



Abstract:

With the continued implementation of artificial intelligence (AI) into many workplace areas, understanding the role AI could take with Pathologists’ Assistants could lead to advancements in digital pathology and a decrease in workload and turn-around times. This project aims to evaluate and develop an accessible, standardized AI-driven tool to assist in specimen grossing according to established College of American Pathologists (CAP) protocols. Comparison of the dictation templates for a gallbladder and a benign uterus from ChatGPT and Gemini AI software to CAP protocols to determine their accuracy will drive the development of an AI-driven tool. The aim is to provide an AI software that provides CAP grossing protocols generated based on prompts as small as one word.

Both ChatGPT and Gemini provided adequate grossing guidelines for both specimens, however they required more detail in the prompt and either provided templates that did not capture variabilities or created templates that were too broad listing every variability possible. The AI bot that was created provided CAP protocols when given a specimen name, and it will ask necessary questions about variabilities only if needed. This allows for a concise, easy to follow template that includes only the required descriptions. If prompted, it also provides a random specimen with clinical history as a test specimen and will grade the given dictation and provide feedback allowing students to practice grossing templates.

Background:

AI has emerged as a promising tool to improve workflow efficiency. With the continued implementation of AI into many workplace areas, such as PathAI becoming popular in diagnostic practices^[1], integration into the Pathologists' Assistant workflow has the potential to be beneficial. Advancements in digital pathology are becoming more evident as PathAI is being praised for reducing the need for unnecessary tests, analyzes large amounts of data faster than humans, identifies people who might potentially acquire diseases through pattern detection, provides early diagnosis, and analyzes the medical history of a patient to offer personalized recommendations.^[1] While there are lots of emerging AI software’s showing great potential in the field of pathology, there are limited amounts of AI technology for Pathologists’ Assistants.

Rationale and Hypothesis:

This project aims to evaluate current AI tools that could be implemented into the Pathologists’ Assistants workplace, such as ChatGPT and Gemini. Based on these findings, an accessible, standardized AI-driven tool was developed and tested to assist in specimen grossing according to established CAP protocols. The goal was to determine whether a widely accessible AI tool for Pathologists' Assistants could be developed while maintaining CAP standards and HIPAA compliance. The tool will be designed to reinforce consistency, reduce variability, and support trainees and practicing Pathologists’ Assistants alike.

Methodology:

Using ChatGPT and Gemini AI platforms, a simple organ dictation template was asked to be provided. The organ of choice was the gallbladder. The prompt given to both software platforms will be “I am a Pathologists’ Assistant, and I am grossing a gallbladder. Please generate me a perfect dictation template for grossing it according to CAP protocols.” This prompt will be asked 10 different times, to check consistency. A comparison of their responses to CAP protocols will determine how accurate these templates are. Then a dictation template for a moderately complex specimen, such as a benign uterus will be asked and tested in the same manner.

Building upon these findings, their templates, and the compliance with CAP protocols, an original AI-driven tool will be created. The AI will be trained and provided specific specifications to ensure CAP grossing protocols can be generated based on prompts as small as one word. This system will allow Pathologists’ Assistants to input specimen-specific data, which then generates structured gross descriptions, inking templates, cassette summaries, and tips on what to look for, all guided by CAP protocols.

The second component of the AI focuses on helping Pathologists' Assistant students. They will be able to ask for a specimen to practice on, and the AI will provide a specimen with a clinical scenario and prompt the student to write a dictation. Following their input of the dictation, the AI will grade the response based on accuracy, included information, and CAP protocol and provide feedback allowing students to practice dictation and improve errors before practicing in the field.

Results:

ChatGPT:

ChatGPT generated more comprehensive templates for both specimens by addressing potential specimen variations and indicating where these findings should be incorporated into the gross description. The grossing templates that included variabilities were significantly longer and less organized, as they attempted to list every possible scenario. Other templates were concise and only provided the necessary template for a benign specimen, displaying inconsistency.

Gemini:

Gemini provided concise templates and did not describe the variabilities within the template. These variabilities were listed at the end without indicating where they should be incorporated into the gross description, which could lead to lack of proper placement into the dictation.

Both:

While both AI platforms described certain variabilities that could be encountered, they did not describe what would need to be done differently, such as inking protocols, sectioning differences, and if encountering a lesion/they failed to specify which margins should be measured, margins to include in sections, and how to submit lesions/masses. With the cassette summary, both AI models struggled, providing a different cassette summary almost every time the prompt was repeatedly asked. While both AI models provided adequate templates, they were inconsistent and occasionally left out key details and requirements.

PathAssistAI:

Using these results, the AI bot was created to try and combat these issues that were presented by ChatGPT and Gemini. The goal was to create an AI bot that is consistent, asks for specifications to create precise templates, provide an inking protocol, provide a cassette summary, and provide detailed instructions and key details of things that could be encountered. The bot was trained by providing CAP grossing dictation guideline documents and was instructed on how to react to certain prompts, what to provide, when to ask for details, and how to format the dictation templates.

The bot is titled “PathAssistAI” and was developed through prompt engineering and testing by providing a large language model with CAP grossing guidelines. The AI was trained to generate standardized grossing templates, cassette summaries, inking protocols, and educational feedback while asking follow-up questions only when necessary. Outputs were repeatedly evaluated and refined to improve consistency, accuracy, and usability for Pathologists' Assistants and students. Following development and testing, ChatGPT, Gemini, and PathAssistAI were analyzed and compared, as evident by *Figure 1*. PathAssistAI provided more consistent, standardized, and specimen-specific grossing guidance, including cassette summaries and inking protocols, more precise templates, all while requiring less detailed prompting.

	ChatGPT	Gemini	PathAssistAI
CAP Compliance	High	Moderate	High
Consistency	Variable	Variable	Stable
Cassette Summaries	Inconsistent	Inconsistent	Standardized
Inking Protocol	Missing	Missing	Present
Template Specificity	Broad	Simple	Concise

Figure 1. Comparison of the three AI software's

Student Application:

The second aspect of the bot was designed with students in mind. When prompted for a test specimen, the bot provides a random specimen with clinical history and will grade the given dictation and provide feedback allowing students to practice developing grossing templates. It will also grade any dictation provided without having to ask for a test specimen. Following the provided dictation template, PathAssistAI will provide a grade, strengths, areas of improvement, and missing information. This will allow students to practice their dictations and correct errors before practicing in the field.

Gallbladder Grossing Template

The specimen is received [fresh/in formalin], labeled with the patient's name, medical record number, and "[specimen label]." The specimen is a gallbladder measuring [] x [] **cm. The serosal surface is [smooth/granular/fibrous/notable findings], [tan-pink/green/color], and [no exudate or adhesions are identified/notable findings]. The cystic duct margin is taken prior to opening and measures []** cm in length and [] cm in diameter.

The gallbladder is opened along its length to reveal [clear bile/turbid bile/sludge/no contents]. The mucosal surface is [green/tan/yellow/color], [velvety/granular/trabeculated/description], and [no lesions are identified/notable findings]. The wall thickness measures [] cm. [No stones are identified/Stones are identified, ranging in size from ___ to ___ cm, and are [cholesterol/pigmented/mixed] in character.]

Figure 2. Demonstrates the gallbladder template given with the prompt “gallbladder” followed by “general”. Following the dictation, PathAssistAI provided an accurate cassette summary and a detailed “Blank Summary” that explains each option in the [] to allow for in depth understanding of the template.

Discussion:

One challenge associated with the integration of AI into healthcare is ensuring compliance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The rapid adoption of AI in healthcare has created a critical regulatory compliance gap^[2] due to the appealing ease and efficiency it provides. The use of publicly accessible AI platforms raises concerns regarding HIPAA compliance and data security. It is not clearly expressed whether AI platforms are approved to handle protected health information (PHI), which could expose physicians to HIPAA violations. This represents a limitation of using publicly accessible AI platforms such as ChatGPT and Gemini in the grossing laboratory, when entering specimen information and grossing specifications. This was a key point in the creation of PathAssistAI in understanding how to develop and maintain a HIPAA-compliant AI tool.

There are health care institutions that have successfully implemented AI usage into their workplace and ensure their practitioners and physicians remain HIPAA compliant. These institutions use something called a Business Associate Agreement (BAA). The BAA contractually extends HIPAA’s privacy and security obligations to the third-party vendor. ^[2] If a physician uses an AI tool without institutional safeguards, such as a BAA, the disclosure of patient data may constitute a HIPAA violation, even if the intent was to improve care. ^[2] This shows the importance of BAAs and understanding how health care institutions can make the use of AI safer in practice. Creating a safer AI bot or encouraging the implementation of institutional safeguards into hospital settings can help ensure that AI is being used safely and effectively. Safe, HIPAA compliant AI platforms are possible, such as PathAI undergoing strict monitoring and management to guarantee the security of PHI.^[1]

Conclusion:

This study demonstrated that general-purpose AI models, such as ChatGPT and Gemini, can generate grossing templates but often require detailed prompts and produce inconsistent results. To address these limitations, PathAssistAI was developed using CAP grossing guidelines to provide standardized templates, cassette summaries, and specimen-specific guidance minimal user input. The platform was designed with HIPAA compliance considerations in mind, emphasizing secure handling of patient information and responsible AI implementation in healthcare settings.

Additionally, the platform offers educational feedback to support Pathologists' Assistant education and training. These findings suggest that pathology-specific AI tools have the potential to improve workflow efficiency, consistency, and educational outcomes while maintaining adherence to established grossing standards.

An AI developed specifically for Pathologists’ Assistants could improve efficiency by providing standardized, pathology-focused guidance without the distractions of unrelated information. By generating consistent templates from simple prompts, it could reduce variability, simplify workflows, and enhance the user experience.

References:

[1] BHARDWAJ, S. (2025). PathAI: From diagnosis to treatment. *AI-Personalized Medicine Therapy*, 330 - 358.

[2] Schoolcraft, D., Meltzer, A. C., Sangal, R., Terry, A. T., Robertson, K., Buckland, D., ... & Waseem, T. (2026). Health insurance portability and accountability act liability in the age of generative artificial intelligence. *JACEP Open*, 7(2), 1-7.