

March 7, 1956

Mr. Wesley C. L. Hemeon
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Dear Wes:

I hasten to reply to your note of March 6 and to make some addition^{al}/comments on the figures which I gave you hastily when we last talked together.

First, it is important to differentiate between demonstrable facts and plausible opinions derived from interpretations of facts of various kinds. When one considers the extent to which the latter enter into certain of the figures which I gave you, there is considerable doubt as to whether such a table as you suggest should be published without the explanations required to put everything in its proper light. People take these things so literally and use them out of their proper context, that I am wary in my statements of this type. I shall make the differentiation of the type indicated above, and then you can consider further what you may think of the figures.

The data are adequate to substantiate the figures I gave you on the intake of lead by the adult American in his food and drink. The extent of the alimentary absorption of lead at this level of daily intake is a bit hard to determine. Our information on this point is based upon what happens to larger doses - i.e. higher concentrations in the alimentary tract, which show that the extent of the absorption of a soluble (or relatively soluble) compound of lead varies directly with the concentration, being rarely more than 10 to 12 per cent. I picked the figure of 10 per cent out of the air as being the maximum, in all probability.

The data on the atmosphere are subject to some juggling, dependent upon the season, the locality, the atmospheric conditions (inversion, etc.), but in my judgment the average concentration of lead in the atmosphere breathed by an individual during an average 24-hour period would rarely, if ever, exceed 5 micrograms per cubic meter. Assuming that the individual breathes in 20 cubic meters of air per day (probably high), 0.10 mg. passes through the respiratory apparatus per day. The retention of this respired lead in the lung (dependent upon particle size and concentration) may conceivably be as little as 10 per cent, or as much as 50 per cent according to our present

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incomplete data. Of that retained, the greater portion of it is absorbed, unless the fairly recent observations of Ted Hatch necessitate a revision of our ideas concerning the clearing of solid particles from the lung. If he is right, the proportion absorbed may be appreciably less than my estimate. In any case, we can only guess at this at present because of our inadequate information as to the distribution of particle size and the solubility of the compounds borne into the lung. In terms of what happens in the metabolism of the subjects studied in our laboratory, I have estimated that the quantity absorbed from the lung per day may be closer to 0.01 milligrams per day than to any other figure I can arrive at.

The "level of possible concern," as you have set it down is incorrect. What I said was that if the lead in the food and beverages were doubled, we would find ourselves in a situation in which for a period of years (how long one does not know; it might be for the balance of a lifetime) there would be some accumulation of lead in the body. This would be slight. A crucial experiment showed that when we added 1 mg. per day (every day) to that in the food and drink of a normal subject, he accumulated about 120 mg. in something over 4 years. This might become dangerous in the course of time. In any case, a conservative view would be justified to the effect that the ingestion of 1 mg. per day, or even somewhat less (I set down 0.6 mg. as a threshold value) may well be regarded as excessive. (At this level of intake by a normal persons the alimentary absorption approximates 10 per cent, varying with the time required for the tract to empty itself. Thus diarrhoea diminishes absorption, and constipation increases it.)

Now if the absorption of 10 per cent of 1.3 mg. ($0.3 + 1.00$ administered per day) per day gives rise to a significant rate of lead accumulation in the body (120 mg. in 4 plus years), the question is raised, of course, how much breathed into the lung, is capable of giving rise to an equivalent rate of accumulation. This quantity will vary, presumably, with the compound of lead inhaled, the size (and shape) of the particle, and the concentration. Here we have too many imponderables at present, so far as the nature of the contamination of the air with lead, to justify more than a plausible guess. I would hesitate, therefore, to be as concrete in my estimate, for the record, as I have been for the sake of a discussion, which at this point related itself more to a continuing experimental program ahead of us, than to that behind us. I suspect that the deposition of potentially absorbable lead in the lung in the quantity of 0.01 mg. per day will be equivalent, on the average, to the ingestion of approximately 0.10 per day. However, this makes insufficient allowance for variation in the solubility of lead in the alimentary tract and for variations in the behavior of the alimentary tract in health and disease. Therefore, I am loath to make such an unqualified statement for the record. Moreover, the relationship between the concentration of lead in the air and the retention of lead in the lung is a bit too ill-defined, at present, to justify any flat statement or calculation from the one to the other. Since this is a hot subject at the

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moment, and especially so from the aspect of the quotation or misquotation of statements out of context, I think it unwise to authorize your publication of the table unless you do so guardedly.

I would not wish to relate the lead in the air to gasoline consumption, either, since it is not possible, at this time, to determine the contribution made to the lead in the air by the exhaust of automobiles. We can find qualitative evidence that some contribution is made in this manner, but no actual data are available to enable us to estimate the quantity or the proportion in any instance. The sources are multiple and are subject to considerable variation geographically and on a time base. It is not wise, therefore, to use our estimates for the purposes of documentation at this time.

I have just talked to Cholak about your proposal to him and I am sure he will know how to deal with it and with matters that may come out of it later.

Cordially yours,

Robert A. Kehoe, M. D.

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