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Antimicrobial Drug–resistant *Salmonella* Typhimurium (Reply to Helms)

In Reply to Helms: In the article by Helms et al., Helms concludes that infections with *Salmonella* Typhimurium strains resistant to ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline (hereafter referred to as penta-resistant) were associated with higher death rates than infections with non–penta-resistant *S.* Typhimurium. Helms also concluded that infections with quinolone-resistant (nalidixine-resistant) *S.* Typhimurium were associated with higher death rates than quinolone-susceptible *S.* Typhimurium (1).

Table 2 in Helms' article provides information that enables close scrutiny of this conclusion and comparison of the excess mortality associated with penta-resistant, quinolone-susceptible *S.* Typhimurium with the excess mortality of non–penta-resistant *S.* Typhimurium (1). In this letter, the Table is based on the original table. However, two additional comparisons have been added: the p values, which are not based on the data but are approximations based on the parameters in the table.

The conclusion is that only quinolone resistance is associated with excess mortality compared with nonresistant isolates. Penta-resistant, quinolone-susceptible *S.* Typhimurium has a risk ratio of 2.9 (1.1 to 7.9) compared to the ratio of non–penta-resistant isolates 2.1 (1.5 to 2.9). When these figures are compared, the approximate p value is 0.55, which, of course, is far from being significant. Thus, on the basis of the article by Helms, penta resistance may not pose a greater threat to human health than non–penta resistance. However, the measured effect of penta resistance is achieved by the inclusion of quinolone-resistant *S.* Typhimurium in the group.

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Reference

1. Helms M, Vastrup P, Gerner-Smidt P, Mølbak K. Excess mortality associated with antimicrobial drug-resistant *Salmonella* Typhimurium. Emerg Infect Dis 2002;8:490–5.

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Table. Table showing additional comparisons (1)[a]

	Resistant		Susceptible		
	Deaths/ cases	RR[b] (95% CI)	Deaths/ cases	RR[b] (95 % CI)	p value
Penta with and without quinolone	12/283	4.8 (2.2 to 10.5)	47/1,764	2.1 (1.5 to 2.9)	0.06
Penta with quinolone	5/40	13.1 (3.3 to 51.9)	47/1,764	2.1 (1.5 to 2.9)[c]	0.01[d]
Penta without quinolone	7/243	2.9 (1.1 to 7.9)	47/1764	2.1 (1.5 to 2.9)[c]	0.55c[d]

[a]RR, relative risk; CI, confidence interval.
[b]Adjusted for coexisting conditions.
[c]Compared to the non-penta group.
[d]Approximations based on the parameters from the table.

Antimicrobial Drug–resistant *Salmonella* Typhimurium (Reply to Dahl)

In Reply to Dahl: The emergence and spread of multidrug-resistant *Salmonella enterica* serovar Typhimurium DT104 (MDR DT104) contributed to an international increase in antimicrobial drug resistance in *S.* Typhimurium in the late 1990s (1,2). This type of *Salmonella* is usually resistant to five drugs: ampicillin, chloramphenicol, streptomycin, sulfonamides, and tetracycline (R-type ACSSuT) and easily acquires resistance to other drugs, including quinolones, trimethoprim, and aminoglycosides (1,3–5). To determine death rates after infection with MDR DT104 or closely related strains, we identified patients who were infected with strains at least resistant to ACSSuT (6). Analysis limited to strains that were only R-type ACSSuT would have given a misleading result since MDR DT104 often, as mentioned, develops additional resistance to other classes of antimicrobial drugs in addition to the ACSSuT-complex. This fact needs to be taken into account in any attempt to quantify the overall public health impact of MDR DT104 and related strains.

We found, in our matched cohort study (6), that 283 patients infected with strains resistant to at least ACSSuT were 4.8 times more likely to die than the general Danish population, compared with 2.3 for 953 patients infected with pansusceptible strains. This difference in death rates ocurred mainly because 40 of the 283 strains had R-type ACSSuTNx (i.e., additional resistance to nalidixic acid), and infection with this strain in particular is associated with a high death rate (relative mortality 13.1). As Dahl suggests, infection with R-type ACSSuT (Nx susceptible) was not