

Can dose area product be used to monitor staff dosimeter badge compliance?

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PURPOSE: Staff involved in fluoroscopically guided interventions (FGI) are required to wear radiation dosimeter badges, but compliance can be inconsistent and challenging to monitor. We evaluated the correlation between C-arm dose area product (DAP) and physician badge readings to assess whether this correlation could be used to monitor staff compliance.

METHODS: A dosimeter badge was placed on the “C” of an interventional C-arm (Figure 1). For 11-months, the monthly badge reading was compared with total monthly C-arm DAP, since DAP is a surrogate of scatter radiation.

For 27 physicians, the collar badge doses (monthly or quarterly) of each physician were compared with the total DAP of all corresponding procedures. Correlation between badge dose and DAP was assessed using Spearman’s rank correlation coefficient (ρ), with values ranging from -1 (inverse correlation) to 0 (no correlation) to 1 (perfect correlation).

RESULTS: Correlation between the badge placed on the “C” and the total monthly C-arm DAP was very strong ($\rho=0.88$, Figure 1), confirming that the badge reliably measured the radiation scatter present in the procedure room.

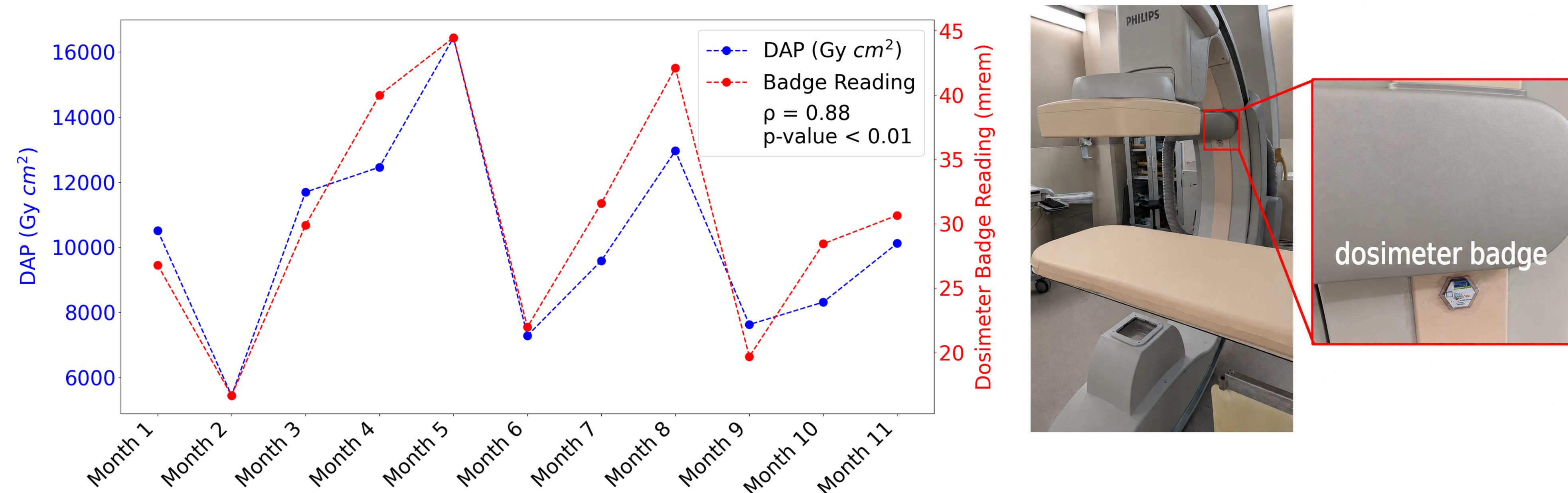


Figure 1: (Left panel) Graph of total monthly DAP of an interventional C-arm (blue, left vertical axis) and corresponding monthly dosimeter badge reading (red, right vertical axis) of a badge placed on the “C” of an interventional C-arm (photo, right panel). Correlation was strong, with Spearman’s rank correlation coefficient $\rho = 0.88$, confirming that the badge reliably measured the radiation scatter present in the procedure room.

For the 27 physicians, data analysis revealed two distinct physician groups, compliant and non-compliant, with significantly different average Spearman rank correlation coefficients: compliant $\rho_{\text{avg}} = 0.38$ vs. non-compliant $\rho_{\text{avg}} = 0.05$ ($p\text{-value} < 0.01$ using an unpaired t-test). Within the compliant group, there was substantial variation in the correlation between badge dose and DAP with ρ ranging from 0.03 to 0.79.

- **Compliant:** Wore badge more than 70% of the time, $\rho_{\text{avg}} = 0.38$

- **Non-compliant:** Wore badge less than 70% of the time, $\rho_{\text{avg}} = 0.05$

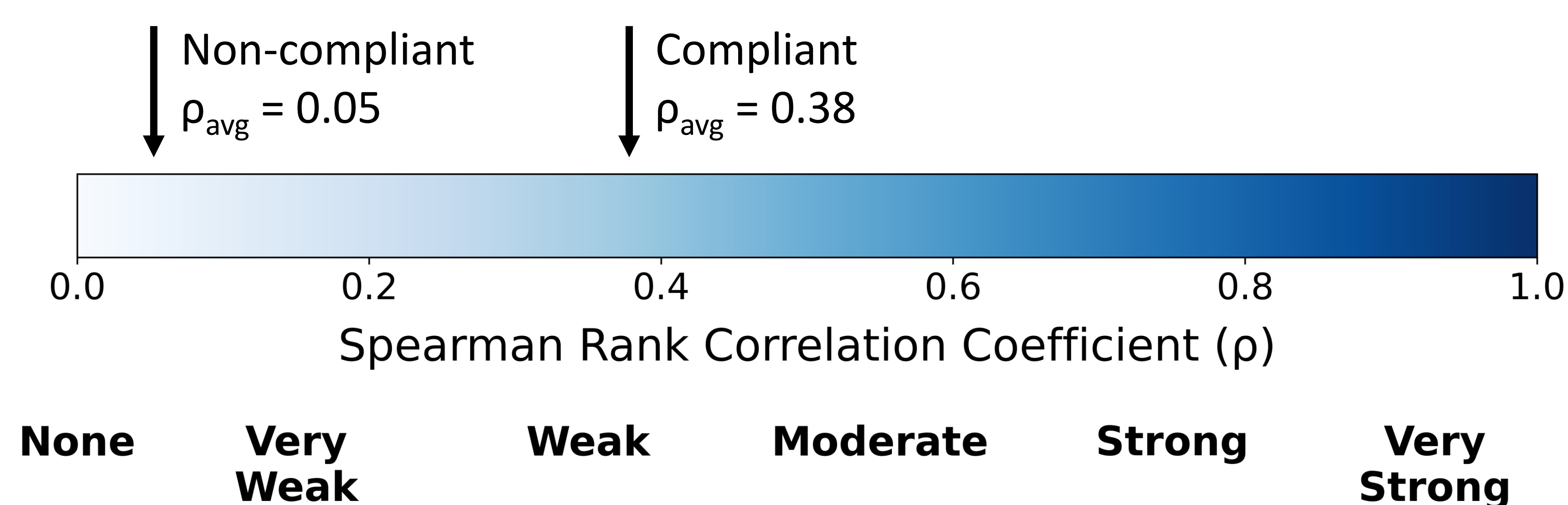


Figure 2: Graphs of badge reading (monthly or quarterly) and corresponding total DAP for an interventional radiologist (top, monthly) and an interventional pulmonologist (bottom, quarterly). Both physicians were compliant in wearing their badges. However, correlation between badge dose and DAP was substantially higher for the pulmonologist ($\rho = 0.74$, strong correlation) than for the radiologist ($\rho = 0.36$, weak correlation). These different correlations may be due to practice differences that affect the badge reading during FGI.

DISCUSSION: On average, the correlation between badge reading and total DAP was significantly higher for compliant than non-compliant physicians ($\rho_{\text{avg}} = 0.38$ vs. 0.05), suggesting that this correlation potentially could be used to monitor staff compliance. However, within both groups, the correlation varied substantially, which presents challenges for assessment of staff compliance. Even among compliant physicians, there are many factors that could affect the strength of the correlation between badge reading and DAP. These factors include:

- inconsistent badge collection time
- inconsistent use of shielding during FGI
- exiting/remaining in procedure room during cases
- variation of physician location during FGI
- accuracy of total DAP calculation

CONCLUSION: The correlation between badge reading and total DAP is significantly higher for physicians that are compliant about wearing their badges than those that are non-compliant. However, the feasibility of monitoring staff badge compliance via this methodology remains questionable due to the substantial variation in this correlation. Consequently, it is likely more practical to monitor compliance simply via the rate that physicians wear their badges each year.