Infants	.547	.620	.622	.624	.75	.702	.699
Infants	1.02	.989	.996	.999	.90	.908	.905
Infants	1.27	1.26	1.28	1.28	.95	.951	.949
Infants	2.21	1.89	1.93	1.92	.99	.996	.995
Children (1-10)	.027	.040	.038	.039	.01	.004	.004
Children	.083	.082	.081	.082	.05	.052	.052
Children	.125	.115	.114	.115	.10	.118	.118
Children	.196	.190	.190	.190	.25	.262	.262
Children	.305	.309	.310	.310	.50	.492	.491
Children	.460	.470	.476	.471	.75	.738	.737
Children	.644	.654	.654	.657	.90	.894	.893
Children	.794	.784	.780	.787	.95	.953	.952
Children	1.14	1.07	1.05	1.07	.99	.993	.993
Teens (11-19)	.012	.023	.022	.023	.01	.002	.002
Teens	.043	.045	.046	.046	.05	.045	.044
Teens	.065	.062	.063	.063	.10	.110	.106
Teens	.106	.100	.102	.102	.25	.274	.267
Teens	.163	.160	.162	.162	.50	.511	.503
Teens	.236	.240	.243	.243	.75	.740	.733
Teens	.323	.331	.335	.335	.90	.891	.887
Teens	.389	.395	.397	.399	.95	.947	.944
Teens	.526	.533	.536	.539	.99	.989	.988
Adults 1 (20-64)	.022	.033	.034	.034	.01	.003	.003
Adults 1	.059	.059	.060	.060	.05	.049	.048
Adults 1	.080	.078	.078	.079	.10	.105	.103
Adults 1	.124	.119	.120	.120	.25	.270	.268
Adults 1	.182	.179	.180	.180	.50	.510	.507
Adults 1	.253	.258	.257	.258	.75	.738	.737
Adults 1	.337	.345	.347	.345	.90	.891	.890
Adults 1	.400	.405	.401	.405	.95	.947	.947
Adults 1	.548	.534	.545	.534	.99	.992	.992
Adults 2 (65+)	.045	.056	.054	.055	.01	.004	.005
Adults 2	.087	.086	.085	.085	.05	.052	.055
Adults 2	.109	.106	.105	.105	.10	.109	.112
Adults 2	.150	.147	.146	.146	.25	.263	.267
Adults 2	.203	.204	.203	.203	.50	.497	.499
Adults 2	.271	.274	.274	.274	.75	.742	.742
Adults 2	.347	.349	.351	.350	.90	.898	.896
Adults 2	.400	.399	.399	.401	.95	.950	.949
Adults 2	.513	.506	.512	.510	.99	.991	.990
All	.017	.027	.027	.027	.01	.003	.003
All	.058	.054	.055	.054	.05	.058	.058
All	.082	.075	.076	.075	.10	.118	.119
All	.130	.123	.123	.123	.25	.274	.275
All	.194	.197	.196	.197	.50	.491	.491
All	.280	.296	.296	.296	.75	.718	.718
All	.398	.410	.406	.409	.90	.890	.890
All	.500	.489	.488	.489	.95	.955	.955
All	.798	.662	.682	.662	.99	.997	.997

Figure 3.1 Tap Water Intake P-P Plots: Children (EFH Table 3-7)

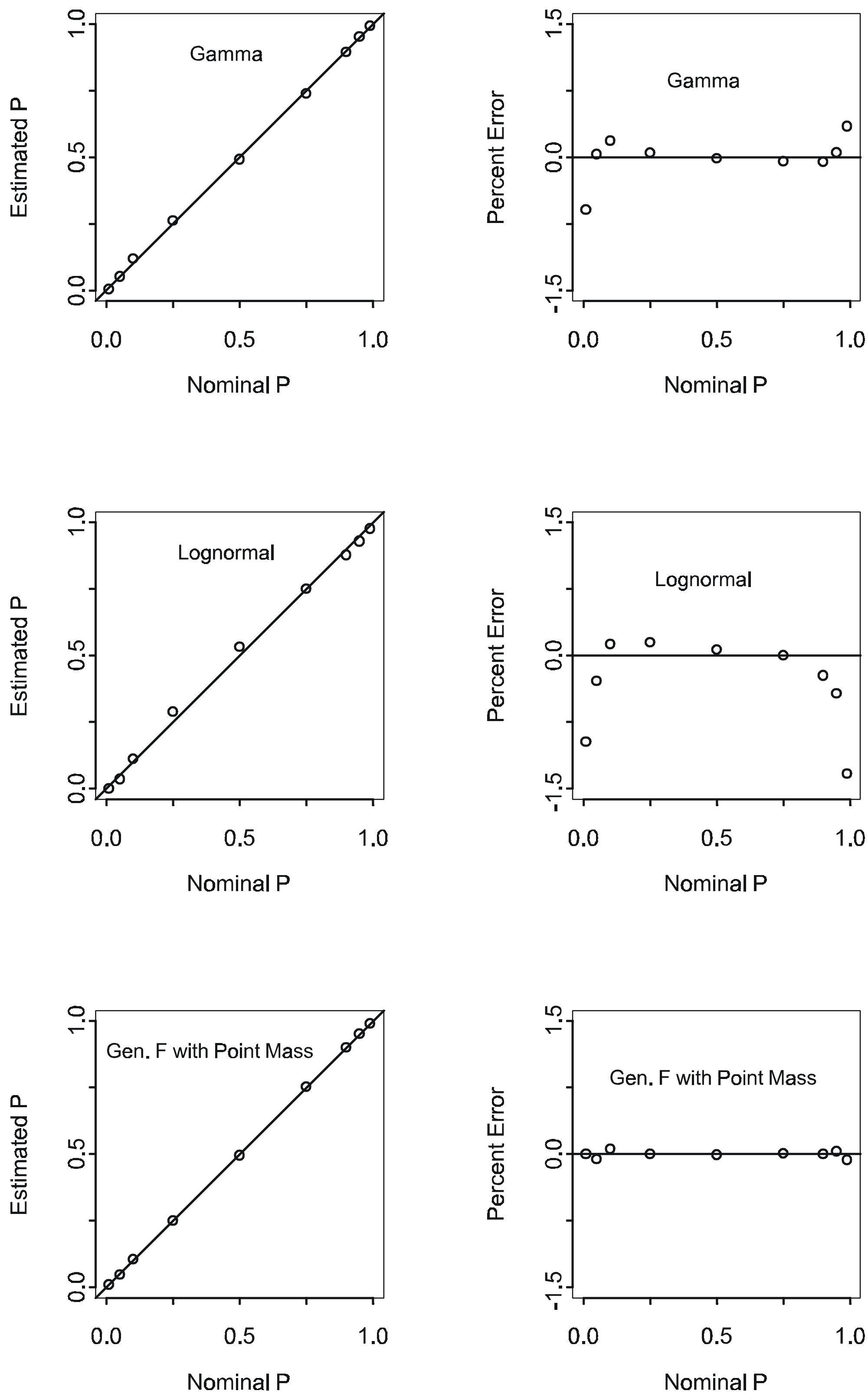

Figure 3.2 Tap Water Intake Q-Q Plots: Children (EFH Table 3-7)