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RADIATION EXPOSURE FROM IMAGING TESTS IN PEDIATRIC EMERGENCY MEDICINE: A SURVEY OF PHYSICIAN KNOWLEDGE AND RISK DISCLOSURE PRACTICES

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☐ **Abstract—Background: Disclosing potential future malignancy risks from diagnostic tests that expose children to ionizing radiation in the emergency department may be challenging. Objectives: We determined the proportion of pediatric emergency medicine (PEM) physicians who are aware of current malignancy risk estimates associated with head computed tomography (CT). We also examined reported risk and strategy disclosure practice patterns. Methods: We conducted an online survey of members of a national Canadian PEM physician association using a modified Dillman's technique. Results: Of 156 eligible participants, 126 (80.8%) responded to the survey. Of the 126 respondents, 124 (98.4%; 95% confidence interval [CI] 96.2–100) reported that there is a potential malignancy risk associated with head CT, and 46 (36.5%; 95% CI 28.1–44.9) correctly identified the best current estimate of this risk. The majority, 68.8% (95% CI 60.7–76.9), reported disclosing these possible risks "most of the time/almost always." Although some physicians reported varying their strategy with the clinical scenario, the most frequently selected disclosure strategies were a comparison with chest radiographs and everyday risks. Frequently cited barriers to informed risk-benefit discussions were concerns that parents will worry excessively about cancer (27.8%), discussions during the treatment of a critically ill child (23.8%), and a concern that parents may not want the test (15.9%). Conclusions: Approximately one-third of pediatric emergency physicians were able to identify the best available estimate of the malignancy risk from a head CT. Although there are some barriers, many PEM physicians report regularly participating in risk-benefit disclosures.** © **2014 Elsevier Inc.**

☐ **Keywords—child; radiation; computed tomography; management**

INTRODUCTION

Numbers of annual computed tomography (CT) examinations have been increasing incrementally in most countries by about 10% each year during the last 10–20 years (1). In particular, CT has become a vital component in the urgent diagnostic evaluation of pediatric emergency department (ED) patients, with usage having increased fivefold in recent years (2). However, there are increasing concerns about the potential future malignancy risk associated with exposure to ionizing radiation in children (3,4). Concerns are heightened for CT, which often involves exposure to higher radiation doses than other diagnostic imaging modalities (5). However, disclosing these potential risks to parents in an ED may be challenging, as the amount of time available to engage in an informed discussion may be limited. In addition, emergency physicians may have concerns that this could

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lead to parental resistance to proceed with a CT scan that is clinically indicated.

Several studies to date have examined physician knowledge of radiation risks in a variety of practice settings. Most have involved physicians caring for adult patients, with a small number of studies directed towards physicians caring for pediatric patients (6–16). Regardless of setting, all have raised concern about deficiencies in physician knowledge regarding the radiation doses associated with diagnostic tests and their associated malignancy risks. No studies have specifically evaluated pediatric emergency medicine (PEM) physicians, a specialty where the relevance of this information to daily practice is particularly high. In addition, we are unaware of any published studies examining strategies employed by physicians to disclose these risks and the perceived barriers faced in initiating such discussions.

We performed a survey of Canadian PEM physicians to determine the proportion who are aware of the most accurate current malignancy risk estimate associated with head CT. In addition, we examined risk disclosure practice patterns and the specific strategies used by these physicians in the ED during discussions with families and patients.

MATERIALS AND METHODS

Survey Design and Study Population

Between August and October 2012, a self-administered online survey was sent to all attending-level physicians who were members of Pediatric Emergency Research Canada (PERC), a national organization that houses a database of PEM physicians. Approximately 75% of all PEM physicians are members of PERC. There are PEM physicians in all of the Canadian provinces, but none in the Territories. Members who did not receive the survey due to technical reasons, did not have an accurate electronic e-mail address on file, or were not staff-/attending-level physicians in Canada working primarily in an ED, were excluded. The study was approved by the institutional research ethics board and PERC prior to administration. Finally, the survey was constructed and reported in accordance with the published recommendations of the *Journal of Medical Internet Research* (17).

Survey Content

A literature search did not reveal any validated questionnaire for our survey content, and thus we developed a survey in accordance with the methods advocated by Streiner and Norman as well as Burns et al. (18,19). The questions and estimates of radiation dose and respective potential risks were based on the best available information from the relevant literature, three PEM physicians with survey expertise, and one pediatric radiologist with survey and content expertise (3–5,20). Radiation dose information used to derive equivalent time periods of background radiation was based on 2011 institutional effective dose estimates of 0.02 mSv for a two-view chest radiograph on a 5-year-old child, 1.5–2.0 mSv for a single-phase (noncontrast) pediatric head CT scan, and an annual background radiation exposure of 3 mSv (5,21). Potential future excess malignancy risk estimates were based on BEIR VII data, and those available from Image Gently, the international pediatric radiation safety awareness campaign (3,20). Although the "most correct estimate" of malignancy risk estimates used were approximately one in a million for a chest radiograph series and one in 10,000 for head CT, the authors acknowledge that risk will vary according to age and gender of a child.

Items for the survey were generated by an expert panel until no new items emerged, distributed over five consensus-based sections. The items were then pre- and pilot-tested on 20 PEM physicians based outside of Canada. Initially, we provided the survey on paper to 10 of these PEM physicians, and we asked for specific feedback. The revised questions were loaded onto the electronic survey platform and pilot-tested on 10 additional PEM physicians distinct from previous PEM participants. These PEM physicians provided input on survey flow, user-friendliness, question clarity/content, and time to completion, and survey questions were removed or modified in accordance with feedback. The final survey included 20 questions, and limited data collection time to 5–10 min per participant. The final survey (Supplemental document S1) addressed the following domains (with respective number of questions): demographics (6 questions), knowledge of potential risks associated with ionizing radiation in imaging (5 questions), risk disclosure (6 questions), and public awareness of radiation exposure from diagnostic imaging tests (3 questions). After completion of the survey, physicians were provided the opportunity to review a Webinar on radiation exposure and potential malignancy risk associated with frequently ordered diagnostic imaging tests and approaches to informing patients about the small potential malignancy risks.

Survey Administration

The survey was administered using www.surveygizmo.com, which allowed for an unlimited number of questions and responses, data collection via Web-link and e-mail, forced responses for each question, the use of skip logic, a progress bar, and downloading to a spreadsheet. Multiple-item screens to decrease completion time and minimize incomplete responses were incorporated into the survey design.