Comparative effectiveness of biodosimetry: comparing throughput and capacity in response to large-scale radiation events

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\textbf{Study Goal:} This study advances a framework for comparing the effectiveness of biodosimetry methods to assess victims potentially exposed to ionizing radiation in a large-scale radiation event. Using the US federal guidelines requiring first level triage biodosimetry to be able to assess one million people in 6 days, the capacity of key biodosimetry methods to meet these throughput demands for initial triage are assessed, taking into account valid sampling and processing times.

\textbf{Abstract:} In the event of a large-scale radiation disaster, such as following deployment of an improvised explosive device with radiation in a large urban setting, it is necessary to find methods that can quickly and reliably differentiate individuals in the vicinity who received a life threatening exposure to radiation requiring acute treatment from those who did not.

\textbf{Methods:} We have proposed a novel framework to compare the efficacy and capacity of various biodosimetry methods to assess a large number of potential victims within a timeframe that is sufficient for medical decision makers to determine who would benefit from receiving mitigators or treatment for acute radiation syndrome. In this paper we advance our framework by assessing how many people, facilities and devices are needed in order for each method to reach the federal requirement of being able to assess one million people within 6 days following an event. Various ‘bottleneck’ points, where different biodosimetry methods fail to keep up with the demands being made for triage, are identified. The assumptions required for the numbers of people and devices to overcome these bottlenecks to meet the federal requirement for throughput are quantified and discussed.

The implications for injured victims (and the biodosimetry needs for combined injury) are discussed. The policy implications of various plausible options to using only one type of dosimetry, such as applying different methods for some parts of the population, are discussed.

\textbf{Conclusion:} The circumstances of the victims, including type of exposure, concomitant injury, and rates of arrival reveal different strengths and weaknesses among the methods. Integrating their use can maximize the capacity to meet the needs for effective and efficient triage. Several plausible scenarios are proposed for planners and policy-makers to consider whether and how to encourage development of biodosimetric methods and stockpiling them.

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