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Alcohol-Based Hand Rub Purchase as a Surrogate Marker for Monitoring Hand Hygiene in Nursing Homes: Results from a French Regional Survey over the 2018–2023 Period

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Abstract

Hand hygiene (HH) is universally recognized as a pillar of infection prevention and control (IPC), both in hospitals and long-term care facilities such as nursing homes (NHs). An annual national survey based on the voluntary notification of purchased alcohol-based hand rubs (ABHRs) has been set up in France since 2019 to appraise the compliance to HH in NHs. The results pertaining to the Hauts-de-France (HdF) region were analyzed over the 2018–2023 period. The impact of factors such as the year, structure status, availability of an infection control link (ICL) nurse and/or an IPC team as well as constant participation in the survey was evaluated. A clear rise in the consumption of ABHRs was witnessed in 2020 followed by a progressive return to the 2018 baseline by 2023 for most NHs. This decrease was significantly less marked in NHs constantly participating in the survey. The ABHR indicator's annual values were significantly higher in public NHs than in associative ones and in NHs with available ICL nurses/IPC teams. Finally, even though less than 50% of regional NHs reached the target of four daily ABHR uses per resident, they more frequently met it than French ones as a whole. This result underscores the need for ceaselessly reiterating the importance of HH and for pursuing training efforts in NHs with the help of ICL nurses and IPC teams.

Keywords: hand hygiene; alcohol-based hand rub; long-term care facilities; infection control and prevention; compliance; monitoring

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1. Introduction

In 2022, 7475 French nursing homes (NHs) were housing around 615,000 people, representing 0.9% of the total French population [1,2]. In the Hauts-de-France (HdF) region alone, around 47,300 people were reported to be accommodated in 584 structures, accounting for 7.8% of the total population housed in French NHs while the weight of this region in the overall French population was 9.1% [2]. Residents in NHs are recognized as having an increased risk of healthcare associated infections (HAIs) because they present and/or are exposed to factors favoring infection transmission such as (but not limited to) underlying health conditions, cognitive impairment, behavioral issues, poor mobility, shared living

areas and a lack of human and/or material resources [3,4]. Among the recommended infection prevention and control (IPC) measures to limit these HAIs, hand hygiene (HH) is universally recognized as an essential part of standard precautions for reducing the spread of pathogens [5–7]. Failure to adhere to best HH practices can indeed rapidly lead to a facility outbreak [8]. HH was also promoted as one of the most important preventive measures in the initial phase of the COVID-19 pandemic [9]. While numerous studies have focused on HH in hospital settings, reports in NHs are less abundant. Nevertheless, the studies in NHs have pointed out a lack of consistent adherence to HH guidelines, with greatly varying compliance rates (from 12 to 79%, depending on the monitoring method) [10–15]. Direct observation is the gold standard for evaluating HH compliance (HHC) but it is resource-consuming and subject to potential biases such as the Hawthorne effect [6]. Another recently developed strategy uses an automatic hand hygiene monitoring system (AHHMS), enabling the evaluation of hand hygiene opportunities (HHOs) and, subsequently, HHC compliance rates [11]. Although interesting, some drawbacks can be pointed out for this system. For example, it does not allow for the systematic evaluation of HHOs occurring before the performance of an aseptic task or after the exposure to body fluids. Moreover, NHs do not always have the financial means to be equipped with AHHMSs. Consumption of ABHRs and antiseptic soaps has therefore been proposed as a rapid and inexpensive surrogate marker for monitoring HH, both in hospitals [16–18] and in NHs [19]. On this basis, an annual national surveillance program based on the voluntary notification of the volume of purchased ABHRs by NHs has been implemented in France since 2019 [20]. From these volumes, a hypothetical number of daily HH per resident is calculated (from here on referred to as the ABHR indicator). A tentative target number of four daily HHOs per hospitalized patient was set in 2009 by the French Ministry for Health and extended to NH residents in 2022 [21,22]. HHC can then be evaluated by comparing ABHR indicator values with this target number. In this work, the results of the monitoring for the HdF region from 2018 to 2023 are reported and compared to the ones reported for France over the same period, and the variations in the indicator over time were evaluated. To the best of our knowledge, this is the first time such a surrogate marker is used to monitor HHC in NHs at a regional level in an uninterrupted series of 6 years. Additionally, as the COVID-19 pandemic fell into this 6-year timeframe, an ancillary objective was to evaluate its impact on ABHR consumption in NHs, a phenomenon for which data are scarce. Indeed, even though the transmission of SARS-CoV-2 virus is mainly through air droplets emanating from a contaminated individual, HH has also been put forward as a basic IPC measure to limit virus dissemination [3,9]. Another ancillary objective was to evaluate whether the availability of IPC expertise and/or infection control link (ICL) nurses would influence ABHR consumption.

2. Materials and Methods

2.1. Data Collection

As stated above, a national surveillance program based on the purchase of ABHRs in NHs has been set up in France since 2019 under the sponsorship of Santé Publique France (SPF). It is an annual cross-sectional study held under the care of the PRIMO mission, one of the French national surveillance programs for IPC. The PRIMO mission is more specifically dedicated to the surveillance and prevention of antibiotic resistance and HAIs in community healthcare and the medical/social fields, the latter including NHs. A preliminary test phase was held in a few French regions including HdF in 2019 and ever since, each year, all NHs from the 17 included French regions are asked to report their purchases of ABHRs for the two previous years via on online platform that is open for at least 3 months each year [23]. All NHs are invited to take part in this non-mandatory surveillance through

various channels (e-mailing campaigns, online advertisement on PRIMO mission website, direct person to person interactions, etc.). Through a single reference number identification system, the platform guarantees that only one annual set of data is created for each facility and the following items are recorded:

- Volume (L) of alcohol-based hand rub purchased in years n-1 and n-2 (year n being the year of the survey);
- Status of the facility (private, public, associative or other);
- Number of beds (year n);
- Number of occupied bed days (year n);
- Availability of an infection control link (ICL) nurse in the facility;
- Availability of an IPC team for the facility.

The estimated time to fill out this online survey is 15 min.

From the pieces of information mentioned above, the following ABHR indicator is calculated for each facility and each year, assuming that one hand rub necessitates 3 mL of ABHR to be adequately performed:

$$N = \frac{Vol}{\mathrm{n} \times 0.003} \quad (1)$$

where N is the number of daily hand sanitation occurrences performed per resident, Vol is the volume of purchased ABHR for a given year (expressed in L), n is the number of occupied bed days and 0.003 is the volume deemed necessary for an efficient hand rub (expressed in L).

The results for the HdF region were retrieved from the national database on 22 February 2025 by the curator appointed by the PRIMO mission (author C.M.).

2.2. Statistical Analysis

The Z-ratio was calculated to evaluate the difference between independent proportions for the comparison of turnouts and NH characteristics. McNemar's test was used for correlated proportions.

For the ABHR indicator, multiple comparisons using the whole dataset over the 2018–2023 period were performed using the Kruskal–Wallis test for independent groups followed by a post hoc Dunn's test for pairwise comparisons with Bonferroni correction. The Friedman test was used for multiple comparisons of dependent groups followed by a post hoc Nemenyi test for pairwise comparisons for a subset of 36 facilities that had contributed data every year over the 2018–2023 period (from here on referred to as the constant contribution group). Finally, the Mann–Whitney test was performed to compare the yearly results of NHs with a constant contribution and those without. $p < 0.05$ was considered significant unless otherwise stated.

3. Results

3.1. Participating Facilities and Their Characteristics

In the HdF region, the highest turnout was observed during the initial test phase in 2018. The participation rate significantly decreased from 2019 to 2021 (Figure 1). A significant rebound was observed between 2021 and 2022. However, 2023 once more registered a decrease in participation compared to 2022 (Figure 1).

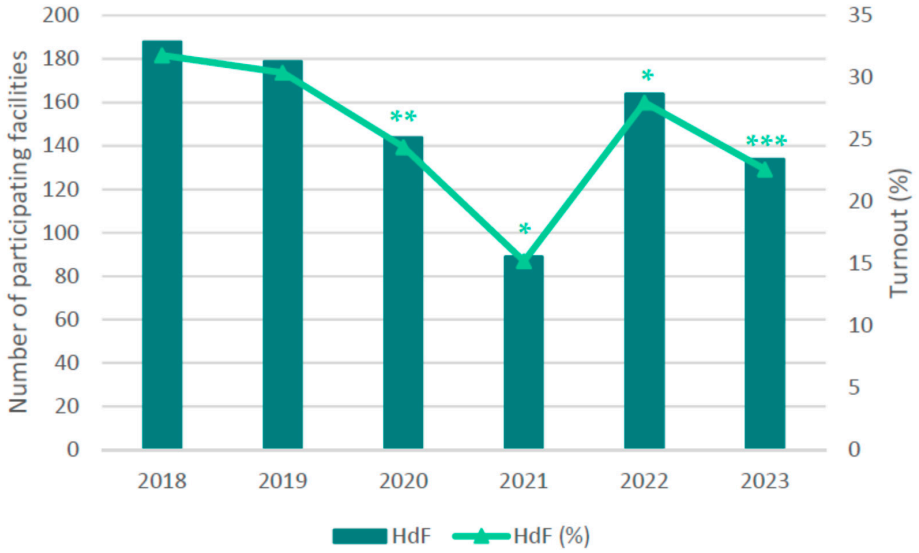

Figure 1. Voluntary entry into the annual survey on purchased alcohol-based hand rubs for the Hauts-de-France region. Bars represent the raw number of facilities and the turnouts (participation rates) are shown as a curve (expressed as percentages). Significant differences in turnout compared to the preceding year: * $p < 0.002$, ** $p = 0.0193$ and *** $p = 0.0319$.

The HdF participation rate was significantly higher than the one for France in 2019 (31.8% vs. 17.2%, $p < 0.002$). However, in both 2021 and 2023, the HdF turnout was significantly lower than the national turnout: 15.2% vs. 23.2% ($p < 0.002$) and 22.6% vs. 28.6% ($p = 0.0014$), respectively [24–29].

In every year, most of the HdF facilities belonged to the public system (Figure 2). The relative proportions of public and associative NHs among the participating facilities did not significantly vary from one year to the next. However, for private facilities, a significant increase in their proportion was noted in 2021 compared to 2020. It was followed by a significant decrease between 2022 and 2023 (Figure 2). Compared to the French proportions of NHs with different statuses in 2023 [30], in the HdF sample, the proportions of public facilities from 2018 to 2023 were significantly higher (64.8% vs. 44.3%, $p < 0.0002$) while the proportions of associative facilities were significantly lower (16.6% vs. 31.6%, $p < 0.01$). The proportion of private NHs in the HdF sample was also significantly lower than the national one (12.3% vs. 24.1%, $p < 0.01$). Data from facilities classified as "Other" was not subjected to statistical analysis due to the low numbers, which did not allow for a sufficient statistical power.

In every year, an ICL nurse was available in the vast majority of the participating facilities (Figure 3). No significant differences were observed over time in the proportions of facilities benefiting from an ICL nurse. They varied from 65.2% (2021) to 77.3% (2023). The expertise of an IPC team was also available for most facilities, with the proportions ranging from 59.4% in 2018 to 83.6% in 2023 (Figure 3). The proportion of facilities with an IPC team in 2018 was significantly lower than that in all the other years, except for 2019 (Figure 3). Additionally, a scissor effect between the availabilities of ICL nurses and IPC teams was visible in 2020, when IPC team availability became higher than ICL nurse availability (Figure 3). However, the difference between IPC team and ICL nurse availabilities only reached significance in 2018 (Figure 3).

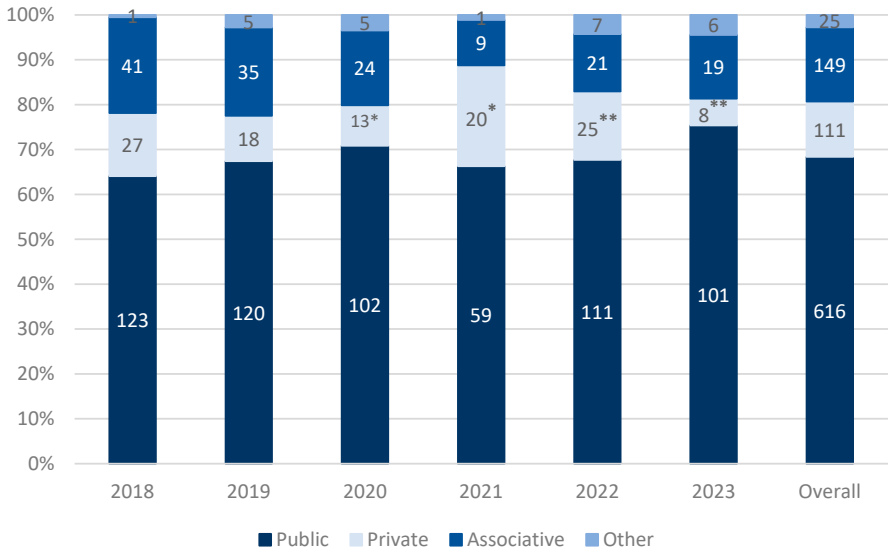

Figure 2. Distribution of facilities with different statuses in the Hauts-de-France region according to the year of participation (figures in bars represent the number of facilities with each status). Significant difference in the proportion of private facilities: * between 2020 and 2021 (p = 0.0042) and ** between 2022 and 2023 (p = 0.0111).

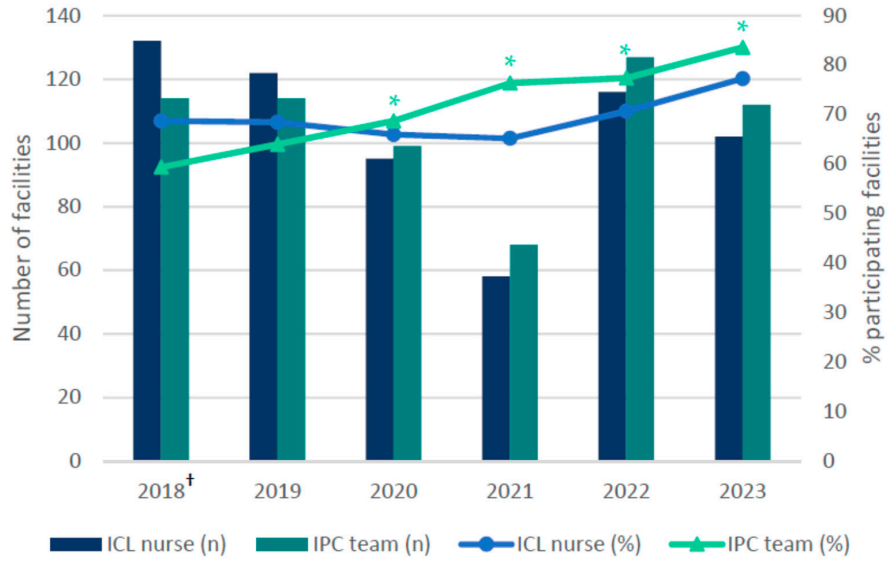

Figure 3. Availability of infection control link (ICL) nurses and infection prevention and control (IPC) teams in nursing homes in the Hauts-de-France region from 2018 to 2023. Bars represent the raw numbers and curves represent the proportions (expressed as percentages) of facilities with an identified ICL nurse/IPC team. * significant increase in IPC team availability compared to 2018 ($p < 0.05$). † significant difference between ICL nurse and IPC team availabilities in 2018 (p = 0.023).

3.2. ABHR Indicator Analysis

On the whole, the highest value for the calculated ABHR indicator was obtained in 2020 (Figure 4). It was significantly higher than the values registered for the other years in the 2018–2023 period. Similarly, the 2021 value was significantly higher than those of 2018, 2019, and 2023 while the 2022 value was significantly greater than those of 2018 and 2019 (Figure 4).

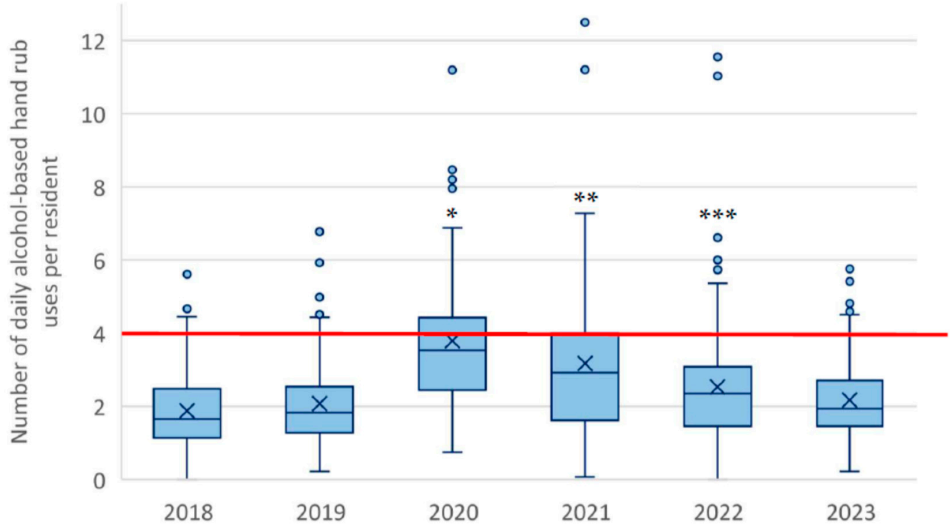

Figure 4. Box plot of calculated daily alcohol-based hand rub uses per nursing home resident in the Hauts-de-France region over the 2018–2023 period. Two outliers were omitted in the graphic representation: one with a value of 19.58 in 2019 and the other with a value of 25.32 in 2020. The red line represents the target of the 2022–2025 national strategy. * statistically significant difference between 2020 and all of the other years included in the study ($p < 0.003$); ** statistically significant difference between 2021 and all of the other years included in the study except for 2022 ($p < 0.00005$); *** statistically significant difference between 2022 and the years 2018–2019 ($p < 0.0004$) (corrected α (Bonferroni method): 0.00333).

Dividing the facilities based on status, the highest values for the ABHR indicator were also reached in 2020 in all the groups (Table 1). These values for public and associative facilities were significantly higher in 2020 compared to all the other survey years, except for 2021. For private facilities, the difference was only statistically significant between the years 2018 and 2020 (Table 1). A higher value for the ABHR indicator was only observed in 2021 and 2022 in public facilities compared to 2018 and 2019. Finally, a significant decrease was registered in 2023 for public facilities compared to 2021 (Table 1). The low number of observations for "Other" facilities precluded any relevant statistical analysis for this category. When the values for the facilities with different statuses were compared over the 2018–2023 period, the only statistically significant difference was found between public and private facilities, with a higher ABHR indicator value for the former (Figure 5a).

A positive impact on the ABHR indicator of facilities with ICL nurses and ICP teams was observed over the 2018–2023 period, with significantly higher ABHR values in NHs benefiting from an ICL nurse and/or an IPC team compared to those without these resources (Figure 5b). Significant variations over time were also observed and displayed similar time-dependent patterns to those mentioned above, with a peak value in 2020 (Table 2). This peak value was consistently significantly higher than all the other registered values over the 2018–2023 period, with the exception of 2021, in facilities with or without available infection control resources (Table 2). However, 2018 was the only year with a significantly lower ABHR value than the 2021 values for facilities without an ICL nurse. Additionally, no further significant differences between years were found in NHs without an ICL nurse or an IPC team (Table 2). On the contrary, facilities benefiting from these IPC resources retained significantly higher ABHR values in both 2021 and 2022 compared to some of the other years of the survey period (Table 2).

Table 1. Number of daily hand sanitation occurrences with alcohol-based hand rubs per resident (median [interquartile]) according to the year and the facility's status.

Year	Facility Status			
	Public	**Private**	**Associative**	**Other**
2018	1.83 [1.29–2.69] $^{*,\dagger,\$}$	1.37 [0.90–2.43] *	1.39 [0.87–1.89] *	2.09 -
2019	1.96 [1.38–2.64] $^{*,\dagger,\$}$	1.75 [0.81–3.11]	1.65 [1.03–2.11] *	1.40 [1.36–1.60]
2020	3.55 [2.57–4.38] *	4.36 [2.13–4.96] *	3.33 [2.48–4.23] *	3.10 [2.07–4.18]
2021	3.24 [2.26–3.93] †	1.90 [1.16–3.85]	2.83 [1.40–4.27]	1.18 -
2022	2.54 [1.82–3.14] $^{*,\$}$	1.97 [1.28–2.73]	1.35 [1.14–2.26] *	1.96 [1.82–2.31]
2023	2.14 [1.64–2.71] *,†	2.08 [1.25–3.14]	1.36 [0.79–1.65] *	2.19 [1.74–2.80]

For a given status, a significant difference (corrected α (Bonferroni method) = 0.00333) was observed between * 2020 and the years with the same symbol at $p \leq 0.0026$; † 2021 and the years with the same symbol at $p \leq 6.7 \times 10^{-6}$; $^{\$}$ 2022 and the years with the same symbol at $p \leq 0.00028$.

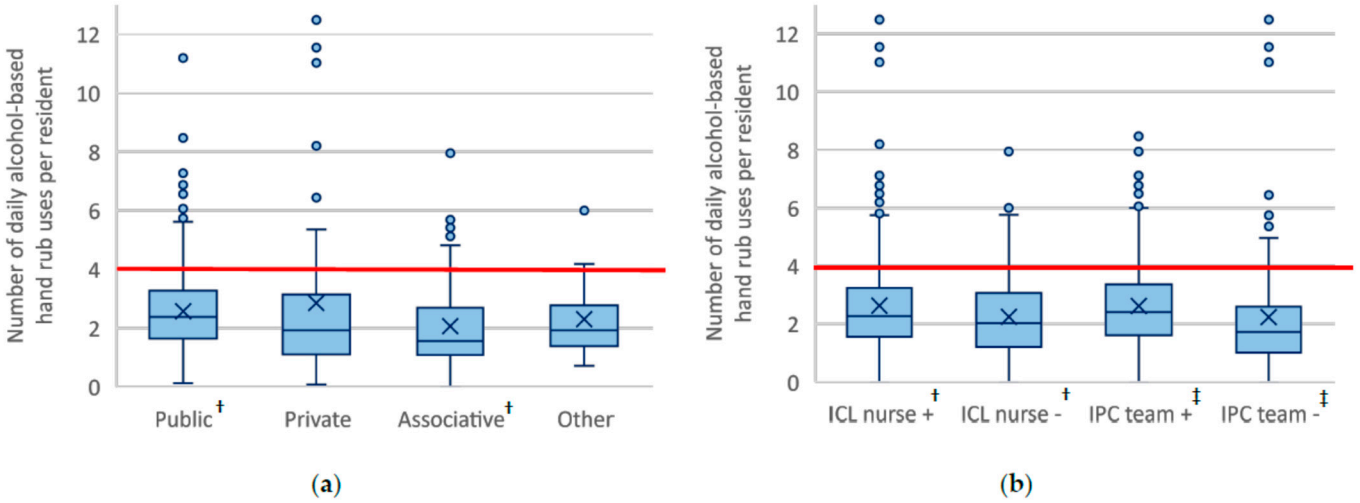

Figure 5. Box plot of calculated daily alcohol-based hand rub (AHRB) uses per nursing home (NH) resident in the Hauts-de-France (HdF) region according to (**a**) the facility status († significant difference between the two status at $p = 4.98 \times 10^{-7}$ (corrected α (Bonferroni method): 0.008333)); (**b**) the presence of an infection control link (ICL) nurse and the availability of an infection control and prevention (IPC) team († significant difference between NHs with and without an ICL nurse at $p = 0.0022$ and ‡ significant difference between NHs with and without an IPC team at $p = 2.14 \times 10^{-11}$ (corrected α (Bonferroni method): 0.008333)). Two outliers were omitted in these graphic representations: one with a value of 19.58 in 2019 and the other with a value of 25.32 in 2020. The red line represents the target of the 2022–2025 national strategy.

Table 2. Number of daily hand sanitation occurrences with alcohol-based hand rubs per resident (median [interquartile]) according to the year and availability of an infection control link (ICL) nurse or an infection prevention and control (IPC) team.

Year	ICL Nurse		IPC Team	
	Available	**Unavailable**	**Available**	**Unavailable**
2018	1.80 [1.34–2.58] $^{*,\dagger,\$}$	1.27 [0.85–2.24] *,†	1.94 [1.39–2.72] $^{*,\dagger,\$}$	1.30 [0.87–1.98] *
2019	1.87 [1.37–2.61] $^{*,\dagger,\$}$	1.64 [1.08–2.43] *	1.95 [1.51–2.78] *,†	1.50 [0.87–2.12] *
2020	3.57 [2.61–4.43] *	3.48 [2.37–4.18] *	3.72 [2.54–4.58] *	2.99 [2.29–3.99] *
2021	3.21 [1.90–4.08] †	2.48 [1.31–3.78] †	3.15 [2.01–4.03] †	1.88 [1.18–3.77]
2022	2.47 [1.65–3.03] $^{*,\$}$	2.11 [1.30–3.08] *	2.50 [1.71–3.16] $^{*,\$}$	1.66 [1.28–2.60] *
2023	2.00 [1.57–2.64] *,†	1.69 [1.23–2.72] *	2.15 [1.58–2.89] *,†	1.59 [1.04–1.82] *

For a given status, a significant difference (corrected α (Bonferroni method) = 0.00333) was observed between * 2020 and the years with the same symbol at $p \leq 0.00028$; † 2021 and the years with the same symbol at $p \leq 0.00159$; $^{\$}$ 2022 and the years with the same symbol at $p \leq 0.00268$.

3.3. Constant Versus Inconstant 2018–2023 Notification to the Survey

The comparative analysis of ABHR indicator values over time of the 36 NHs belonging to the constant contribution group showed a significant increase in these values starting in 2020 compared to 2018–2019. Meanwhile, no significant increase in ABHR indicator values was observed over time for the group with inconstant contributions in the 2018–2023 timeframe. A higher annual value for the constant contribution group was maintained until 2023, which was not the case when the overall analysis was held (Figure 4) or when only the irregular notification group was taken into account (Figure 6). Moreover, NHs with constant 2018–2023 participation in the survey had significantly higher values for the ABHR indicator than those who irregularly participated over the 2021–2023 period (Figure 6).

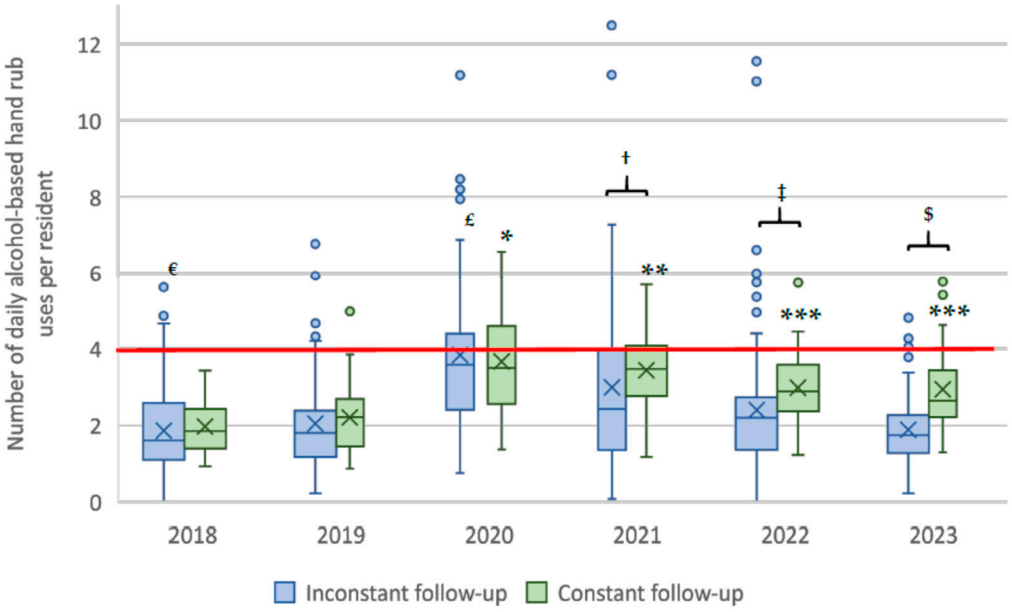

Figure 6. Box plot of calculated daily alcohol-based hand rub (AHRB) uses per nursing home resident in the Hauts-de-France region for the 36 NHs providing data throughout the 2018–2023 period (constant notification group) and the other NHs (irregular notification group). Two outliers were omitted in the graphic representation: one with a value of 19.58 in 2019 and the other with a value of 25.32 in 2020, both in the irregular notification group. The red line represents the target of the 2022–2025 national strategy. Statistically significant difference for the constant follow-up group between the years 2018–2019 and * 2020 ($p < 1.5 \times 10^{-8}$); ** 2021 ($p < 1.81 \times 10^{-6}$); *** 2022 and 2023 ($p < 0.01347$). Statistically significant difference for the irregular follow-up group between $^{£}$ the year 2020 and all other years ($p \leq 7 \times 10^{-5}$) and $^{€}$ the years 2021–2022 and 2018 (corrected α (Bonferroni method): 0.00333). Statistically significant difference between the constant and irregular follow-up groups: † $p = 0.0082$; ‡ $p = 0.00041$; $^{\$}$ $p = 1.28 \times 10^{-7}$.

3.4. Fulfillment of the National Target for the Number of Daily ABHR Uses per Resident

As can be seen in Table 3, the proportion of NHs reaching the national target of four daily uses of ABHR per resident increased from 2018 to 2020. After the 2020 peak, a significant decrease started in 2022 and was maintained in 2023. A significantly higher proportion of regional NHs reached the national target from 2021 to 2023 compared to all French NHs (Table 3).

Table 3. Nursing homes reaching the national target of 4 daily uses of alcohol-based hand rub per resident.

Year	HdF NHs [1] with Daily ABHR [1] Uses $\geq$ 4 per Resident	% Total HdF NHs	% Total National NHs [2]
2018	7	3.7 *	NA [1]
2019	9	5.1 **	4.9
2020	52	36.1	29.3
2021	22	24.7 †	14.1 †
2022	18	11.1 ***,‡	6.7 ‡
2023	12	9.0 $,£	3.6 £

[1] ABHR: alcohol-based hand rub; HdF: Hauts-de-France; NA: not available; NH: nursing home. [2] Data retrieved from national survey reports [20–24]. For the HdF region: significantly lower proportion than that of * 2020–2023 ($p \leq 0.0441$); ** 2020–2022 ($p \leq 0.0426$); *** 2020–2021 ($p \leq 0.0042$); $ 2020–2021 ($p \leq 0.0013$). For France vs. HdF comparisons: † $p < 0.0002$; ‡ $p = 0.0402$; £ $p = 0.018$.

4. Discussion

HH can be classified as a horizontal IPC intervention aimed to simultaneously control the dissemination of multiple pathogens [31]. It is a pillar of standard precautions [5–7]. Monitoring HHC in NHs at a regional or national level is challenging because it has to be evaluated in a large number of facilities with a consistent methodology, even more so if the measure is to be repeated and compared over time. Direct observation has been the main methodology used to evaluate HHC in NHs [10,12–15] but this time-consuming method is usually employed in a limited number of NHs (from 4 to 33 in the given examples) and for limited periods of time (generally 20 min to 1.5 h of observation per healthcare worker over periods ranging from a few days to a couple of weeks). From a monitoring point of view, the results thus obtained therefore offer an incomplete picture of the actual long-term HHC in NHs. A recent study reported the use of an AHHMS that might offer a more reliable picture of long-term HHC [11]. Indeed, it enables the monitoring of all healthcare workers within a facility for extended periods of time (5 months in the published study). However, this AHHMS was only deployed in one NH [11]. The main hurdle to using this system for a regional/national survey would be its deployment in all the NHs. Therefore, because it is easily implemented and inexpensive, most regional/national/international HHC monitoring surveys, both in hospitals and NHs, have turned to ABHR consumption as a surrogate marker [16,18–20]. In these surveys, the ABHR consumption method allowed for the retrieval of data encompassing 232 to 1290 healthcare facilities over periods ranging from 7 months to 3 years [16,18–20]. Apart from the French surveillance survey this work is part of [20], the only other monitoring study held in NHs was the one taking place in Hungary [19]. It was a national survey for the year 2013 and had a 24% turnout rate, which is similar to the results obtained in our study. However, the end results from this study and our work are not comparable. Indeed, the former study's calculated outcomes were the daily median consumption and number of HH occurrences per healthcare worker (2.2 mL and 0.6 HH, respectively) while the outcomes in this work were calculated per resident-day. To the best of our knowledge, the results reported here are therefore the first to investigate regional HHC in NHs over a 6-year period and its variation.

HH was promoted as one of the most important preventive measures in the initial phase of the COVID-19 pandemic [9]. Subsequently, HH survey reports held in hospitals showed a peak in compliance in 2020, be they based on ABHR consumption [18] or other methods [31–33]. This observation held true for NHs in both France [26,27] and the HdF region, with the highest numbers of ABHR purchases also registered in 2020 regardless of the availability of an ICL nurse/IPC team or the facility's status. Unfortunately, the

momentum gained during the 2020 pandemic for HHC was not maintained in most NHs and the ABHR indicator values gradually returned to their 2018–2019 baseline levels. This pattern was also observed in the studies in hospitals mentioned above [18,31–33] but, to our knowledge, such a phenomenon has seldom been reported in NHs. Possible explanations for this rapid decrease in the HH compliance improvements during the COVID-19 pandemic include the increased turnover in healthcare workers and quiet quitting following this pandemic [34,35]. The COVID-19 pandemic has not only exacerbated several risk factors that have been linked to an increased turnover in NH staff such as low wages and poor working conditions [4], but has also added mental stress to the mix. Increased turnover leads to the loss of adequately trained workers that would in turn impact overall HHC in NHs, even more so if the person leaving the facility is the ICL nurse. HH training of healthcare workers in NHs is a recurring need, as recently pointed out in a survey in Alabama, where HH was pointed out as the second most frequently identified training need [4]. Moreover, various mechanisms have been identified as crucial for learning HH and could also help in reengaging quiet quitters: repeated practice, task realism (i.e., perceived relevance to work), feedback and reminders, and interactivity [36].

Nevertheless, a longer lasting "memory effect" was observed in the regional NHs with constant participation over the period of 2018–2023, with significantly higher ABHR indicator values than those of NHs reporting irregularly. This effect was maintained until 2023 and the ABHR indicator values remained above 2 ABHR uses per resident per day. This might be linked with motivated and involved ICL nurses and/or IPC teams who remained steadfast throughout and after the COVID-19 pandemic. It would be interesting to design specific studies to further compare HH practices (including educational programs) in NHs with a constant contribution to the survey to those without. This type of study could help in identifying factors conducive to better adhesion to HH best practices in NHs.

In the HdF region, NHs with an ICL nurse and/or an IPC team had significantly higher ABHR indicator values than NHs without these resources over the 2018–2023 period. This was also the case with the annual results for France as a whole in every year between 2018 and 2023 [24–29]. This finding clearly backs up the positive impact of having educated and dedicated IPC human resources within a facility to empower HHC. A significant rise in IPC team availability starting in 2020–2021 and lasting until 2023 was observed in HdF. This piece of information over the 2018–2023 period was not available for France as a whole. Nevertheless, from a regional point of view, the rise in IPC team availability in HdF NHs can be linked to the implementation of a national program that was started in 2021 and aims to provide IPC team expertise for all French NHs. This program was built on the positive results observed since the inception in 2013 of mobile teams to deliver on-site IPC strategies for NHs in the Auvergne–Rhone–Alpes region [20]. IPC teams and ICL nurses are often involved in multimodal interventions based on WHO recommendations to improve compliance to HH best practices. The role modeling provided by ICL nurses is also of utmost importance in improving the HHC of NH healthcare workers [37]. Nevertheless, the deployment of new tools and educational approaches that could better engage healthcare workers, especially the younger ones, should also be considered. These tools and approaches include nudges such as feedback lights on ABHR dispensers [11], virtual reality and augmented reality applications [36], as well as videos, gamification or real-time feedback [38]. Some of these educational approaches also included patient/resident/visitors [38] and it would be interesting to assess the impact of their implementation in HdF NHs.

A further comparison of the national and regional results shed light on several additional points. The first one was that after an initial regional participation rate above the one for France in 2018, the turnout subsequently dwindled for the HdF region. This was

not the case in other regions, as exemplified by the significantly higher turnout values for France in 2021 and 2023. Indeed, ever since 2019, the overall French participation in the survey statistically increased from one year to the next, except between 2020 and 2021, and reached 28.6% in 2023, its highest level since 2018 [24–29]. A possible explanation for the decrease in the HdF regional participation rates over time might be that the same data as the one used to calculate the ABHR indicator is now asked for in various forms/reports that are completed by regional NHs. Therefore, some facilities might not see the point in duplicating their entries in several survey/report systems. Indeed, the Auvergne–Rhône–Alpes region is relying on its well-structured network of mobile IPC teams rather than on the online platform to contribute data to the PRIMO surveillance program, with a resulting turnout range between 43% and 70% between 2018 and 2023 [24–29]. Coordinating the various surveillance programs and reporting systems on a regional scale might therefore be an efficient way to increase regional NHs' participation through a single-entry point for data related to HH compliance.

A second point was that public NHs had higher ABHR indicator values than associative ones over the 2018–2023 period in HdF. A similar trend was observed at the national level, except for the years 2020 and 2021 when only participating private NHs recorded values significantly higher than those of associative NHs [24–29]. The reasons for a lower ABHR consumption in regional and French associative NHs have not been determined but one explanation might be the tighter budget of these not-for-profit facilities compared to private ones, which might have hindered supplementary ABHR orders during the COVID-19 pandemic. Another explanation for this phenomenon might be that private facilities that bought and used more ABHRs would be more inclined to participate in the national survey while those who reduced ABHR availability due to cutting costs would refrain from participating. However, one has to take these regional and national results on the link between the facility's status and ABHR indicator scores with caution as public NHs were overrepresented compared with private and associative ones [30].

A third element was that, in every year, the national objective of four daily uses of ABHR per resident was only achieved by a minority of the participating NHs in the HdF region and at the national level. The highest compliance rate was registered in 2020 with a higher proportion of NHs complying to the national target in the HdF region compared the national proportion. This difference between regional and national ABHR indicator values reached significance in 2021 and was maintained until 2023. Again, it would be interesting to explore the reasons for this higher HH compliance rate at the regional level than at the national one. This might help in identifying possible ways to improve the overall low HH compliance in French NHs.

Finally, it has to be underscored that several limits to HH monitoring through ABHR consumption have been pointed out. Indeed, some comparative studies conducted over short periods of time reported that the results from ABHR consumption monitoring were not in accordance with those of the gold standard observation method [6] while another study held over a 4-year period concluded that the results from the two surveillance systems were consistent [39]. Similarly, another German study found that ABHR consumption mirrored direct observations of HHC over a 7-year period [17]. Therefore, monitoring HHC through ABHR consumption could be seen as a good tool for assessing variations in HHC over long time series, as was performed in the present study. Nevertheless, some potential limits/biases can still be highlighted. First of all, this surveillance is based on the good faith of facilities in their reports. And, even if the reports are truthful, a bias can be introduced by grouped purchasing policies, which may artificially increase the quantity of ABHRs bought one year and lower it the next, when stocks from the previous year are still being used. This phenomenon could induce some NHs to contribute to the survey in years when bulk

purchases are made while avoiding participating in years when no or smaller purchases are made. This leads to another potential bias linked to the voluntary contribution of facilities to this survey; a self-selection bias may exist where only the facilities that believe that they have adequate HHC/ABHR consumption contribute to the survey. Another drawback of this surrogate marker is that it does not give any indication on who is using the purchased ABHRs; residents, visitors and healthcare workers are all likely to use it, while the national target the resulting data is pitted against is only set for healthcare workers. A further limitation is that the calculated ABHR indicator values do not permit an evaluation of the proper use of ABHRs. Indeed, it does not evaluate if (i) the right amount of an ABHR is used to perform HH, (ii) the technique used by healthcare workers to perform HH is correct, (iii) the amount of time spent to perform HH is sufficient and (iv) if HH is performed in the correct situations. Complementary approaches to circumvent this latter bias could be deployed in addition to measuring the ABHR consumption indicator such as resident-based observational audits [40]. This type of audit could be used in conjunction with the annual national survey to assess whether their end results agree or not. If not, multimodal interventions to improve compliance to HH best practices should be reconsidered.

5. Conclusions

The regional HdF results for the national monitoring for HH compliance in French NHs showed that despite a dwindling participation turnout over the last few years, this region remains above the national values for the proportion of NHs meeting the national target of four ABHR uses per resident per day. However, after peaking in 2020, this proportion registered a significant decrease, especially in facilities irregularly notifying their annual ABHR consumption to the monitoring system. Additionally, even at its highest value, the proportion of NHs reaching the target was only one-third. The regional and national sub-optimal HH compliance rates over the last 6 years underscore the need for ceaselessly reiterating the importance of HH in NHs and for pursuing training efforts. The help of ICL nurses and IPC teams for carrying out these tasks is paramount.

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Abbreviations

The following abbreviations are used in this manuscript:

ABHR	Alcohol-Based Hand Rub
AHHMS	Automatic Hand Hygiene Monitoring System
HAI	Healthcare-Associated Infection
HdF	Hauts-de-France
HH	Hand Hygiene
HHC	Hand Hygiene Compliance
HHO	Hand Hygiene Opportunity
ICL	Infection Control Link
IPC	Infection Control and Prevention
NH	Nursing Home

References

1. Institut National de la Statistique et des Etudes Economiques (INSEE)—Bilan Démographique. 2022. Available online: https://www.insee.fr/fr/statistiques/6687000?sommaire=6686521 (accessed on 9 May 2025).
2. Score Santé—STATISS: Statistiques et Indicateurs de la Santé et du Social. Available online: https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.scoresante.org%2FuploadedFiles%2FSCORE-Sante%2FStatiss%2FSTATISS_2023_VF.xlsx&wdOrigin=BROWSELINK (accessed on 2 May 2025).
3. Henriques, H.R.; Sousa, D.; Faria, J.; Pinto, J.; Costa, A.; Henriques, M.A.; Durão, M.C. Learning from the COVID-19 outbreaks in long-term care facilities: A systematic review. *BMC Geriatr.* **2023**, *23*, 618. [CrossRef]
4. Fifolt, M.; Baker, N.; Menefee, R.W.; Kidd, E.; McCormick, L.C. An analysis of ICAR recommendations for long-term care facilities in Alabama. *Am. J. Infect. Control.* **2024**, *52*, 974–976. [CrossRef] [PubMed]
5. Jara, B.J. Infection Prevention in the Era of COVID-19: 2021 Basic Procedure Review. *J. Nucl. Med. Technol.* **2021**, *49*, 126–131. [CrossRef]
6. Boyce, J.M.; Pittet, D. HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Guideline for hand hygiene in health-care settings. Recommendations of the healthcare infection control practices advisory committee and the HIPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Am. J. Infect. Control.* **2002**, *30*, S1–S46. [CrossRef]
7. Glowicz, J.B.; Landon, E.; Sickbert-Bennett, E.E.; Aiello, A.E.; de Kay, K.; Hoffmann, K.K.; Maragakis, L.; Olmsted, R.N.; Polgreen, P.M.; Trexler, P.A.; et al. SHEA/IDSA/APIC practice recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. *Infect. Control Hosp. Epidemiol.* **2023**, *44*, 355–376. [CrossRef]
8. Lee, M.H.; Lee, G.A.; Lee, S.H.; Park, Y.H. A systematic review on the causes of the transmission and control measures of outbreaks in long-term care facilities: Back to basics of infection control. *PLoS ONE* **2020**, *15*, e0229911. [CrossRef] [PubMed]
9. Boyce, J.M. Current issues in hand hygiene. *Am. J. Infect. Control.* **2023**, *51*, A35–A43. [CrossRef]
10. Haenen, A.; de Greeff, S.; Voss, A.; Liefers, J.; Hulscher, M.; Huis, A. Hand hygiene compliance and its drivers in long-term care facilities; observations and a survey. *Antimicrob. Resist. Infect. Control.* **2022**, *11*, 50. [CrossRef]
11. Iversen, A.M.; Hansen, M.B.; Kristensen, B.; Ellermann-Eriksen, S. Hand hygiene compliance in nursing home wards: The effects of feedback with lights on alcohol-based hand rub dispensers. *Am. J. Infect. Control.* **2024**, *52*, 1020–1024. [CrossRef]
12. Eveillard, M.; Pradelle, M.T.; Lefrancq, B.; Guilloteau, V.; Rabjeau, A.; Kempf, M.; Vidalenc, O.; Grosbois, M.; Zilli-Dewaele, M.; Raymond, F.; et al. Measurement of hand hygiene compliance and gloving practices in different settings for the elderly considering the location of hand hygiene opportunities during patient care. *Am. J. Infect. Control.* **2011**, *39*, 339–341. [CrossRef] [PubMed]
13. Løyland, B.; Peveri, A.M.; Hessevaagbakke, E.; Taasen, I.; Lindeflaten, K. Students' observations of hand hygiene in nursing homes using the five moments of hand hygiene. *J. Clin. Nurs.* **2020**, *29*, 821–830. [CrossRef]
14. Teesing, G.R.; Erasmus, V.; Nieboer, D.; Petrignani, M.; Koopmans, M.P.G.; Vos, M.C.; Verduijn-Leenman, A.; Schols, J.M.G.A.; Richardus, J.H.; Voeten, H.A.C.M. Increased hand hygiene compliance in nursing homes after a multimodal intervention: A cluster randomized controlled trial (HANDSOME). *Infect. Control Hosp. Epidemiol.* **2020**, *41*, 1169–1177. [CrossRef]
15. Sandbekken, I.H.; Hermansen, Å.; Utne, I.; Grov, E.K.; Løyland, B. Students' observations of hand hygiene adherence in 20 nursing home wards, during the COVID-19 pandemic. *BMC Infect. Dis.* **2022**, *22*, 156. [CrossRef] [PubMed]
16. Hansen, S.; Schwab, F.; Gastmeier, P.; PROHIBIT Study Group; Pittet, D.; Zingg, W.; Sax, H.; Gastmeier, P.; Hansen, S.; Grundmann, H.; et al. Provision and consumption of alcohol-based hand rubs in European hospitals. *Clin. Microbiol. Infect.* **2015**, *21*, 1047–1051. [CrossRef]

17. Haubitz, S.; Atkinson, A.; Kaspar, T.; Nydegger, D.; Eichenberger, A.; Sommerstein, R.; Marschall, J. Handrub consumption mirrors hand hygiene compliance. *Infect. Control Hosp. Epidemiol.* **2016**, *37*, 707–710. [CrossRef]
18. Caramia, A.; Petrone, D.; Isonne, C.; Battistelli, F.; Sisi, S.; Boros, S.; Fadda, G.; Vescio, M.F.; Grossi, A.; Barchitta, M.; et al. Italian national surveillance of alcohol-based hand rub consumption in a healthcare setting-A three-year analysis: 2020–2022. *J. Clin. Med.* **2024**, *13*, 3371. [CrossRef]
19. Szabó, R.; Morvai, J.; Bellissimo-Rodrigues, F.; Pittet, D. Use of hand hygiene agents as a surrogate marker of compliance in Hungarian long-term care facilities: First nationwide survey. *Antimicrob. Resist. Infect. Control.* **2015**, *4*, 32. [CrossRef]
20. Ali-Brandmeyer, O.; Blanckaert, K.; Nion-Huang, M.; Simon, L.; Birgand, G.; CPias Network. Consumption of alcohol-based hand rub in French nursing homes: Results from a nationwide survey, 2018–2019. *J. Hosp. Infect.* **2021**, *118*, 27–31. [CrossRef]
21. Ministère de la Santé et des Sports—Qualité et Sécurité des Soins: Tableau de Bord 2008 des Infections Nosocomiales & Publication D'indicateurs de Qualité des Soins. Available online: https://sante.gouv.fr/IMG/pdf/DP_IN_indicateurs_decembre09.pdf (accessed on 9 May 2025).
22. Ministère des Solidarités et de la Santé. Stratégie Nationale 2022–2025 de Prévention des Infections et de L'antibiorésistance—Santé Humaine. Available online: https://sante.gouv.fr/IMG/pdf/strategie_nationale_2022-2025_prevention_des_infections_et_de_l_antibioresistance.pdf (accessed on 12 May 2025).
23. Repia PRIMO—Connexion. Available online: https://antibioresistance.fr/login (accessed on 9 May 2025).
24. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en EHPAD*; Résultats de la Phase Pilote Inter-régionale; Santé Publique France: Saint-Maurice, France, 2020; 50p. Available online: https://www.cpias-ile-de-france.fr/docprocom/doc/primo-surveillance-sha-ehpad-dec2020.pdf (accessed on 26 August 2025).
25. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en Etablissement d'Hébergement pour Personnes Agées Dépendantes*; Résultats nationaux, données 2018–2019; Santé Publique France: Saint-Maurice, France, 2021; 39p. Available online: https://antibioresistance.fr/images/PCI/SURVEILLANCE/419492_spf00003002.pdf (accessed on 26 August 2025).
26. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en Etablissement d'Hébergement pour Personnes Agées Dépendantes*; Résultats nationaux, données 2019–2020; Santé Publique France: Saint-Maurice, France, 2022; 47p. Available online: https://antibioresistance.fr/images/PCI/SURVEILLANCE/501111_spf00003727.pdf (accessed on 26 August 2025).
27. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en Etablissement d'Hébergement pour Personnes Agées Dépendantes*; Résultats de la surveillance nationale, données 2020–2021; Santé Publique France: Saint-Maurice, France, 2022; 23p. Available online: https://antibioresistance.fr/images/PCI/SURVEILLANCE/579578_spf00004257.pdf (accessed on 26 August 2025).
28. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en Etablissement d'Hébergement pour Personnes Agées Dépendantes*; Résultats de la surveillance nationale, données 2021–2022; Santé Publique France: Saint-Maurice, France, 2024; 24p. Available online: https://antibioresistance.fr/images/PCI/SURVEILLANCE/RAPPORT2023_PHA.pdf (accessed on 26 August 2025).
29. Mission Primo. *Surveillance des Consommations de Produits Hydro-Alcooliques en Etablissement D'hébergement pour Personnes Agées Dépendantes et en Etablissement du Secteur du Handicap*; Résultats de la surveillance nationale, données 2022–2023; Santé Publique France: Saint-Maurice, France, 2025; 29p. Available online: https://antibioresistance.fr/images/PCI/SURVEILLANCE/Rapport_surveillance_conso_PHA_ESMS_2022_2023.pdf (accessed on 26 August 2025).
30. UniSanté—Panorama des EHPAD 2023. Available online: https://www.conseildependance.fr/wp-content/uploads/2023/02/2023-02-21_panorama-ehpad-2022_PDF.pdf (accessed on 30 May 2025).
31. Moore, L.D.; Robbins, G.; Quinn, J.; Arbogast, J.W. The impact of COVID-19 pandemic on hand hygiene performance in hospitals. *Am. J. Infect. Control.* **2021**, *49*, 30–33. [CrossRef] [PubMed]
32. Makhni, S.; Umscheid, C.A.; Soo, J.; Chu, V.; Bartlett, A.; Landon, E.; Marrs, R. Hand Hygiene Compliance Rate During the COVID-19 Pandemic. *JAMA Intern. Med.* **2021**, *181*, 1006–1008. [CrossRef] [PubMed]
33. Williams, V.; Kovacs-Litman, A.; Muller, M.P.; Hota, S.; Powis, J.E.; Ricciuto, D.R.; Mertz, D.; Katz, K.; Castellani, L.; Kiss, A.; et al. Impact of COVID-19 on hospital hand hygiene performance: A multicentre observational study using group electronic monitoring. *CMAJ Open* **2021**, *9*, E1175–E1180. [CrossRef] [PubMed]
34. Galanis, P.; Moisoglou, I.; Malliarou, M.; Papathanasiou, I.V.; Katsiroumpa, A.; Vraka, I.; Siskou, O.; Konstantakopoulou, O.; Kaitelidou, D. Quiet quitting among nurses increases their turnover intention: Evidence from Greece in the post-COVID-19 era. *Healthcare* **2023**, *12*, 79. [CrossRef]
35. Leep-Lazar, K.; Stimpfel, A.W. Factors associated with working during the COVID-19 pandemic and intent to stay at current nursing position. *Online J. Issues Nurs.* **2024**, *29*, 1–14. [CrossRef]
36. Gasteiger, N.; van der Veer, S.N.; Wilson, P.; Dowding, D. Virtual reality and augmented reality smartphone applications for upskilling care home workers in hand hygiene: A realist multi-site feasibility, usability, acceptability, and efficacy study. *J. Am. Med. Inform. Assoc.* **2023**, *31*, 45–60. [CrossRef] [PubMed]
37. Hammerschmidt, J.; Manser, T. Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: A cross-sectional mixed-methods study. *BMC Health Serv. Res.* **2019**, *19*, 547. [CrossRef]

38. Fernandes, D.R.; Santos, B.N.D.; Guimarães, C.S.; Ferreira, E.B.; Margatho, A.S.; Reis, P.E.D.D.; Pittet, D.; Silveira, R.C.C.P. Educational technologies for teaching hand hygiene: Systematic review. *PLoS ONE* **2024**, *19*, e0294725. [CrossRef]
39. Garlasco, J.; Vicentini, C.; Emelurumonye, I.N.; D'Alessandro, G.; Quattrocolo, F.; Zotti, C.M. Alcohol-based hand rub consumption and world health organization hand hygiene self-assessment framework: A comparison between the 2 surveillances in a 4-year region-wide experience. *J. Patient Saf.* **2022**, *18*, e658–e665. [CrossRef]
40. Velardo, F.; Péfau, M.; Nasso, R.; Parneix, P.; Venier, A.G. Using patients' observations to evaluate healthcare workers' alcohol-based hand rub with Pulpe'friction audits: A promising approach? *GMS. Hyg. Infect. Control.* **2023**, *18*, Doc29. [CrossRef] [PubMed]