# EXHIBIT 56

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# Meta-Analysis of Glyphosate Use and Risk of Non-Hodgkin Lymphoma

This Technical Memorandum summarizes the results of a meta-analysis of glyphosate use and risk of non-Hodgkin lymphoma (NHL) using unpublished results from the Agricultural Health Study (AHS) cohort (Alavanja et al. 2013)[1]. For the purpose of sensitivity analysis, this meta-analysis also includes unpublished results from the North American Pooled Project (Pahwa et al. 2015)[2]. We used these two sets of results in place of other results that were included in our previously published systematic review and meta-analysis of the association between glyphosate use and NHL risk (Chang and Delzell 2016)[3]. That meta-analysis relied upon earlier, published results from the AHS cohort (De Roos et al. 2005)[4] and earlier, published results from the case-control studies that contributed to the North American Pooled Project (Cantor et al. 1992; De Roos et al. 2003; Hoar et al. 1986; McDuffie et al. 2001; Zahm et al. 1990)[5].

As stated in our paper (Chang and Delzell 2016), meta-analyses are not intended to identify, validate, or dispute causal relationships. They can provide a statistically precise summary measure of association across multiple studies and aid in identifying heterogeneity of results among studies; however, they also can obscure important differences in methods and results

1 Alavanja MCR et al. DRAFT- Lymphoma risk and pesticide use in the Agricultural Health Study. March 15, 2013. Received by Exponent from Mr. Eric G. Lasker, Hollingsworth LLP.

2 Pahwa M et al. An evaluation of glyphosate use and the risk of non-Hodgkin lymphoma msajor histological subtypes in the North American Pooled Project. Presented at International Society for Environmental Epidemiology Conference, Sao Paolo, Brazil. August 31, 2015. Received by Exponent from Mr. Eric G. Lasker, Hollingsworth LLP.

3 Chang ET, Delzell E. Systematic review and meta-analysis of glyphosate exposure and risk of lymphohematopoietic cancers. J Environ Sci Health B 2016;51(6):402–434.

4 De Roos AJ et al. Cancer incidence among glyphosate-exposed pesticide applicators in the Agricultural Health Study. Environ Health Perspect 2005;113(1):49–54.

5 Cantor KP et al. Pesticides and other agricultural risk factors for non-Hodgkin's lymphoma among men in Iowa and Minnesota. Cancer Res 1992;52(9):2447–2455.

De Roos AJ et al. Integrative assessment of multiple pesticides as risk factors for non-Hodgkin's lymphoma among men. Occup Environ Med 2003;60(9):E11.

Hoar SK et al. Agricultural herbicide use and risk of lymphoma and soft-tissue sarcoma. JAMA 1986;256(9):1141–1147. The estimated association between glyphosate use and NHL risk was not reported in this paper, although relevant data were available.

McDuffie HH et al. Non-Hodgkin's lymphoma and specific pesticide exposures in men: cross-Canada study of pesticides and health. Cancer Epidemiol Biomarkers Prev 2001;10(11):1155–1163.

Zahm SH et al. A case-control study of non-Hodgkin’s lymphoma and the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) in eastern Nebraska. Epidemiol 1990;1(5):349–356. The estimated association between glyphosate use and NHL risk was not reported in this paper, although relevant data were available.

among studies that can be more thoroughly evaluated in a detailed qualitative review of study strengths, limitations, and interpretations. In the presence of dissimilar studies, even if heterogeneity of results is not detectable using formal statistical tests, a single summary estimate may not be scientifically meaningful. Additionally, meta-analysis cannot overcome problems in the design and conduct of the underlying studies, and consistent findings across multiple studies may be due to shared biases rather than a true association.

In the meta-analysis described here, earlier results from the AHS cohort were replaced with results from Alavanja et al. (2013). In alternative models used for sensitivity analysis, earlier results from the North American case-control studies were replaced with results from Pahwa et al. (2015)[6]. However, Pahwa et al. (2015) did not describe in detail the eligibility criteria or the numbers of subjects included from each underlying study that contributed to their analysis. The numbers of total and reportedly glyphosate-exposed cases and controls in the North American Pooled Project, as reported by Pahwa et al. (2015), cannot readily be derived from the published numbers from the underlying studies. Due to the lack of transparency on this issue in the documents available to us[7], and our resulting lack of confidence in the results, we did not include the findings from Pahwa et al. (2015) in our primary analysis.

Differences between the analysis of Alavanja et al. (2013) and that of De Roos et al. (2005) include the following:

- Longer follow-up through 2008 (Alavanja et al. 2013) instead of 2001 (De Roos et al. 2005), resulting in the identification of more NHL cases (333 versus 92 in the complete cohort, respectively) and greater statistical power in Alavanja et al. (2013);
- Reporting of “high,” “medium,” and “low” glyphosate exposure versus none but not ever versus never glyphosate use (Alavanja et al. 2013) rather than tertiles of glyphosate exposure and ever versus never glyphosate use (De Roos et al. 2005);
- Use of a newer histopathological classification of NHL that includes chronic lymphocytic leukemia (CLL) and some other, less common subtypes (but not multiple myeloma) (Alavanja et al. 2013) that were excluded previously (De Roos et al. 2005);
- Adjustment for age, smoking status, number of livestock, driving of a diesel tractor, and state of residence in fully adjusted models (Alavanja et al. 2013) as opposed to

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[6] De Roos et al. (2003) included results from Cantor et al. (1992), Hoar et al. (1986), and Zahm et al. (1990) in their pooled analysis of multiple pesticides and NHL. Due to study overlap, and because Hoar et al. (1986) and Zahm et al. (1990) did not report associations between glyphosate use and NHL risk, we included only the results of De Roos et al. (2003) in our original meta-analysis (Chang and Delzell 2016).

[7] Other documents that we reviewed were an unpublished draft manuscript (Pahwa et al. An evaluation of glyphosate use and the risk of non-Hodgkin lymphoma major histological sub-types in the North American Pooled Project (NAPP). September 21, 2015; received by Exponent from Mr. Eric G. Lasker, Hollingsworth LLP; tables, figure, and appendix omitted) and a published abstract from the 2015 International Society for Environmental Epidemiology Conference in Sao Paolo, Brazil (http://ehp.niehs.nih.gov/isee/2015-868/).

adjustment for age, education, smoking pack-years, alcohol consumption, first-degree family history of cancer, state of residence, and use of 2,4-dichlorophenoxyacetic acid (2,4-D), alachlor, atrazine, metolachlor, trifluralin, benomyl, maneb, paraquat, carbaryl, and diazinon (De Roos et al. 2005); and

- Possible revision of the algorithm for estimating intensity of pesticide exposure using questionnaire data on mixing status, application, method, equipment repair, and use of personal protective equipment[8].

Differences between the analysis of Pahwa et al. (2015) and those of Cantor et al. (1992), De Roos et al. (2003), Hoar et al. (1986), McDuffie et al. (2001), and Zahm et al. (1990) include the following:

- Pooling of raw data for a unified analysis (Pahwa et al. 2015) instead of analyzing each contributing study separately (Cantor et al. 1992; De Roos et al. 2003; Hoar et al. 1986; McDuffie et al. 2001; Zahm et al. 1990), thereby resulting in greater statistical power in Pahwa et al. (2015);
- Inclusion of data on glyphosate exposure (Pahwa et al. 2015) that were not published by Hoar et al. (1986) and Zahm et al. (1990);
- Adjustment for age, sex, state/province, first-degree family history of lymphohematopoietic cancer, proxy respondent use, any personal protective equipment use, and use of 2,4-D, dicamba, or malathion in the unified dataset (Pahwa et al. 2015) as opposed to study-specific adjustment for age, state, vital status, cigarette smoking status, family history of lymphopoietic cancer, high-risk occupations, and high-risk exposures (Cantor et al. 1992); age, study site, and ten other pesticides (De Roos et al. 2003); age (Hoar et al. 1986; associations with glyphosate use not reported); age and province (McDuffie et al. 2001); or age (Zahm et al. 1990; associations with glyphosate use not reported);
- Inclusion of women (Pahwa et al. 2015), who were excluded from prior analyses (Zahm et al. 1990; De Roos et al. 2003);
- Possible inclusion of subjects who lived or worked on a farm when younger than 18 years of age, but not after age 18 (Pahwa et al. 2015), who were excluded from prior analyses (Zahm et al. 1990; De Roos et al. 2003);
- Use of logistic regression analysis in the unified dataset (Pahwa et al. 2015) versus use of either hierarchical or logistic regression analysis in one of the case-control studies (De Roos et al. 2003).

[8] Alavanja et al. (2013) cited Coble et al. (An updated algorithm for estimation of pesticide exposure intensity in the agricultural health study. Int J Environ Res Public Health 2011;8(12):4608–4622) as the source for this algorithm, whereas De Roos et al. (2005) cited Dosemeci et al. (A quantitative approach for estimating exposure to pesticides in the Agricultural Health Study. Ann Occup Hyg 2002;46(2):245–260).

We used the same meta-analysis statistical methods as described in our publication (Chang and Delzell 2016). Following those methods, the primary relative risk (RR) estimate that we chose to include based on data from Alavanja et al. (2013) was an estimate calculated by us that compared ever versus never use of glyphosate, using the fully adjusted model and the newer histopathological classification of NHL (from Supplemental Table 2 of Alavanja et al. (2013)). Because Alavanja et al. (2013) did not report RR estimates for ever versus never use of glyphosate, but instead reported RRs for low, medium, and high versus no exposure to glyphosate, we combined the RR estimates for the three different levels of exposure into a single estimate using random-effects meta-analysis. As shown in Table 1 below, the combined RR for ever versus never use of glyphosate in association with NHL risk in Alavanja et al. (2013) was the same after rounding (i.e., combined RR = 0.9, 95% confidence interval (CI) = 0.7–1.1) regardless of whether glyphosate exposure was classified using total days of exposure or intensity-weighted days of exposure, and whether the newer or an older classification of NHL was used.[9]

We conducted sensitivity analyses using four alternative RR estimates from Alavanja et al. (2013), namely, those comparing 1) "high" versus no exposure to glyphosate using intensity-weighted days of exposure, the newer NHL classification, and the fully adjusted model (from Supplemental Table 2 of Alavanja et al. (2013)); 2) "high" versus no exposure to glyphosate using unweighted days of exposure, the newer NHL classification, and the fully adjusted model (from Supplemental Table 2 of Alavanja et al. (2013)); 3) "high" versus no exposure to glyphosate using intensity-weighted days of exposure, the older NHL classification, and the age-adjusted model (from Supplemental Table 7 of Alavanja et al. (2013); results of fully adjusted model not reported); and 4) "high" versus no exposure to glyphosate using unweighted days of exposure, the older NHL classification, and the age-adjusted model (from Supplemental Table 7 of Alavanja et al. (2013); results of fully adjusted model not reported).

In our previously published meta-analysis, we prioritized the results of De Roos et al. (2003) based on a hierarchical regression model over the results from a logistic regression model because, according to the authors, hierarchical models can have "increased precision and accuracy for the ensemble of estimates" when modeling multiple pesticides simultaneously, and the more conservative prior assumptions specified in these models "seemed appropriate in a largely exploratory analysis of multiple exposures for which there is little prior knowledge about how pesticide exposures interact in relation to the risk of NHL." However, since 2003, the International Agency for Research on Cancer and the United States Environmental Protection

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[9] De Roos et al. (2005) coded cancers according to the *International Classification of Diseases*, 9th Revision (1975), whereas the older classification used by Alavanja et al. (2013) was the *International Classification of Diseases for Oncology*, 3rd Edition (2000). These two classifications are not equivalent, although they are broadly similar for NHL overall (see http://apps.who.int/iris/bitstream/10665/96612/1/9789241548496_eng.pdf).

Agency have changed their classifications of the probable carcinogenicity of some pesticides, including glyphosate.[10] Because the prior covariates used by De Roos et al. (2003) probably would have changed in light of these revised classifications, we prioritized the results of the logistical regression model in the present meta-analysis.[11]

The RR estimate that we chose to include from Pahwa et al. (2015) was the fully adjusted estimate comparing ever versus never use of glyphosate using both self- and proxy respondents (RR = 1.13, 95% CI = 0.84–1.51).

Alavanja et al. (2013) also reported RRs for associations between glyphosate use (using unweighted days of exposure and the age-adjusted model) and risk of diffuse large B-cell lymphoma (DLBCL), CLL/small lymphocytic lymphoma (SLL)/mantle-cell lymphoma (MCL), and follicular lymphoma (FL) (from Table 3 of Alavanja et al. (2013)). Likewise, Pahwa et al. (2015) reported fully adjusted RRs for associations between ever versus never glyphosate use and risk of DLBCL, SLL, and FL. Therefore, we also calculated new meta-analysis results for these three NHL subtypes, with the results of Pahwa et al. (2015) included in sensitivity analyses but not in our primary analyses due to our concerns about subject inclusion criteria. For the primary analysis of NHL subtypes, we again combined the Alavanja et al. (2013) RR estimates for low, medium, and high versus no exposure (classified based on total days of exposure; results for intensity-weighted days of exposure not reported) into a single RR estimate for ever versus never glyphosate use using random-effects meta-analysis.

As shown in Table 1 and Figure 1, the primary random-effects meta-RR for the association between glyphosate use and risk of overall NHL, based on six independent studies[12], was 1.2 (95% CI = 0.91–1.6). Thus, compared with our originally reported meta-RR, which included the earlier AHS results of De Roos et al. (2005) and the hierarchical regression model results of De Roos et al. (2003) (meta-RR = 1.3, 95% CI = 1.0–1.6), the new meta-RR was attenuated and statistically nonsignificant. The attenuation is the result of the replacement of the results of De Roos et al. (2005) (RR = 1.1, 95% CI = 0.7–1.9 for ever use of glyphosate) with results of our

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[10] International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 112. Some Organophosphate Insecticides and Herbicides. Lyon: IARC, 2017.

[11] The RR for glyphosate use and NHL risk from the hierarchical model used by De Roos et al. (2003) was 1.6 (95% confidence interval (CI): 0.9–2.8) and that from the logistic regression model was 2.1 (95% CI: 1.1–4.0); thus, using the logistic regression results favored a higher estimated meta-RR.

[12] Alavanja et al. (2013); De Roos et al. (2003); Eriksson M et al. Pesticide exposure as risk factor for non-Hodgkin lymphoma including histopathological subgroup analysis. Int J Cancer 2008;123(7):1657–1663; Hardell L et al.. Exposure to pesticides as risk factor for non-Hodgkin's lymphoma and hairy cell leukemia: pooled analysis of two Swedish case-control studies. Leuk Lymphoma 2002;43(5):1043–1049; McDuffie HH et al. Non-Hodgkin's lymphoma and specific pesticide exposures in men: cross-Canada study of pesticides and health. Cancer Epidemiol Biomarkers Prev 2001;10(11):1155–1163; Orsi L et al. Occupational exposure to pesticides and lymphoid neoplasms among men: results of a French case-control study. Occup Environ Med 2009;66(5):291–298.

analysis of data from Alavanja et al. (2013) (combined RR = 0.9, 95% CI = 0.7–1.1 for ever use of glyphosate).

Table 1 also shows the results of various sensitivity analyses using the alternative RR estimates from Alavanja et al. (2013); results from De Roos et al. (2005) instead of those from Alavanja et al. (2013); results from Hohenadel et al. (2011)[13] instead of those from McDuffie et al. (2001); and results from Pahwa et al. (2015) instead of those from De Roos et al. (2003) and McDuffie et al. (2001). All of the random-effects and fixed-effects meta-RRs for the association between glyphosate use and NHL risk were statistically nonsignificant, with little change in the point estimate and 95% CI (range of meta-RRs = 1.0–1.3, range of 95% confidence limits = 0.86–1.8) based on the inclusion of alternative RRs.

After inclusion of the results of Alavanja et al. (2013), meta-RRs from our primary analyses of the association between glyphosate use and risk of DLBCL, CLL/SLL with or without MCL, or FL also were statistically nonsignificant and attenuated (for DLBCL and CLL/SLL/MCL) or reversed from positive to inverse (for FL), compared with those reported our original meta-analysis (Table 1). In sensitivity analyses, two meta-RRs for SLL with or without CLL or MCL were statistically marginally nonsignificant or statistically significant, namely, models 4 and 5. However, both of these results were obtained using fixed effects models that included data of uncertain validity from Pahwa et al. (2015). In addition, given the presence of substantial and statistically significant heterogeneity among study-specific RRs in both of these analyses, the random-effects meta-analysis model is preferred[14]. In both analyses, the random-effects meta-RR was statistically nonsignificant and attenuated in comparison with the fixed-effects-meta-RR.

In summary, replacement of the results of De Roos et al. (2005) with the more recent results of Alavanja et al. (2013) resulted in weakened, statistically nonsignificant associations between glyphosate use and risk of all outcomes evaluated, including NHL, DLBCL, CLL/SLL/MCL, and FL.

## Limitations

This analysis used non-peer-reviewed results from the AHS reported in a draft manuscript by Alavanja et al. dated March 15, 2013, and non-peer-reviewed, publicly presented results from the North American Pooled Project reported in a presentation by Pahwa et al. at the

[13] Hohenadel K et al. Exposure to multiple pesticides and risk of non-Hodgkin lymphoma in men from six Canadian provinces. Int J Environ Res Public Health 2011;8(6):2320–2330.

[14] Higgins JPT and Green S. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. Updated March 2011. Available: http://handbook.cochrane.org/chapter_9/9_5_4_incorporating_heterogeneity_into_random_effects_models.htm.

International Society for Environmental Epidemiology Conference on August 31, 2015. We cannot verify the accuracy of these results or the published results of any of the other studies included in this analysis.

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Figure 1. Forest plot of meta-analysis of glyphosate use and non-Hodgkin lymphoma risk using unpublished results from Alavanja et al. (2013) in place of previously published results from De Roos et al. (2005) based on the Agricultural Health Study cohort. Some confidence limits are slightly different from those reported in original studies due to the recalculation of standard errors by the Comprehensive Meta-Analysis software (Biostat, Inc., Englewood, NJ).

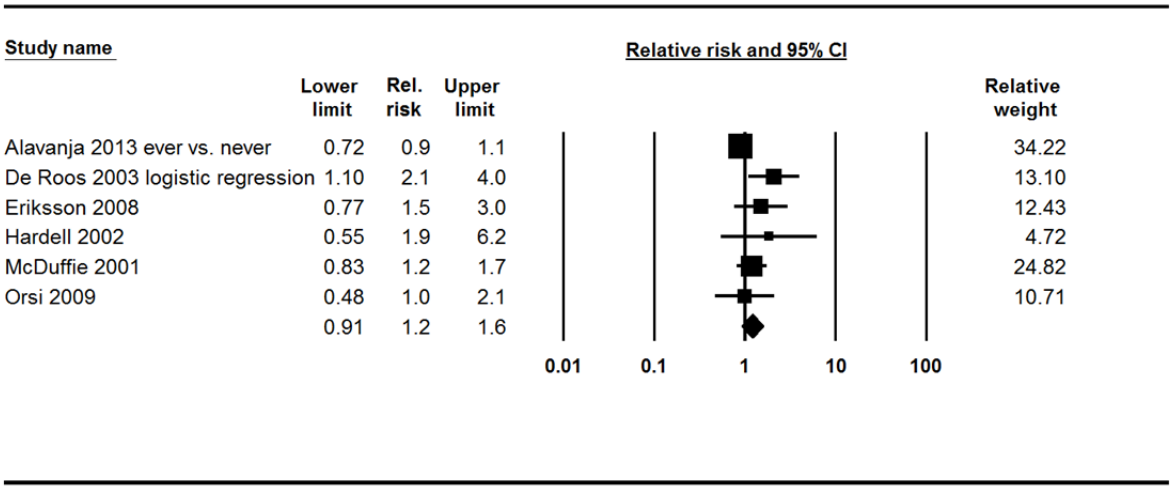

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Table 1. Results of meta-analysis of glyphosate use and non-Hodgkin lymphoma risk including unpublished results from Alavanja et al. (2013) and Pahwa et al. (2015)

| Study # | Author | Year | Outcome | Number of exposed subjects | RR | 95% CI |
|---|---|---|---|---|---|---|
| 1 | Alavanja et al. | 2013 | Non-Hodgkin lymphoma | 82 cases highly exposed, 249 cases ever exposed based on intensity-weighted exposure, new classification<br><br>83 cases highly exposed, 250 cases ever exposed based on total exposure, new classification<br><br>60 cases highly exposed, 182 cases ever exposed based on intensity-weighted exposure, old classification<br><br>60 cases highly exposed, 183 cases ever exposed based on total exposure, old classification | a. 0.9 (ever vs. never random-effects meta-RR, intensity-weighted exposure, new classification)<br>b. 0.9 (ever vs. never random-effects meta-RR, total exposure, new classification)<br>c. 0.9 (ever vs. never random-effects meta-RR, intensity-weighted exposure, old classification)<br>d. 0.9 (ever vs. never random-effects meta-RR, total exposure, old classification)<br>e. 0.97 (intensity-weighted high exposure, new classification)<br>f. 1.0 (total high exposure, new classification)<br>g. 0.9 (intensity-weighted high exposure, old classification)<br>h. 1.0 (total high exposure, old classification) | a. 0.7–1.1 (ever vs. never random-effects meta-CI, intensity-weighted exposure, new classification)<br>b. 0.7–1.1 (ever vs. never random-effects meta-CI, total exposure, new classification)<br>c. 0.7–1.1 (ever vs. never random-effects meta-CI, intensity-weighted exposure, old classification)<br>d. 0.7–1.1 (ever vs. never random-effects meta-CI, total exposure, old classification)<br>e. 0.7–1.4 (intensity-weighted high exposure, new classification)<br>f. 0.7–1.4 (total high exposure, new classification)<br>g. 0.6–1.4 (intensity-weighted high exposure, old classification)<br>h. 0.7–1.4 (total high exposure, old classification) |
| 2 | De Roos et al. | 2003 | Non-Hodgkin lymphoma | 36 cases, 61 controls | a. 2.1 (logistic regression)<br>b. 1.6 (hierarchical regression) | a. 1.1–4.0 (logistic regression)<br>b. 0.9–2.8 (hierarchical regression) |
| 3 | De Roos et al. | 2005 | Non-Hodgkin lymphoma | 71 cases (total; not analytic cohort) | 1.1 | 0.7–1.9 |
| 4 | Eriksson et al. | 2008 | Non-Hodgkin lymphoma | 29 cases, 18 controls | 1.51 | 0.77–2.94 |
| 5 | Hardell et al. | 2002 | Non-Hodgkin lymphoma | 8 cases, 8 controls | 1.85 | 0.55–6.20 |
| 6 | Hohenadel et al. | 2011 | Non-Hodgkin lymphoma | 50 cases, 133 controls | 1.40 (ever vs. never random-effects meta-RR) | 0.62–3.15 (ever vs. never random-effects meta-CI) |
| 7 | McDuffie et al. | 2001 | Non-Hodgkin lymphoma | 51 cases, 133 controls | 1.20 | 0.83–1.74 |
| 8 | Orsi et al. | 2009 | Non-Hodgkin lymphoma | 12 cases, 24 controls | 1.0 | 0.5–2.2 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9 | Pahwa et al. | 2015 | Non-Hodgkin lymphoma | 113 cases; controls NR | 1.13 | | 0.84–1.51 | | |
| | **Meta-analysis model** | | **Outcome** | **Studies included** | | **Meta-RR** | **95% CI** | $I^2$ | $P_{heterogeneity}$ |
| | ***Model 1, random effects** | | **Non-Hodgkin lymphoma** | **1a/b/c/d, 2a, 4, 5, 7, 8** | **1.2** | | **0.91–1.6** | **42.2%** | **0.12** |
| | Model 1, fixed effects | | " | " | 1.1 | | 0.90–1.3 | " | " |
| | Model 2, random effects | | " | 1e, 2a, 4, 5, 7, 8 | 1.2 | | 0.97–1.5 | 9.3% | 0.36 |
| | Model 2, fixed effects | | " | " | 1.2 | | 0.98–1.5 | " | " |
| | Model 3, random effects | | " | 1f, 2a, 4, 5, 7, 8 | 1.2 | | 0.99–1.5 | 2.2% | 0.40 |
| | Model 3, fixed effects | | " | " | 1.2 | | 0.99–1.5 | " | " |
| | Model 4, random effects | | " | 1g, 2a, 4, 5, 7, 8 | 1.2 | | 0.96–1.6 | 14.2% | 0.32 |
| | Model 4, fixed effects | | " | " | 1.2 | | 0.97–1.5 | " | " |
| | Model 5, random effects | | " | 1h, 2a, 4, 5, 7, 8 | 1.2 | | 0.99–1.5 | 2.2% | 0.40 |
| | Model 5, fixed effects | | " | " | 1.2 | | 0.99–1.5 | " | " |
| | Model 6, random effects | | " | 1a/b/c/d, 2b, 4, 5, 7, 8 | 1.1 | | 0.90–1.4 | 21.6% | 0.27 |
| | Model 6, fixed effects | | " | " | 1.1 | | 0.90–1.3 | " | " |
| | Model 7, fixed and random effects | | " | 1e, 2b, 4, 5, 7, 8 | 1.2 | | 0.96–1.5 | 0.0% | 0.61 |
| | Model 8, fixed and random effects | | " | 1f, 2b, 4, 5, 7, 8 | 1.2 | | 0.97–1.5 | 0.0% | 0.67 |
| | Model 9, fixed and random effects | | " | 1g, 2b, 4, 5, 7, 8 | 1.2 | | 0.95–1.5 | 0.0% | 0.56 |
| | Model 10, fixed and random effects | | " | 1h, 2b, 4, 5, 7, 8 | 1.2 | | 0.97–1.5 | 0.0% | 0.67 |
| | Model 11, random effects | | " | 1a/b/c/d, 2a, 4, 5, 6, 8 | 1.3 | | 0.90–1.8 | 42.4% | 0.12 |
| | Model 11, fixed effects | | " | " | 1.1 | | 0.88–1.3 | " | " |
| | Model 12, random effects | | " | 1e, 2a, 4, 5, 6, 8 | 1.3 | | 0.96–1.6 | 11.2% | 0.34 |
| | Model 12, fixed effects | | " | " | 1.2 | | 0.96–1.6 | " | " |
| | Model 13, random effects | | " | 1f, 2a, 4, 5, 6, 8 | 1.3 | | 0.97–1.6 | 3.8% | 0.39 |
| | Model 13, fixed effects | | " | " | 1.2 | | 0.97–1.6 | " | " |
| | Model 14, random effects | | " | 1g, 2a, 4, 5, 6, 8 | 1.3 | | 0.94–1.7 | 15.5% | 0.31 |
| | Model 14, fixed effects | | " | " | 1.2 | | 0.95–1.6 | " | " |
| | Model 15, random effects | | " | 1h, 2a, 4, 5, 6, 8 | 1.3 | | 0.97–1.6 | 3.8% | 0.39 |
| | Model 15, fixed effects | | " | " | 1.2 | | 0.97–1.6 | " | " |
| | Model 16, random effects | | " | 1a/b/c/d, 2b, 4, 5, 6, 8 | 1.1 | | 0.88–1.5 | 21.5% | 0.27 |
| | Model 16, fixed effects | | " | " | 1.0 | | 0.87–1.3 | " | " |
| | Model 17, fixed and random effects | | " | 1e, 2b, 4, 5, 6, 8 | 1.2 | | 0.94–1.5 | 0.0% | 0.59 |
| | Model 18, fixed and random effects | | " | 1f, 2b, 4, 5, 6, 8 | 1.2 | | 0.95–1.5 | 0.0% | 0.64 |
| | Model 19, fixed and random effects | | " | 1g, 2b, 4, 5, 6, 8 | 1.2 | | 0.93–1.6 | 0.0% | 0.54 |
| | Model 20, fixed and random effects | | " | 1h, 2b, 4, 5, 6, 8 | 1.2 | | 0.95–1.5 | 0.0% | 0.64 |
| | Model 21, fixed and random effects | | " | 1a/b/c/d, 4, 5, 8, 9 | 1.0 | | 0.86–1.2 | 0.0% | 0.42 |
| | Model 22, fixed and random effects | | " | 1e, 4, 5, 8, 9 | 1.1 | | 0.91–1.4 | 0.0% | 0.71 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Model 23, fixed and random effects | " | 1f, 4, 5, 8, 9 | 1.1 | 0.91–1.4 | 0.0% | 0.75 |
| | Model 24, fixed and random effects | " | 1g, 4, 5, 8, 9 | 1.1 | 0.89–1.4 | 0.0% | 0.64 |
| | Model 25, fixed and random effects | " | 1h, 4, 5, 8, 9 | 1.1 | 0.91–1.4 | 0.0% | 0.75 |
| | Model 26, fixed and random effects | " | 3, 4, 5, 8, 9 | 1.2 | 0.94–1.5 | 0.0% | 0.85 |

| Study # | Author | Year | Outcome | Number of exposed subjects | RR | 95% CI |
|---|---|---|---|---|---|---|
| 1 | Alavanja et al. | 2013 | Diffuse large B-cell lymphoma | 22 cases highly exposed, 68 cases ever exposed based on total exposure | a. 1.0 (ever vs. never random-effects meta-RR, total exposure)<br>b. 0.7 (total high exposure) | a. 0.7–1.4 (ever vs. never random-effects meta-RR, total exposure)<br>b. 0.4–1.3 (total high exposure) |
| 4 | Eriksson et al. | 2008 | Diffuse large B-cell lymphoma | Not reported | 1.22 | 0.44–3.35 |
| 8 | Orsi et al. | 2009 | Diffuse large B-cell lymphoma | 5 cases, 24 controls | 1.0 | 0.3–2.7 |
| 9 | Pahwa et al. | 2015 | Diffuse large B-cell lymphoma | 45 cases; controls NR | 1.23 | 0.81–1.88 |

| | Meta-analysis model | Outcome | Studies included | Meta-RR | 95% CI | $I^2$ | $P_{heterogeneity}$ |
|---|---|---|---|---|---|---|---|
| | ***Model 1, fixed and random effects** | **Diffuse large B-cell lymphoma** | **1a, 4, 8** | **1.0** | **0.74–1.4** | **0.0%** | **0.94** |
| | Model 2, fixed and random effects | " | 1b, 4, 8 | 0.84 | 0.53–1.3 | 0.0% | 0.61 |
| | Model 3, fixed and random effects | " | 1a, 4, 8, 9 | 1.1 | 0.85–1.4 | 0.0% | 0.89 |
| | Model 4, fixed and random effects | " | 1b, 4, 8, 9 | 1.0 | 0.76–1.4 | 0.0% | 0.49 |
| | Model 5, fixed and random effects | " | 4, 8, 9 | 1.2 | 0.83–1.7 | 0.0% | 0.94 |

| Study # | Author | Year | Outcome | Number of exposed subjects | RR | 95% CI |
|---|---|---|---|---|---|---|
| 1 | Alavanja et al. | 2013 | CLL/SLL/MCL | 29 cases highly exposed, 90 cases ever exposed based on total exposure | a. 0.9 (ever vs. never random-effects meta-RR, total exposure)<br>b. 1.1 (total high exposure) | a. 0.6–1.3 (ever vs. never random-effects meta-RR, total exposure)<br>b. 0.6–1.8 (total high exposure) |
| 4 | Eriksson et al. | 2008 | CLL/SLL | Not reported | 3.35 | 1.42–7.89 |
| 8 | Orsi et al. | 2009 | CLL/SLL | 2 cases, 18 controls | 0.4 | 0.1–1.8 |
| 9 | Pahwa et al. | 2015 | SLL | 15 cases; controls NR | 1.79 | 0.87–3.69 |

| | Meta-analysis model | Outcome | Studies included | Meta-RR | 95% CI | $I^2$ | $P_{heterogeneity}$ |
|---|---|---|---|---|---|---|---|
| | ***Model 1, random effects** | **CLL/SLL/MCL** | **1a, 4, 8** | **1.2** | **0.41–3.3** | **78.6%** | **0.009** |
| | Model 1, fixed effects | " | " | 1.1 | 0.75–1.5 | " | " |
| | Model 2, random effects | " | 1b, 4, 8 | 1.3 | 0.47–3.5 | 73.6% | 0.02 |
| | Model 2, fixed effects | " | " | 1.3 | 0.87–2.1 | " | " |
| | Model 3, random effects | " | 1a, 4, 8, 9 | 1.3 | 0.64–2.7 | 72.7% | 0.01 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Model 3, fixed effects | " | " | 1.2 | 0.86–1.6 | " | " |
| | Model 4, random effects | " | 1b, 4, 8, 9 | 1.4 | 0.74–2.8 | 62.6% | 0.05 |
| | Model 4, fixed effects | " | " | 1.5 | 1.0–2.1 | " | " |
| | Model 5, random effects | " | 4, 8, 9 | 1.6 | 0.59–4.2 | 67.6% | 0.05 |
| | Model 5, fixed effects | " | " | 1.9 | 1.1–3.1 | " | " |

| Study # | Author | Year | Outcome | Number of exposed subjects | RR | 95% CI |
|---|---|---|---|---|---|---|
| 1 | Alavanja et al. | 2013 | Follicular lymphoma | 12 cases highly exposed, 38 cases ever exposed based on total exposure | a. 0.7 (ever vs. never random-effects meta-RR, total exposure)<br>b. 0.7 (total high exposure) | a. 0.4–1.1 (ever vs. never random-effects meta-RR, total exposure)<br>b. 0.4–1.8 (total high exposure) |
| 4 | Eriksson et al. | 2008 | " | Not reported | 1.89 | 0.62–5.79 |
| 8 | Orsi et al. | 2009 | " | 3 cases, 24 controls | 1.4 | 0.4–5.2 |
| 9 | Pahwa et al. | 2015 | Follicular lymphoma | 28 cases; controls NR | 0.69 | 0.41–1.15 |

| Meta-analysis model | Outcome | Studies included | Meta-RR | 95% CI | $I^2$ | $P_{heterogeneity}$ |
|---|---|---|---|---|---|---|
| ***Model 1, random effects** | **Follicular lymphoma** | **1a, 4, 8** | **1.0** | **0.53–1.9** | **35.2%** | **0.21** |
| Model 1, fixed effects | " | " | 0.88 | 0.57–1.4 | " | " |
| Model 2, random effects | " | 1b, 4, 8 | 1.1 | 0.60–2.1 | 75.0% | 0.37 |
| Model 2, fixed effects | " | " | 1.1 | 0.60–2.0 | " | " |
| Model 3, random effects | " | 1a, 4, 8, 9 | 0.82 | 0.56–1.2 | 16.4% | 0.31 |
| Model 3, fixed effects | " | " | 0.80 | 0.57–1.1 | " | " |
| Model 4, random effects | " | 1b, 4, 8, 9 | 0.86 | 0.56–1.3 | 10.5% | 0.34 |
| Model 4, fixed effects | " | " | 0.84 | 0.57–1.2 | " | " |
| Model 5, random effects | " | 4, 8, 9 | 1.0 | 0.53–2.0 | 36.6% | 0.21 |
| Model 5, fixed effects | " | " | 0.88 | 0.57–1.4 | " | " |

*Primary analysis

CI: confidence interval; CLL: chronic lymphocytic leukemia; MCL: mantle-cell lymphoma; RR: relative risk; SLL: small lymphocytic lymphoma