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INTRODUCTION

- Anatomy and physiology serve as foundational courses in nursing, medical, and allied health care programs; yet there is a growing concern regarding the longevity of students' retention of the knowledge gained from these subjects (Narnaware & Chahal, 2021). Not only do students struggle to acquire this knowledge but also to retain, transfer, and apply this knowledge in subsequent years of their program (Narnaware, Y. 2021; Neumeier and Narnaware, 2023b).
- Resource shortages plays a role in the struggle that students face in acquiring, retaining, and transferring knowledge. In 1831, there were only 11 bodies that were legally available for the 900 students studying anatomy in London (Kleeman, 2024). The lack of resources available to students contributes to both physiological and anatomical knowledge loss they experience.
- Various factors such as student demographics, the integration of numerous active teaching methods, instructional technology, and laboratory components have been demonstrated to impact retention rates within these groups (Narnaware, Y. 2021).
- Physiological knowledge retention however has not received as much attention in the aforementioned disciplines compared to anatomical knowledge retention, with very few studies focusing on nursing students (Aari et al., 2004). Most of these studies are conducted post-graduation (Aari et al., 2004) or are focused on a singular or restricted set of organ systems (Pourshanzari et al., 2013)

PURPOSE

- The primary aim of this study is to assess the extent of physiological knowledge lost by nursing students in the fourth year between completing their physiology course in first-year nursing and their enrolment in the fourth year Critical Care Nursing course.

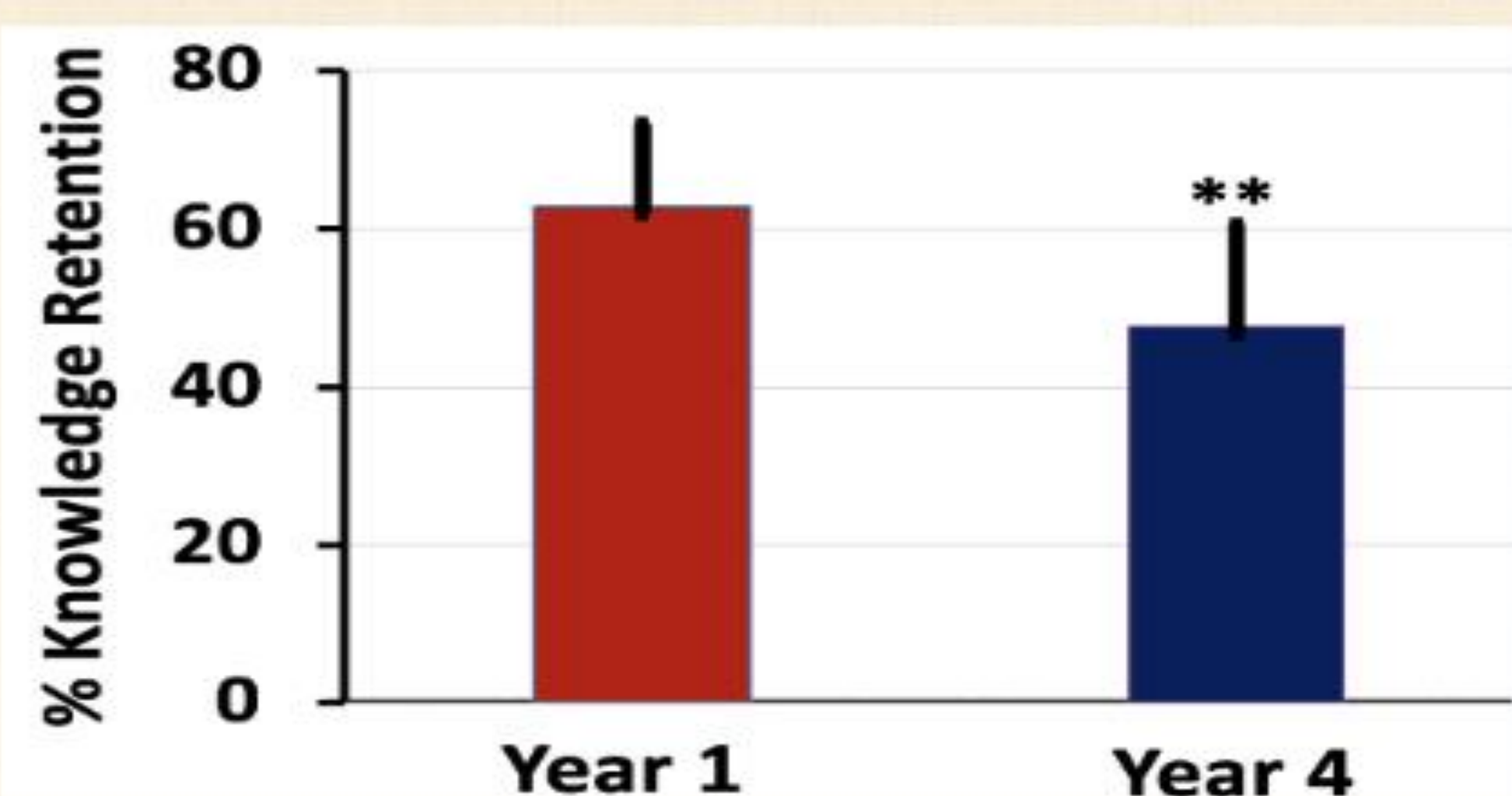
METHODS

- Fourth year nursing students were tested in ten organ systems using an online quizzing platform called Kahoot (Kahoot Inc., Oslo, Norway) to assess physiological knowledge retention to answer the question posed above. Students were encouraged not to study for these quizzes in advance to assess their retentivity. Between nine and eleven multiple choice questions were asked each of which reflected first-year knowledge from each major organ system. Ten different Kahoot's were developed to represent ten organ systems.
- Scores from fourth year quizzes were compared to first year nursing students' quiz scores on the same content to determine overall knowledge retention over three years.
- The combined data from both the first-year physiology course and the fourth-year Critical Care Nursing course underwent statistical analysis using SPSS II (IBM Corp; Armonk, NY) to determine overall knowledge retention. Mean values were compared utilizing 2-sample 't' tests, with significant differences established at P<0.05.

RESULTS

- In first year, nursing students the mean score of questions from ten organ systems was 62.89 ± 10.5 (\pm SD).
- When comparing this score with the test items assessed in the fourth-year Critical Care Nursing course, there is a decline in the average scores from 62.89 ± 10.5 (\pm SD) to 47.69 ± 8.23 (\pm SD), indicating a 15.2% decrease in knowledge or an 84.8% retention rate over three years (Figure 1).
- The highest physiological knowledge retention was noted for fluids and electrolytes (30.7%), hormones (28.6%), defenses (22.5%), and reproductive physiology (22.5%), followed by renal physiology (19.7%).
- Knowledge loss was comparatively higher for blood (15.9%), inflammation (11.2%), vascular (7.5%) and respiratory physiology (3.7%).

Figure 1. The Summary of Overall Retention



Year 1 and Year 4 bars represent the overall mean scores from ten organ systems converted into percent knowledge. There is a significant decrease in knowledge between years 1 and 4. ** P<0.001.

Table 1. Retention by Organ Systems

Organ System	Year 1	Year 4	% Knowledge lost	't' test/P values
	Mean Score \pm SD	Mean Score \pm SD	% Knowledge Loss	
Vascular	66.98 \pm 23.3	59.5 \pm 27.3	7.5%	0.471
Blood	59.82 \pm 13.4	43.9 \pm 20.3	15.9%	0.024
Defences	67.48 \pm 20.8	45.0 \pm 26.2	22.5%	0.018
Inflammation	73.67 \pm 19.3	62.5 \pm 29.2	11.2%	0.266
Respiration	46.29 \pm 11.9	41.6 \pm 28.8	4.7%	0.606
Hormones	75.97 \pm 17.7	47.4 \pm 31.2	28.6%	0.006
Renal	54.67 \pm 15.0	35.6 \pm 21.0	19.7%	0.009
Fluid & Electrolyte	72.59 \pm 17.2	41.9 \pm 17.7	30.7%	0.001
Digestive	48.05 \pm 22.4	51.8 \pm 26.4	-3.7%	0.773
Reproductive	63.36 \pm 16.7	40.9 \pm 24.1	22.5%	0.059

DISCUSSION

- These findings illustrate a notable degree of overall knowledge retention, with system specific variations. The retention level documented in this study surpasses that reported in previous studies involving medical and allied-health students (Pourshanzari et al., 2013) and notable exceeds anatomical knowledge retention levels within the same population (Narnaware and Neumeier, 2023).
- The acquisition of foundational knowledge across ten physiological systems in notable lower compared to the acquisition of anatomical knowledge (Narnaware, Neumeier, 2023b).
- Variations in the retention of organ system specific knowledge could stem from factors such as question complexity, the duration between learning and assessment, students' perception of the information's relevance, and the nature of bioscience subjects. Future research could delve into these variables to better understand their influence on the retention of system-specific knowledge and explore potential interventions to enhance retention rates.

CONCLUSION

- Retention of physiological knowledge varied across the different body organ systems. The overall decline of 15.2% aligns with finding observed in medical and allied health professional students (Pourshanzari et al., 2013). This decrease is marginally higher than the third year (Narnaware et al., 2023) and short term (4-month) retention rates reported for the same population (Narnaware et al., 2023a).

CONCLUSION CONTINUED

- Physiological knowledge loss in this study is significantly lower than recent anatomical knowledge loss reported in fourth year nursing students (Neumeier and Narnaware, 2023b). Although the level of retention is consistent with other disciplines, it raises the concern of how much physiological knowledge is lost by students throughout their program and registered nurses once they enter practice.
- Future studies can involve the development and evaluation of teaching strategies to increase the level of physiological knowledge retention in health disciplines.

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