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Title: Assessing NTP's Effectiveness: A Case Study on Hexavalent Chromium

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Purpose

For over 35 years, the National Toxicology Program (NTP) has conducted research and analysis activities and disseminated information about potential health hazards in our environment. We sought to assess the effectiveness of NTP's science at advancing toxicology and being translated to public health decision-making. A logic model was developed with defined inputs, outputs (activities and products), and outcomes (proximal, intermediate, distal) and applied retrospectively to NTP's research program on hexavalent chromium (Cr6) as a case study.

Background and Significance

A number of studies, supported by public universities, private organizations, and federal agencies, have evaluated the impact of federally funded research [1–10]. In 2013, the National Institutes of Health (NIH) released a report on the approaches for assessing the value of biomedical research supported by NIH [11], and the National Academies of Science published a report related to measuring the impact of research on society [12]. The literature for assessing the value of research highlights the importance of measuring impact and the challenges involved, such as attribution (finding a connection from research to an impact), lag time (accounting for the potentially long period of time between research and impact), and external factors (research institutions lack direct control over how their work will be applied by federal agencies, industry, and the public) [2,3,7,9–12].

Cr6 was selected for the case study because NTP's work was completed several years earlier with presumably sufficient time to identify its use by stakeholders and evaluate impacts. NTP's products on Cr6 included 1 technical report, 1 toxicity report, 5 journal articles, 3 laboratory reports, and a listing in the *Report on Carcinogens* [13]. Proximal outcomes measured by Webtrends data and external requests showed stakeholders had immediate awareness of NTP's products. Intermediate outcomes of NTP's work to inform science were many. NTP's research on Cr6 was cited in scientific publications to justify further studies, inform study designs, or interpret new data. Stakeholders used NTP's work to identify Cr6 as a hazard in legal and policy documents, science reports, congressional testimonies, proposed legislations or regulations, and non-regulatory actions.

Pinpointing distal outcomes showing NTP's products led to a positive change for public health was challenging because NTP has no regulatory authority, the time lag to impact varies, and external factors may affect use or progress of intended actions. Although proposed federal laws or state regulations cited NTP's products, often they were not enacted or were delayed by external factors. Notably, NTP's research was key to the nation's first-ever drinking water standard for Cr6 adopted by California in 2014.

This case study demonstrated NTP's science on Cr6 had impact in many areas including public health. Furthermore, it identified broad and objective approaches for assessing NTP's effectiveness, along with data and methodological gaps that need to be addressed for more thorough and efficient assessments in the future.

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