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Review

Same automation pressure, divergent outlooks: human resource development deficits associated with the stagnant employment outlook for Korean pharmacists in the age of Artificial Intelligence

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Abstract: Artificial intelligence (AI) and automation are reshaping the health workforce, yet projected employment differs across professions. The 2025–2035 qualitative job outlook published by the Korea Employment Information Service categorizes occupations using mean annual employment changes from its 2023–2033 quantitative projection. These changes are +2.7% for nurses, +1.9% for physicians and dentists, +1.7% for radiological technologists, +1.6% for Korean medicine doctors, +1.5% for clinical laboratory technologists, and +0.5% for pharmacists. Pharmacists alone among these seven professions are categorized as maintaining their current employment level, a downgrade from the previous edition. The outlook lists AI-driven automation as a decreasing factor for nurses, radiological technologists, and clinical laboratory technologists as well, although their projected growth remains positive. This narrative review combines policy and document analysis, an analysis of the national health insurance fee schedule effective 1 September 2026, and a comparison of pharmacy curricula to examine institutional characteristics that may help explain this divergence. Three interrelated features of pharmacist human resource development (HRD) are identified. First, 257 of 281 community pharmacy billing codes (91.5%) are dispensing fees tiered by days' supply; medication counseling is the sole explicitly cognitive service among the six pharmacy fee categories. Second, professional development infrastructure was established later than for physicians and nurses, and a national specialist pathway for community practice is planned but not yet operational. Third, the extension of pharmacy education to six years substantially expanded experiential training, while school-based preparation remains limited in the curricula examined. No objective comparison of the outcomes of four- and six-year graduates was identified in this review. These features may help explain the divergence but have not been shown to cause the employment projection. An HRD agenda linking professional development, remunerated services, community specialization, and AI competencies is proposed.

Keywords: human resource development; health workforce planning; pharmacy education; continuing professional development; remuneration; automation; South Korea

1. Introduction

Artificial intelligence (AI) and automation are changing the composition of work in almost every occupation, and health care is no exception (Frey and Osborne, 2017). For human resource management (HRM), the key question is not whether a profession is exposed to automation but how its members, employers, and institutions respond: which tasks are reallocated, which new tasks are created, and whether the workforce is developed to perform them (Budhwar et al., 2023). Human capital theory predicts that the returns to a workforce depend on continued investment in its

skills (Becker, 1993), and the sociology of professions describes how occupations that fail to claim new tasks lose jurisdiction to competitors or to technology (Abbott, 1988).

On 29 April 2026, the Korea Employment Information Service (KEIS) released its 2025–2035 qualitative job outlook for 182 occupations (Korea Employment Information Service, 2026). Among the licensed professions that work most closely with pharmacists in patient care, the outlook projects employment growth for all except one: pharmacists, whose outlook was downgraded from "slight increase" to "maintain current level." The contrast is striking because the same report lists AI-driven automation as a decreasing factor for nurses, radiological technologists, and clinical laboratory technologists, all of whom are nevertheless projected to grow. Automation alone therefore cannot explain why pharmacists stand apart.

The question matters for workforce planning because Korean pharmacy has expanded rapidly. The number of colleges of pharmacy increased from 20 to 37 after 2011, the length of education was extended to six years, and the majority of the profession is concentrated in community pharmacies whose revenue depends on dispensing (Son, 2025). At the same time, automated dispensing systems are spreading in hospitals and pharmacies, and AI tools are being introduced for drug interaction checking, medication review, and adherence support (Batson et al., 2021; Chalasani et al., 2023). If the patient-care tasks that only pharmacists can perform are not clearly defined, if colleges of pharmacy do not develop within the six years of education the patient-centered competence needed to perform these tasks independently from the first day after licensure, and if the health system does not remunerate this professional expertise, a larger and longer-educated workforce may face a narrower scope of paid work.

The purpose of this review is to examine institutional characteristics of pharmacist human resource development (HRD) that may help explain the stagnant employment outlook of Korean pharmacists, and to propose an HRD agenda linking pharmacy education, continuing professional development (CPD), and remuneration in the AI era. The analysis is interpretive: it identifies associations and proposes a conceptual framework rather than establishing causal relationships.

2. Materials and methods

2.1. Design and type of analysis

This article is a narrative review combined with structured document analysis. It integrates four components: (i) a policy analysis of the national employment outlook and of the statutes governing specialist certification and continuing education; (ii) a descriptive analysis of the national health insurance fee schedule at the level of billing codes; (iii) a comparison of pharmacy curricula before and after the six-year reform; and (iv) a narrative synthesis of peer-reviewed literature on pharmacy workforce, education, and automation. No systematic review protocol was registered, and no meta-analysis was performed. The study used publicly available documents and aggregated data, and did not involve human participants; ethical approval was therefore not required.

2.2. Document sources and search strategy

Searches were conducted between March and September 2026. Peer-reviewed literature was identified in PubMed, Scopus, and the Korea Citation Index using combinations of the terms pharmacist, pharmacy education, health workforce,

continuing professional development, specialist pharmacist, remuneration, reimbursement, automation, and artificial intelligence, in English and Korean, with no restriction on publication year. Articles were included when they reported on the Korean pharmacy workforce or education, on international remuneration or practice models relevant to that context, or on automation and AI in pharmacy practice; articles limited to clinical outcomes of specific drug therapies were excluded. Official documents were retrieved directly from the issuing bodies: the Korea Employment Information Service for the 2025–2035 qualitative job outlook and the 2023–2033 quantitative projection, the Health Insurance Review and Assessment Service for the fee schedule, the Ministry of Health and Welfare for press releases and legislative notices, the Korea Law Information Center for statutes and enforcement rules, and individual colleges of pharmacy for curriculum tables. Professional and news sources were used only for recent developments that are not yet covered by official statistics or peer-reviewed studies, such as fee negotiations concluded in 2026 and association surveys; each such item was checked against the original announcement or a second independent outlet where one was available, and is identified as a professional or news source in the reference list.

2.3. Analysis of the fee schedule

The fee schedule file effective 1 September 2026 was analyzed as distributed by the Health Insurance Review and Assessment Service. Only the insured (benefit) sheets were counted. For each sector, the number of billing codes, of distinct fee classification numbers, and of base codes (the first five characters of a billing code) was tabulated, and pharmacy codes were grouped into fee categories using the classification numbers of the schedule. Code counts describe how finely services are itemized. They do not measure expenditure, service volume, or workforce intensity, and are interpreted accordingly in Section 4.

2.4. Comparison of curricula

Curricula were compared using official tables published by colleges of pharmacy. Current 2+4 and integrated six-year curricula were eligible when publicly available itemized tables reported credit values for required major courses; image-only tables or summary totals were not suitable for consistent extraction. Eight post-reform curriculum tables from six colleges met this criterion: two 2+4 and six integrated six-year curricula. They include public and private institutions within and outside the Seoul metropolitan area. Separately, the 2005 graduating cohort at Duksung Women's University was the one pre-reform four-year curriculum for which the author had complete, verifiable credit records. The analysis therefore covers seven distinct universities but only one pre-reform university, and does not represent all programs before the reform. Courses were classified as clinical or practice related when titles and available descriptions indicated pharmacotherapy, clinical pharmacy, pharmaceutical care, dispensing, clinical pharmacokinetics, patient counseling and communication, or on-campus practice laboratories; social pharmacy, law, management, and basic-science courses carrying a clinical label were excluded. The author performed the classification. It was not independently double-coded, and no formal sensitivity analysis of borderline course assignments was conducted.

2.5. Comparator professions

Six licensed professions whose members work most closely with pharmacists in patient care were selected for comparison: physicians, dentists, Korean medicine doctors, nurses, radiological technologists, and clinical laboratory technologists.

Korean herbal pharmacists were excluded because the quantitative projection pools them with pharmacists.

3. Divergent employment outlooks among Korean health professions

The KEIS outlook assigns each occupation to one of five categories anchored on the projected mean annual change in employment for 2023–2033: increase (>2%), slight increase (1%–2%), maintain (−1% to <1%), slight decrease (−2% to −1%), and decrease (<−2%). Increasing and decreasing factors are then described qualitatively under five headings: population structure, values and lifestyle, science and technology, industry structure, and law and policy (Korea Employment Information Service, 2026). **Table 1** and **Figure 1** summarize the seven professions.

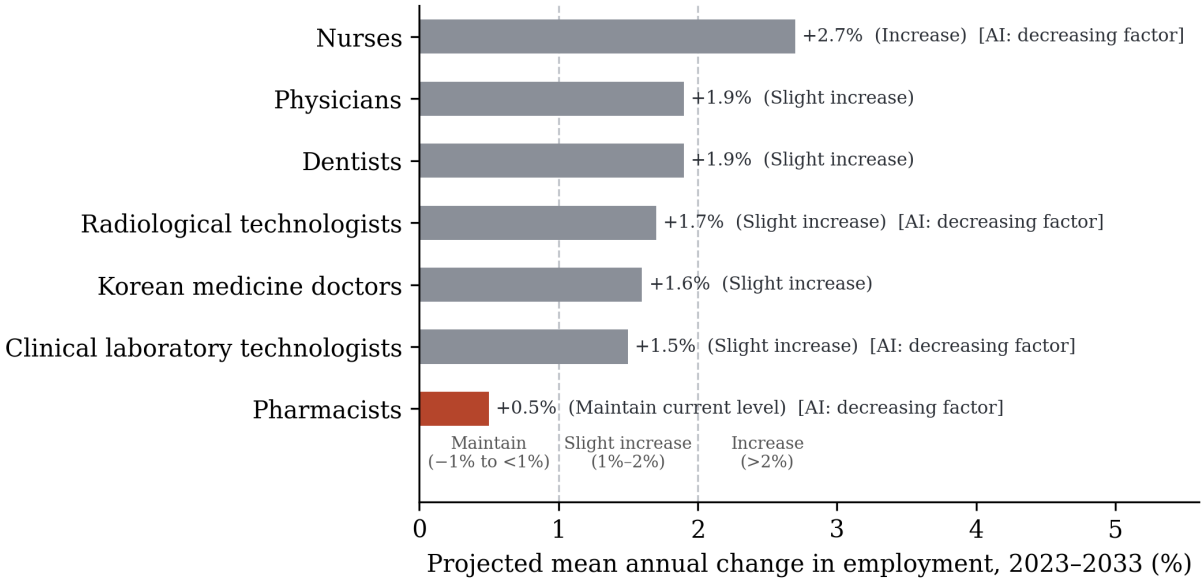


Figure 1. Projected mean annual change in employment (2023–2033) and 2025–2035 outlook category for seven licensed health professions in Korea. Dashed lines mark the category thresholds. "AI: decreasing factor" indicates that the outlook lists AI-driven automation among the decreasing factors. Source: Korea Employment Information Service (2025, 2026).

Table 1. Employment outlook, projected growth, and listed increasing and decreasing factors for seven licensed health professions.

Profession	Outlook(previous → 2025)	Annual change	Incumbents expecting decrease	Main increasing factors	Decreasing factors
Nurses	Increase → Increase	+2.7%	26.7%	Ageing; health-care industry growth; integrated nursing–care service; legal recognition of physician-assistant nurses	Automation of some tasks by AI
Physicians	— → Slight increase [a]	+1.9%	50.0% [b]	Ageing; medical tourism; essential and primary care policies	Low fertility (selected specialties); concentration on specialists

Continuation Table:

Profession	Outlook(previous → 2025)	Annual change	Incumbents expecting decrease	Main increasing factors	Decreasing factors
Dentists	Increase → Slight increase	+1.9%	36.7%	Ageing; aesthetic and preventive demand; insurance coverage of implants	Low fertility
Korean medicine doctors	Increase → Slight increase	+1.6%	30.0%	Ageing; government promotion of Korean medicine	Lower use by younger people; competition
Radiological technologists	Slight increase → Slight increase	+1.7%	42.9%	Ageing; advanced imaging; AI-enabled specialization of roles; coverage of MRI and ultrasound	AI-based automation
Clinical laboratory technologists	Slight increase → Slight increase	+1.5%	53.3%	Ageing; health screening; molecular diagnostics; infection control	Automation of analyzers and AI
Pharmacists	**Slight increase → Maintain**	**+0.5%** [c]	**60.0%**	**Ageing and polypharmacy; health interest; pharmaceutical industry roles; medical tourism; insurance coverage**	**AI-based dispensing automation**

[a] Specialist physicians were newly separated in 2025; general physicians were rated "slight decrease" in the previous edition. [b] General physicians. [c] Pooled with Korean herbal pharmacists in the quantitative projection. Incumbents expecting decrease: share of about 30 surveyed incumbents answering "decrease somewhat" or "decrease greatly" for employment ten years later. Source: Korea Employment Information Service (2025, 2026).

Three observations follow. First, AI is not unique to the pharmacist outlook. It appears as a decreasing factor for nurses, radiological technologists, and clinical laboratory technologists, and for radiological technologists the same report also lists AI as an increasing factor because it specializes the role. The report describes physicians' AI exposure as a change in role toward higher-order care rather than as a loss of jobs. For pharmacists, by contrast, AI is framed only as a substitute for dispensing.

Second, what distinguishes the growing professions is the presence of institutionalized new demand in the increasing factors. For nurses, the listed factors include the integrated nursing–care service and the legal recognition of physician-assistant nurses; for radiological technologists and clinical laboratory technologists, new insurance-covered examinations and diagnostic fields. The pharmacist entry lists demand-side trends (ageing, polypharmacy, interest in health) but no new service that is financed by the health system. The narrative mentions the growing need for polypharmacy management and medication counseling, yet these appear as needs

rather than as remunerated roles.

Third, pharmacists themselves are the most pessimistic group. In the incumbent survey, 60.0% of pharmacists expected employment to decrease within ten years and only 20.0% expected an increase, compared with 26.7% and 36.6%, respectively, among nurses. It should be noted that the outlook category is anchored on the quantitative projection rather than on the qualitative factors, which are written afterwards. The qualitative factors therefore describe, rather than determine, the difference in projected growth. Their value for this review is that they show which institutional levers other professions have and pharmacists lack.

4. Product-based remuneration and unpaid professional services

4.1. Structure of the pharmacy fee schedule

Since the separation of prescribing and dispensing in 2000, community pharmacies in Korea have been paid through a small set of dispensing-related fees. The HIRA fee schedule effective 1 September 2026 was analyzed (**Table 2**, panel B). The pharmacy sheet contains 281 billing codes that collapse into 39 base codes and six fee categories: pharmacy management fee, dispensing base fee, medication counseling fee, dispensing fee, drug management fee, and night dispensing management fee. Of the 281 codes, 257 (91.5%) are dispensing fees tiered by days' supply (individually for 1–15 days, then in bands up to 91 days or more) and by route. Only one category, the medication counseling fee (1,150 KRW per visit in 2026; 7 codes, 2.5%), remunerates a cognitive service, and it is charged per visit regardless of the complexity of the patient's regimen.

Table 2. Community pharmacy fees in the national health insurance fee schedule: (A) size relative to all insured fee codes and (B) structure of pharmacy fees (fee schedule effective 1 September 2026).

(A) Insured fee codes by sector

Sector	Billing codes, n	Share of all insured codes	Classification items, n	Base codes, n
Medical and dental	413,662	98.82%	7,675	9,072
Korean medicine	4,663	1.11%	310	618
Community pharmacy	**281**	**0.07%**	**39**	**39**
Total	**418,606**	**100.00%**	**8,024**	**9,729**

(B) Structure of community pharmacy fees

Fee category	Unit	Base fee (KRW)	Billing codes, n (% of pharmacy; % of all)	Nature of the service
Pharmacy management fee	Per visit	790	2 (0.7; <0.01)	Overhead
Dispensing base fee	Per visit	1,720	12 (4.3; <0.01)	Dispensing (time and age add-ons)
Medication counseling fee	Per visit	1,150	7 (2.5; <0.01)	Cognitive service
Dispensing fee	Per days' supply and route	1,810–16,650 [a]	257 (91.5; 0.06)	Dispensing volume
Drug management fee	Per visit	680 (950 with narcotics)	2 (0.7; <0.01)	Product handling

Continuation Table:

Fee category	Unit	Base fee (KRW)	Billing codes, n (% of pharmacy; % of all)	Nature of the service
Night dispensing management fee	Per visit	4,310	1 (0.4; <0.01)	Extended hours [b]
Pharmacy total			**281 (100.0; 0.07)**	

Only insured (benefit) sheets were counted; non-covered items and full-copayment items were excluded. Billing codes include add-on variants (night, holiday, Saturday morning, age <6 years, late night). Classification items are distinct fee classification numbers; base codes are the first five characters of the billing code. % of all, share of the 418,606 insured billing codes. [a] Oral prescriptions, 1 day to ≥91 days. [b] Partner pharmacies of pediatric night clinics. Source: the author's analysis of the HIRA fee schedule file effective 1 September 2026.

Across the whole schedule, the 281 pharmacy codes represent 0.07% of the 418,606 insured billing codes, against 413,662 codes (98.82%) and 7,675 classification items for medical and dental care and 4,663 codes for Korean medicine (**Table 2**, panel A). This contrast should be read with care. The number of codes reflects how finely a sector's services are itemized in the schedule; it is not a measure of the economic value, the volume, or the workforce intensity of those services, and it partly reflects the broader range of procedures performed by physicians and dentists. A profession may be well remunerated through a small number of high-value codes. What the counts do describe is the granularity with which each sector's professional work is recognized as distinct, billable activity, and on this descriptive measure community pharmacy is represented by six fee categories, of which one corresponds to a cognitive service. A comparable pattern is visible in the wording of the schedule: the Korean term for nurse (*ganhosa*) appears in 93 fee classification items, most of which link payment to nurse staffing levels, whereas the term for pharmacist (*yaksa*) appears in none.

4.2. Services performed without remuneration

Korean pharmacists already deliver several services that are paid for elsewhere. Community pharmacists intervene in prescriptions, and an analysis presented by the Korean Pharmaceutical Association in 2026 estimated about 3.06 million prescription changes per year resulting from such interventions, none of which is separately reimbursed (Daily Pharm, 2026a). Drug utilization review checks at dispensing carry no fee. The polypharmacy management program for older adults has been run by the National Health Insurance Service as a pilot since 2018 and has not become a regular benefit; pharmacists participating in it cite insufficient time and inadequate incentives (Kim, 2025). Under the integrated community care system in force since March 2026, medication counseling and polypharmacy management are financed as municipal programs rather than as insurance benefits (Daily Pharm, 2026b). In hospitals, the antimicrobial stewardship pilot launched in November 2024 is the first program to set staffing requirements that include pharmacists (Jang and Kim, 2025).

This pattern is consistent with the international finding that pharmacy remuneration remains largely tied to products and therefore gives little incentive to change practice (International Pharmaceutical Federation, 2015). Where pharmacist services have become remunerated, they were preceded by outcome evidence. The English New Medicine Service improved adherence in a randomized trial and was shown to be cost-effective before being scaled nationally (Elliott et al., 2016, 2017).

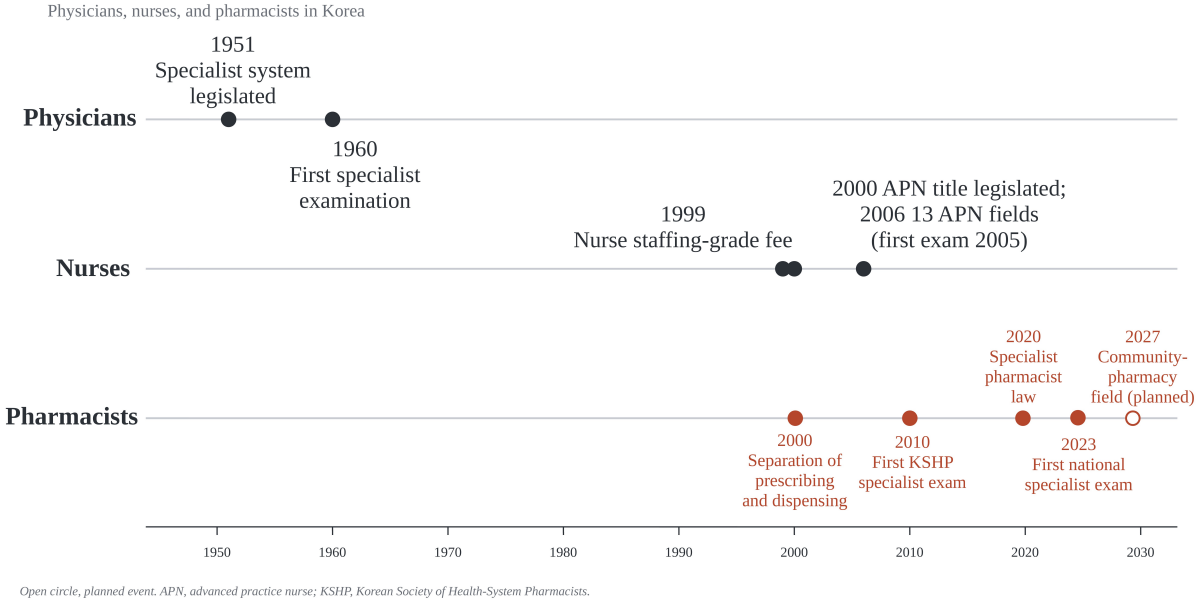
In Korea, the 2027 pharmacy fee increase of 3.7% was the largest since the separation of prescribing and dispensing, but it raised the unit price of existing items (Daily Pharm, 2026c) rather than adding new service items. From an HRM perspective, a remuneration system that pays for the task that automation performs best, and not for the tasks that require professional judgement, provides neither employers nor individual pharmacists with a reason to invest in new competencies.

The same asymmetry is found inside hospitals. Hospital pharmacists provide pharmacokinetic consultation, nutrition support, oncology and transplant pharmacotherapy, and participation in multidisciplinary teams. Systematic reviews and meta-analyses report that pharmacist participation in care teams is associated with improved therapeutic and safety outcomes, including fewer adverse drug events (Chisholm-Burns et al., 2010; Lee et al., 2019; Kelly et al., 2024), although the patient outcomes of these services in Korea are not estimated in the present fee-schedule analysis. In the fee items identified in the schedule analyzed here, pharmacists are not named as required members of multidisciplinary counseling or care teams. The medication dispensing chapter of the hospital fee schedule contains 69 items, of which 63 are dispensing fees tiered by days' supply and six are aseptic compounding fees, with no item for clinical pharmacy services. Pharmacy departments also receive no night or holiday add-on for dispensing even though other hospital services do (Daily Pharm, 2026d). This limited itemization may restrict the direct billing rationale for new clinical pharmacist positions. A survey of certified specialist pharmacists separately found weak economic rewards and promotion opportunities (Park et al., 2026).

5. Delayed infrastructure for professional development

Specialist certification and mandatory continuing education are the two main institutional channels through which a profession develops its workforce after licensure. **Figure 2** compares their timelines.

Figure 2. Timeline of professional development infrastructure



Open circle, planned event. APN, advanced practice nurse; KSHP, Korean Society of Health-System Pharmacists.

Figure 2. Timeline of professional development infrastructure for physicians, nurses, and pharmacists in Korea. The open circle marks a planned event. APN, advanced practice nurse; KSHP, Korean Society of Health-System Pharmacists.

The specialist system for physicians was legislated in 1951, and the first specialist examination was held in 1960. Nurses obtained the legal title of advanced practice nurse in 2000; the number of fields reached 13 by 2006, and the first certification examination was held in 2005 (Kwon et al., 2021). Pharmacy specialization began as a voluntary certification by the Korean Society of Health-System Pharmacists in 2010. National specialist pharmacists were introduced by an amendment to the Pharmaceutical Affairs Act in 2020, and the first national examination was held in December 2023 (Hirata, 2026). As of 2026, 1,073 national specialist pharmacists had been certified in nine fields (Nam et al., 2026), almost all of them in hospital practice. A field for community pharmacy practice is planned for 2027. About 73% of the 39,925 active members of the Korean Pharmaceutical Association work in community pharmacies (Korean Pharmaceutical Association, 2026), which means that the large majority of pharmacists still have no specialist pathway.

Even where specialization exists, it is weakly connected to employment rewards. A 2024 national survey of certified specialist pharmacists found that participation in specialty-related clinical work reached 64% in the year of certification but fell to 32% six years later, and that economic rewards and promotion opportunities received the lowest satisfaction ratings (Park et al., 2026). Advanced practice nurses likewise have no dedicated fee (Kwon et al., 2021), which indicates that certification without remuneration is not sufficient; nurses, however, benefited from staffing-linked fees that made nursing labor itself a remunerated input.

Mandatory continuing education shows the same gap. Under the Enforcement Rule of the Medical Service Act, physicians and nurses must complete at least eight hours per year, whereas the Enforcement Rule of the Pharmaceutical Affairs Act requires six hours for pharmacists. Neither system links CPD to competency assessment or to the delivery of remunerated services.

Weak HRD is also visible in retention. The turnover rate of Korean hospital pharmacists was 18.0% in 2022, higher than the 8.6%–17% reported abroad (Nam et al., 2026). A recent survey reported a 39% turnover rate among employed community pharmacists, and their turnover intention was associated with job stress and lack of social support (Yang and Lee, 2026). High turnover reduces employers' return on training and reinforces reliance on dispensing tasks that require little organization-specific skill.

6. Pharmacy education reform: structure versus content

Korea extended pharmacy education from four to six years through the 2+4 system, with the first entry in 2011, and converted almost all colleges to an integrated six-year program from 2022 (Hirata, 2026). The two formats share the same structure of two pre-pharmacy years followed by four years of professional education; they differ mainly in the admission route, from transfer after two years of university study to direct entry from high school. The conversion to the integrated format therefore did not in itself require a new curriculum, and the integrated curricula examined here differ from their 2+4 predecessors by only two didactic clinical credits. The number of colleges increased from 20 to 37, and the annual intake rose accordingly (Hirata, 2026; Son, 2025). The stated purpose of the extension was to strengthen clinical pharmacy education, and the most visible change was the introduction of experiential training of about 1,400–1,600 hours in hospitals, community pharmacies, industry, and government (Ministry of Health and Welfare, 2013).

The relevant comparison is therefore between the four-year curriculum before the reform and the post-reform curricula. Using the criteria set out in Section 2.4, the clinical and practice-related credits in eight post-reform curricula from six colleges were compared with the four-year curriculum of Duksung Women's University in 2005 (**Table 3**). Because only one pre-reform curriculum was available, this comparison is exploratory and illustrative rather than representative of all Korean programs before the reform. Clinical and practice courses were defined as pharmacotherapy, clinical pharmacy, pharmaceutical care, dispensing, clinical pharmacokinetics, patient counseling and communication, and on-campus practice laboratories; social pharmacy, law, management, and basic-science courses with a clinical label were excluded.

Table 3. Clinical and practice-related content in four-year, 2+4, and integrated six-year pharmacy curricula.

Program (college, cohort)	Required major credits	Didactic clinical/practice credits	Required experiential credits	Didactic share	Share incl. experiential
Four-year (Duksung, 2005) [a]	120	0	0	0.0%	0.0%
2+4 (Hanyang)	120	16	18	13.3%	28.3%
Integrated six-year (Hanyang, 2025–)	168	18	18	10.7%	21.4%
2+4 (Chung-Ang)	146	19	16	13.0%	24.0%
Integrated six-year (Chung-Ang, 2024–)	≈187	21	16	11.2%	19.8%
Integrated six-year (Yonsei, 2022–)	128	19	15	14.8%	26.6%
Integrated six-year (Kyung Hee, 2026)	175	17	16	9.7%	18.9%
Integrated six-year (Sahmyook, 2026)	169	20	17	11.8%	21.9%
Integrated six-year (Seoul National, 2022–)	110 [b]	16	15	14.5%	28.2%

Didactic share = didactic clinical/practice credits ÷ required major credits. Share incl. experiential = (didactic clinical/practice credits + required experiential credits) ÷ required major credits. Values are rounded to one decimal place; the approximate denominator for the integrated program at Chung-Ang yields an approximate percentage. Credit values understate contact time: credits for experiential training are awarded at a reduced rate relative to the hours actually completed, so the 15–18 required credits correspond to approximately 1,400–1,600 hours of supervised placement. [a] Four-year program, 2005 graduating cohort; no required credit-bearing clinical or practice course and no credit-bearing experiential training were counted under this classification. [b] Required major courses only. Source: the author's analysis of official curriculum tables.

The expansion of experiential training is the clearest achievement of the reform. In the 2005 four-year curriculum, none of the 120 required major credits was allocated to credit-bearing experiential training; in the six-year curricula, 15–18 required credits are, which in practice devotes most of the final year to placements in hospitals, community pharmacies, and other settings. This is an encouraging change toward teaching pharmacy practice where it occurs. School-based preparation for these placements, however, has not expanded in proportion. Across the six-year curricula, required didactic clinical and practice courses account for only about 10%–15% of required major credits, or roughly one credit in ten, during the five years that precede the final-year placements. Beyond the on-campus counseling examination

recommended in the 2021 standard curriculum (Veritas Alpha, 2021), the standard curriculum does not define structured pre-placement practice, patient case analysis, or simulation with standardized patients as required components. Students therefore enter advanced placements with limited prior practice in the patient-care tasks those placements are meant to consolidate, and the burden of basic training falls on hospital preceptors, who report high stress and modest self-rated competence as educators (Seo et al., 2018). The Korean Pharmaceutical Association also criticized the 2021 standard curriculum for reducing experiential hours (Daily Pharm, 2021b).

The licensing examination reinforces this balance. Since 2015, clinical and practice subjects have accounted for 140 of 350 items (40%), and law for 20 items, with the remainder in life and industrial pharmaceutical sciences (Daily Pharm, 2021a). A skills-based component has not been introduced, although 60% of surveyed pharmacists and faculty judged it necessary (Kim et al., 2017).

International frameworks define the outcome of pharmacy education in terms of competencies rather than years. The FIP Global Competency Framework describes the pharmaceutical public health, pharmaceutical care, organization and management, and professional and personal competencies expected of early-career pharmacists and is intended to connect initial education with workplace development (International Pharmaceutical Federation, 2020b). The FIP Development Goals similarly treat education, early-career training, advanced practice, and CPD as a single continuum (International Pharmaceutical Federation, 2020a). In Korea, however, the competency statements of the standard curriculum are not linked to post-licensure development, and the experiential year is the only point at which education and workplace training meet.

No study objectively comparing four-year and six-year Korean pharmacy graduates on licensing performance, clinical competence, patient outcomes, or employer ratings was identified in this review. A 2021 survey of 562 pharmacists reported that 68% perceived little difference in professional competence between graduates of the two programs (Korean Pharmaceutical Association News, 2021). A survey of four-year graduates identified perceived curricular gaps rather than measured performance (Yoo et al., 2014), and international comparisons of BPharm and PharmD graduates have also relied on self-reported outcomes (Suttajit et al., 2018; Supapaan et al., 2019). Graduates of the 2+4 program predominantly entered community pharmacy (Park and Kang, 2021), and students at one institution reported a preference for community pharmacy (Noh and Son, 2025). A separate study associated the expansion of colleges with increased income among pharmacy owners but not employed or hospital pharmacists (Son, 2025). These sources cannot establish whether the additional education improved graduate competence; a direct national outcome evaluation would be needed.

7. Discussion

7.1. A proposed reinforcing loop of under-investment

The three features described above can be read as parts of a single self-reinforcing process. The model in **Figure 3** is proposed by the author as a conceptual framework; it organizes the documentary findings but has not been tested empirically, and each link should be regarded as a hypothesis for future research.

The framework posits the following sequence (**Figure 3**). Product- and volume-based remuneration may leave few routes through which cognitive services can be billed. Where such services are not financed, employers may have less incentive

to invest in developing them. Limited service delivery may in turn yield little documented outcome evidence, which is the evidence that supports negotiations for new fee items. Automation could then concentrate its effect on the dispensing task, which is the task that is remunerated. Read in human capital terms (Becker, 1993), the framework suggests that investment may have gone into the length of initial education rather than into the continuing, service-linked skills that determine the value of labor as technology changes. Each of these links is a proposition derived from the documents reviewed here. None is established as a causal relationship by this review, and each would need to be tested with longitudinal or comparative data.

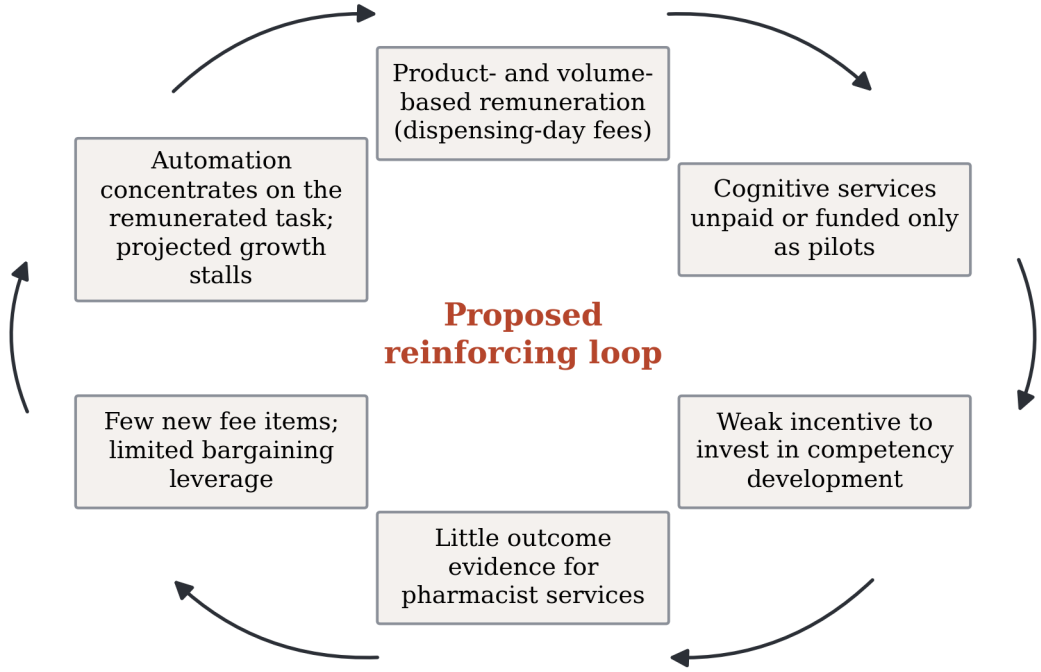


Figure 3. Proposed conceptual framework linking remuneration, human resource development, outcome evidence, and the employment outlook. The framework is an interpretation advanced by the author and has not been empirically tested; each arrow represents a hypothesized rather than a demonstrated relationship, and the labels in the boxes state the propositions of the framework rather than observed outcomes. Entry points for intervention are fee-linked continuing professional development, specialist tracks for community practice, an outcome-focused curriculum, and AI competencies. AI, artificial intelligence; CPD, continuing professional development; HRD, human resource development.

The comparison with nurses is instructive. The nursing outlook lists automation as a decreasing factor, while also listing staffing-linked fees, the integrated nursing–care service, and the legal recognition of expanded roles among the factors expected to increase employment (Korea Employment Information Service, 2026). In each of those instances, a task was defined, attached to a workforce standard, and financed. These observations are consistent with Abbott's (1988) account of how professions extend their jurisdiction, but they do not establish that the policies caused the difference in projected employment between the two professions.

7.2. Implications for AI-driven human resource management

Among the seven professions compared, pharmacists alone are placed in the maintain-current-level category, and AI-based dispensing automation is the only decreasing factor listed for them. Nurses, radiological technologists, and clinical

laboratory technologists also have automation listed as a decreasing factor, yet their projected growth is positive. The documents reviewed here suggest where the difference lies. In the fee schedule examined, dispensing dominates community pharmacy codes while patient-care activities have few distinct fee categories. In the curricula examined, required didactic clinical and practice courses occupy about one credit in ten before the final-year placements. A further gap is that fifteen years after the reform, no national evaluation of its outcomes has been conducted, so the profession cannot demonstrate what the additional education produced. These are features of the institutional environment rather than measured causes of the projection.

The case is not specific to pharmacy. It illustrates a general proposition for HRM: under automation, four elements operate together, namely remuneration, skill development, career pathways, and task redesign. Remuneration defines which tasks an organization is paid for and therefore which skills it is willing to finance. Skill development determines whether the workforce can perform the tasks that technology performs poorly. Career pathways, including specialization and promotion, determine whether those skills are retained in the occupation rather than leaving it. Task redesign determines how work is divided between people and machines. Where the four are aligned, as the nursing case suggests, automation can displace specific tasks while employment continues to grow. Where remuneration remains attached to the automatable task and the other three elements are undeveloped, the profession is exposed at the point where technology is strongest. The practical implication is that workforce planning in automating occupations should start from the question of which tasks are financed, and should treat skill development, career structure, and job design as instruments to be moved together. This proposition is offered for empirical testing in other professions and health systems.

For pharmacy, this implies changing the design of pharmacist development rather than accepting displacement. The six-year program provides sufficient time to develop patient-centered pharmaceutical care as a distinct professional capability, provided that its content is organized for that purpose. Within an HRD framework, education, licensure, CPD, and specialization form one developmental pathway rather than separate stages (International Pharmaceutical Federation, 2020a, 2020b). Task redesign means assigning product verification to automated systems and technicians while pharmacists take responsibility for medication review, follow-up, and team-based care (American Pharmacists Association, 2018). Performance management means measuring the outcomes of pharmacist services, which are also the evidence required to justify their remuneration. AI can support this development: learning analytics in colleges and workforce analytics in pharmacy departments can identify competency gaps early and target training, provided that data governance and fairness are addressed. Specific measures are set out in Section 9.

7.3. Digital transformation of medication services

The transition to digital care is a further context for pharmacist HRD. During the COVID-19 period, Korea permitted temporary telehealth consultations, and about 36.6 million consultations were provided to 13.8 million patients between February 2020 and January 2023; in a survey of users, 77.8% were satisfied and 87.8% intended to use the service again (Ministry of Health and Welfare, 2023). The Medical Service Act was amended in December 2025 to institutionalize telehealth from December 2026, while home delivery of medicines remains limited to specific patient groups (Ministry of Health and Welfare, 2025). The Korean Pharmaceutical

Association has raised concerns about medicine quality during delivery, misuse, and dependence on commercial platforms, and these concerns deserve careful policy consideration.

International experience offers a further context for pharmacist HRD. Japan combined the legalization of online medication counseling, which took effect in September 2020 under the amended Pharmaceuticals and Medical Devices Act, and the national electronic prescription service, which began operating in January 2023, with a policy shift of pharmacists from product-centered to patient-centered work (Ministry of Health, Labour and Welfare of Japan, 2015, n.d.-a, n.d.-b; Takamura et al., 2021). That shift was supported by a certification system for community-linked and specialized-care-linked pharmacies introduced in August 2021 and by dispensing-fee revisions that moved weight from dispensing to pharmaceutical care management (Ministry of Health, Labour and Welfare of Japan, 2021, 2022). Evidence on patient outcomes of these arrangements is still developing; a recent national study of the family pharmacist system found no overall difference in mortality or hospitalization (Iketani and Imai, 2026). In England, the Pharmacy First service, launched in 2024, pays community pharmacists to manage common conditions and is being evaluated nationally (Glover et al., 2025). Technology-focused reports describe telepharmacy and automation as ways to release pharmacist time for patient care (American Pharmacists Association, 2018; International Pharmaceutical Federation, 2023). For Korea, remote counseling, digital medication monitoring, and collaboration across care settings are the competencies that this transition will require, whatever the final policy on home delivery.

7.4. Limitations

This review has several limitations. First, it is an interpretive narrative review. The employment projections do not isolate the effects of remuneration or HRD, and the framework in **Figure 3** remains untested. Second, counts of fee codes and classification items indicate how services are itemized, not their economic value, frequency of use, or workforce intensity. Third, **Table 3** contains eight post-reform curricula from six colleges but only one pre-reform four-year curriculum, and selection depended on the availability of itemized records, which may favor institutions with more transparent documentation. A single author classified the courses, without independent double coding or a formal sensitivity analysis. Fourth, several recent developments are supported by government announcements, professional publications, or news reporting; these source types vary in evidential strength, and the estimates they report should not be treated as independently validated outcomes. Finally, observations from one country and one financing system may not generalize, although the proposed interaction among remuneration, skills, career pathways, and task redesign can be tested elsewhere.

8. Conclusions

The Korean pharmacist outlook is categorized as maintaining current employment levels, while several other health professions exposed to automation are projected to grow. The documents reviewed here identify differences in remunerated services, in professional development infrastructure, and in the curricula examined that may help explain this contrast; they do not establish a causal effect on the projections. Pharmacy education now devotes substantial time to experiential training, but no objective comparison of graduate outcomes was identified, and no national evaluation of the reform has been conducted. The framework proposed here

is a basis for empirical testing and for policy discussion. The proposition it advances, which remains to be tested, is that the employment prospects of the profession depend on whether education, continuing development, specialization, and remuneration are designed and evaluated as one system, rather than on the pace of automation alone.

9. Future direction

Building on the framework above and on the workforce and education goals of the International Pharmaceutical Federation (2020a), five priorities are proposed for pharmacist HRD in Korea.

- **Link CPD to remunerated services.** Replace the six-hour attendance requirement with competency-based CPD that qualifies pharmacists to bill for defined services such as polypharmacy management, prescription intervention, and follow-up counseling.
- **Build a specialist pathway for community practice.** Implement the planned community pharmacy field of the national specialist pharmacist examination and connect certification to service accreditation and fees, drawing on the Japanese certification of community-linked pharmacies.
- **Generate outcome evidence.** Convert pilots such as the polypharmacy management program and the antimicrobial stewardship initiative into evaluated programs with patient outcome and cost measures, following the model of the New Medicine Service.
- **Reform education by content, not by length.** Increase required pharmacotherapy and patient-care courses, build structured school-based pre-placement practice with patient case analysis and simulated patients, aim for independent practice readiness at licensure, introduce a skills component in the licensing examination, and conduct a national outcome evaluation of the six-year program.
- **Embed AI competencies across the education-to-practice continuum.** Train students and practicing pharmacists to supervise automated dispensing, interpret AI-generated medication alerts, and use digital tools for remote monitoring, so that automation releases pharmacist time for patient care rather than replacing pharmacists (Chalasani et al., 2023; Batson et al., 2021).

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