COLLOQUE
IRSST
2021

La recherche en SST
au service des milieux du travail
en période de pandémie

Uniformes médicaux connectés au service de la logistique et de la prévention de contamination en période de pandémie

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Vos conférenciers

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LABO IoT Internet des Objets ESG UQÀM

CRI²GS Centre sur l'intelligence² en gestion de systèmes complexes

LATECE

Réseau Innovation 4.0 Network

HumanIA

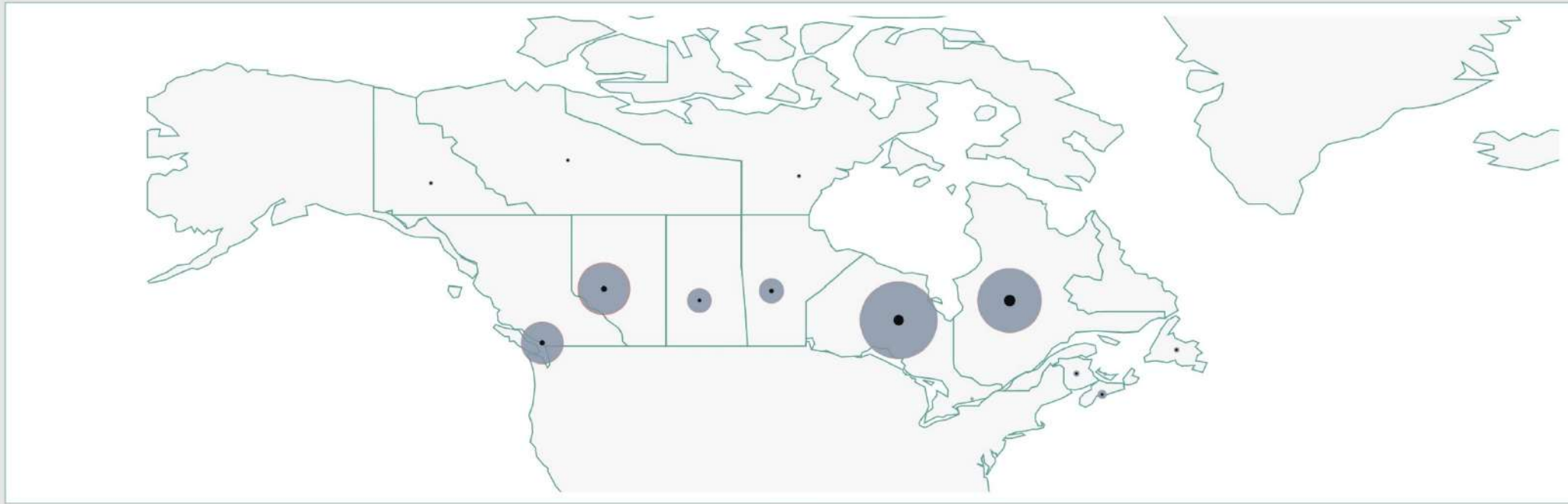
irsst

Où nous en sommes

Absol. No. Per 100,000 ppl.

WORLD **CANADA**

Provinces/Terr.	Number of cases ↓
Canada	1,535,364
Ontario	572,978
Quebec	396,034
Alberta	264,564
British Columbia	172,338
Manitoba	59,203
Saskatchewan	57,521
Nova Scotia	6,117
New Brunswick	2,909
Newfoundland and Labr.	1,532
Yukon	699
Nunavut	658
Northwest Territories	563
Prince Edward Island	235



Canada | Most recent numbers

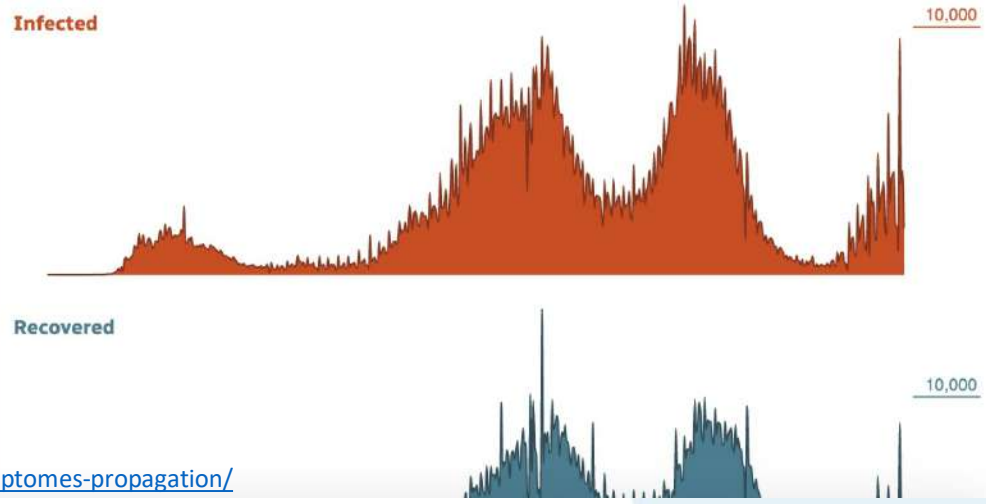
REPORTED CASES		COMPARED TO PREVIOUS DAY
Infected	1,535,364	+ 1,876
Active*	38,497	+ 348
Recov.	1,469,717	+ 1,512
Deaths	27,150	+ 16

*infected people who have neither died nor been officially considered recovered

https://ici.radio-canada.ca/info/2020/coronavirus-covid-19-pandemie-cas-carte-maladie-symptomes-propagation/

Canada | Reported daily cases

Cumulative Logarithmic



Évolution du contexte - avant

Évolution du contexte…et maintenant

Les défis & enjeux - le cas de l'HGJ (notre partenaire dans le projet)

Les défis sont multiples, il faut concilier efficience des opérations et expérience patient-famille, réfléchir à la circulation des patients, du personnel et de l'équipement dans un environnement de travail très exigent.

Co-évolutions du secteur et des technologies

Ubiquité des technologies (Robots) & des objets connectés

Défis & Opportunités d'amélioration en SST

…par où on commence?

Administration
Adult Critical Care
Allergy And Immunology
Ambulatory recovery room
Anaesthesia - Resuscitation
Audio-Visual Services
Audiology & Speech Pathology
Auxiliary
B'rith Room
Biomedical Engineering
Breast Centre
Cancer Prevention Centre
Cardiac Surgery
Cardiology
Cardiovascular Prevention Center
Case room
Central Sterilization Departement
Centre for Nursing Research
Chaplaincy
Clinical Chemistry
Clinical Research Unit
Coffee Shops - Atrium
Colposcopy
Conference Rooms
Continus Quality Improvement CQI
Council of Physicians, Dentists and Pharm
Dentistry
Dermatology
Diagnostic Medecine
Dialysis
Dietetics
Emergency
Employee Assistance Program
Endocrinology
Epidemiology
Family Birthing Centre
Finance
Foundation
Gastroenterology
Geriatrics
Health Sciences LIbrary
Health Services
Health & Safety
Hematology
Herzl Family Practice Center
Hope & Cope
Hospital Training and Staff Development
Housekeeping
Human Resources
Infection Prevention and Control
Information Technologies
Inhalation Respiratory
Institute Of Community And Family Psychiatry
Intensive Care Unit
Internal Medicine
Kidney Treatment Center
Lady Davis Institute For Medical Research
Laundry And Linen Services
Mail Room
Main Lobby
Maintenance and Plant Operations
Maison de la Presse
Medical council
Medical Day Hospital
Medical Genetics
Medical Records
Medical Teaching Office
Medicine
MHA Medical Holding Area
Microbiologie and infectious diseases
Montreal Centre for Experimental Therapeut
MSTU Medical Short Term Unit
Neonatology
Nephrology
Neurology
Neurosurgery
Nuclear Medicine
Nursing
Nursing Research
Obstetrical Ultra Sound
Obstetrics & Gynecology
Occupational Therapy
Oncology
Operating Room
Ophtalmology
Orthopedics
Otolaryngology
Palliative Care
Pastoral Services
Pathology
Pharmacy
Physiotherapy
Plant Operations
Plastic and Reconstructive Surgery
Professional Services
Psychiatry
Psycho-geriatric
Public Affairs and Communications
Pulmonary
Pulmonary Oncology
Purchasing
Quality Program
Radiation Oncology
Radiology
Receiving & Shipping
Recovery Room
Research Ethics Office
Respiratory Physiology
Respiratory Therapy
Rheumatology
Second Cup, Légaré Entrance
Second Cup, Main Lobby
Security
Social Services
Speech Pathology
Sterilization and Distribution Se
Surgery
Surgical Teaching Office
Telecommunications
Television Service
Thoracic Surgery
Transfusion Service
Ultrasound
Undergraduate Teaching Office
Urology
Vascular Surgery
Volunteer Services

Opportunités multiples

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Où tous regardent

Santé numérique - *Digital Health*

Où peu regardent
la logistique Hospitalière

MANAGEMENT Article web 0,00 $

LA LOGISTIQUE HOSPITALIÈRE : CONSTATS D'UNE ENQUÊTE QUÉBÉCOISE

Par Pôle Santé HEC Montréal, Martin Beaulieu, Jacques Roy | Catégorie reliée: Santé

CAIRN.INFO
MATIÈRES À RÉFLEXION
Vos mots-clés

REVUES | OUVRAGES | QUE SAIS-JE ? / REPÈRES | MAGAZINES | MON CAIRN.INFO

ACCUEIL > REVUES > REVUE > NUMÉRO > ARTICLE

Logistique hospitalière, un outil du management

Le cas des hôpitaux français et moldaves

Maria Costin

DANS HUMANISME ET ENTREPRISE 2010/4 (n° 299), PAGES 29 À 48

CITER OU EXPORTER

AJOUTER À MA BIBLIOGRAPHIE

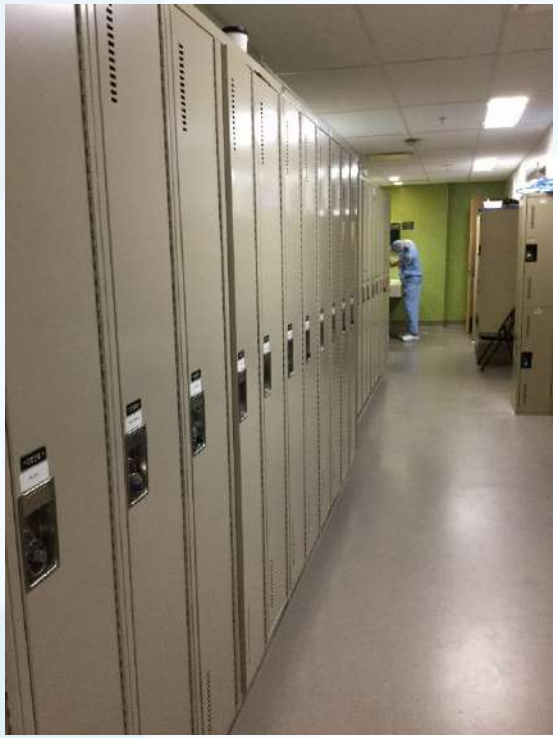
ARTICLE | RÉSUMÉ | PLAN | BIBLIOGRAPHIE | AUTEUR | SUR UN SUJET PROCHE | TÉLÉCHARGER

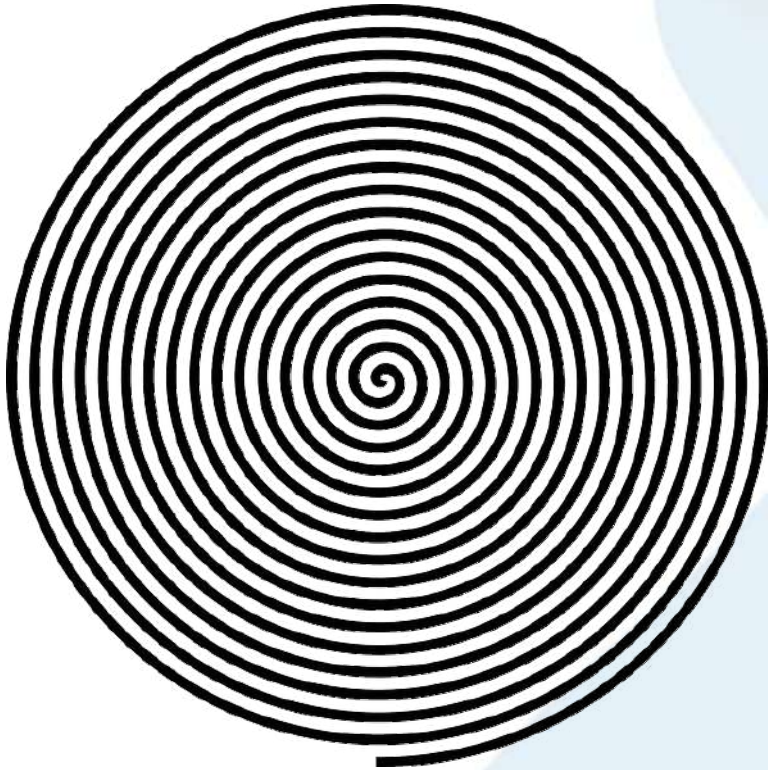
Cas d’étude
Les EPI_PPE (gestion des scrubs)

Problème d’affaire:

- inefficiences logistiques (surstockage, pénurie, vols)
- contamination croisées (règles sanitaires non respectées)
- Santé-sécurité du personnel et des patients

Cas d’étude
les problèmes classiques





Analyse du processus

et c’est tout le circuit logistique qu’il faut revoir et stabiliser…

Et puis…

il faut aussi regarder l'aspect SST

The Centers for Disease Control and Prevention (CDC) says that, although this is not thought to be the main way in which the virus spreads, a person can become infected by touching a surface that has the virus on it "and then touching their own mouth, nose, or possibly their eyes."

Bendavid Y. et Maïzi Y. (2020). Expert View: An Overlooked Use of RFID at Hospitals – Making the case for scrubs-management systems during the COVID-19 pandemic. RFID Journal 6 Mai 2020

Dans la littérature

Nurses' uniforms: How many bacteria do they carry after one shift?

This pilot study investigated the pathogens that nurses are potentially bringing into the public and their home when they wear work uniforms outside of the work environment. To achieve this, sterilized uniforms were distributed to 10 nurses at a local hospital in Washington State at the beginning of their shift. Worn uniforms were collected at the end of the shifts and sent to a laboratory for analysis. Four tests were conducted: 1) a heterotrophic growth plate count, 2) methicillin-resistant *Staphylococcus aureus* (MRSA) growth, 3) vancomycin-resistant *Enterococci* (VRE), and 4) identification of the heterotrophic plate counts. Each participant completed a questionnaire and a survey. **The results showed that the average bacteria colony growth per square inch was 1,246 and 5,795 for day and night shift,** respectively. After 48 h, MRSA positives were present on 4 of the day shift and 3 of the night shift uniforms. Additional bacteria identified include: *Bacillus* sp., Micrococcus luteus, Staphylococcus aureus, Staphylococcus epidermidis, and Micrococcus roseus. The significant presence of bacteria on the uniforms 48 h after the shift ended necessitates further study, discussions and policy consideration regarding wearing health care uniforms outside of the work environment.

Keywords: Scrubs, uniforms, infections, nurses, healthcare providers, pathogens

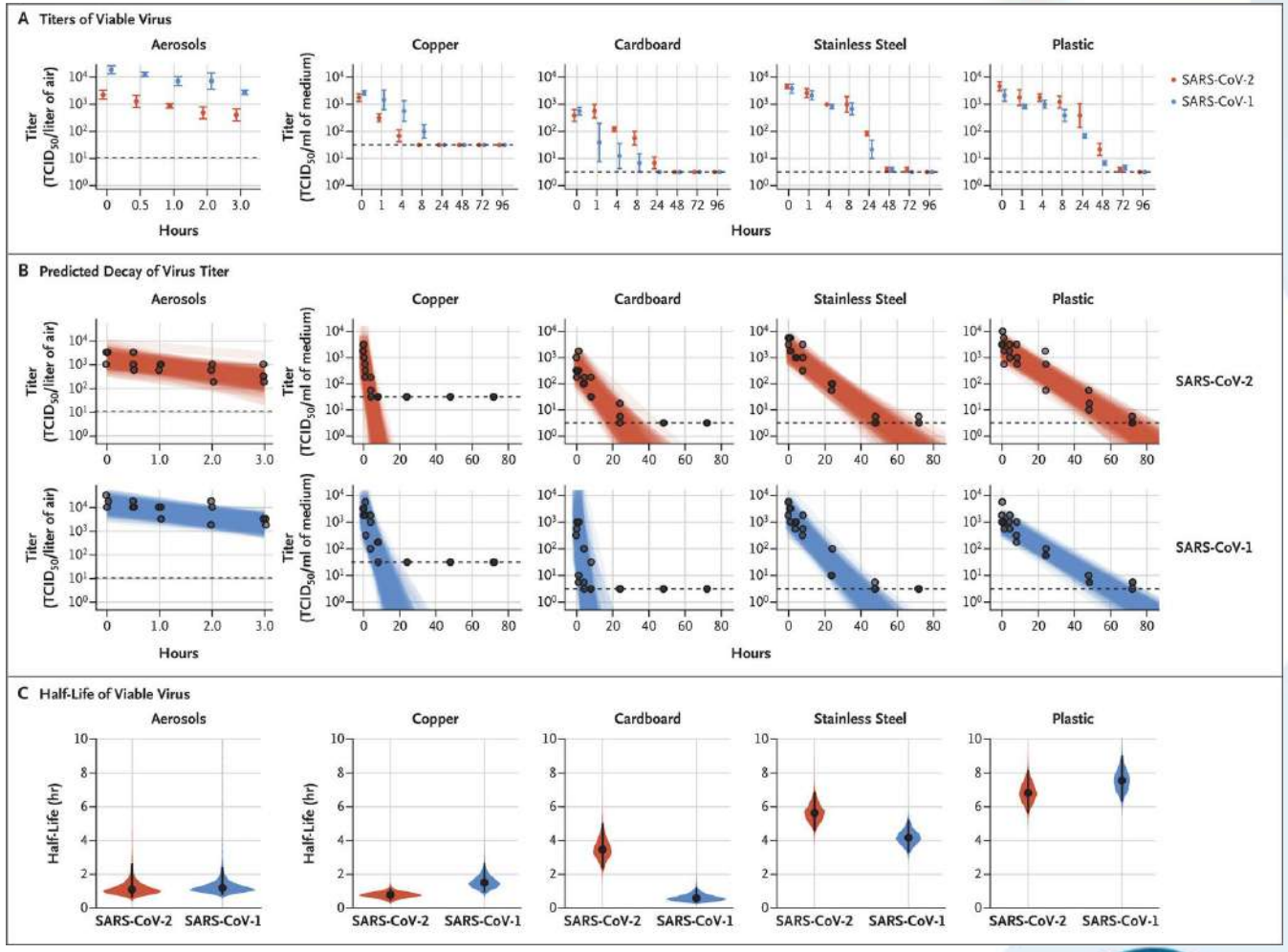
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4180417/

Dans la littérature
virus sur les surfaces

Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1

... «the virus can remain viable and infectious in aerosols for hours and on surfaces up to days (depending on the inoculum shed».

The NEW ENGLAND JOURNAL of MEDICINE



https://www.nejm.org/doi/full/10.1056/nejmc2004973

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Cas d’étude
Les EPI_PPE (gestion des scrubs)

Objectifs du projet:

- Améliorer l’efficiences des de gestion des scrubs (cycle logistique)
- Améliorer la santé-sécurité du personnel et des patient

Technologies IoT sélectionnées:

- IoT en fonction du cas d’utilisation

Cas d’étude
Les EPI_PPE (gestion des scrubs)

Les pistes de solutions

Sensibilisation, surveillance, contrôle...

Vs.

vêtements connectés, Armoires intelligentes, Réapprovisionnements automatisés,

Solutions évisagées

il existe des solutions depuis plus de 15 ans…mais

La RFID remplace le code à barres dans la blanchisserie hospitalière
RÉDACTIONL'USINE NOUVELLE **25/10/2006**

Tagsys Unveils Smart Cabinet to Help Hospitals Manage Surgical Scrubs
RFID Journal Jun 13, 2007
The system takes inventory of available items, records which garments have been dispensed to which hospital staff and documents those returned for laundering.

Keep scrubs in your hospital
HEALTHCARE SECURITY WEEKLY, **March 14, 2004**
Last week a Canadian hospital fed up with an estimated $300,000 loss in stolen scrub suits decided to sell the ultra comfortable hospital uniforms. The hospital hopes to recoup the money in stolen and misplaced scrubs, according to the Calgary Herald.

RFID Tidies Up Distribution of Hospital Scrubs
RFID Journal Feb 06, 2007
At St. Olavs, an RFID-based system tracks work garments, saving space and labor costs while improving inventory accuracy.

Et puis…pourquoi se casser la tête
Modèles de VMI & Solution jetables!

SOLUTION COMPONENTS

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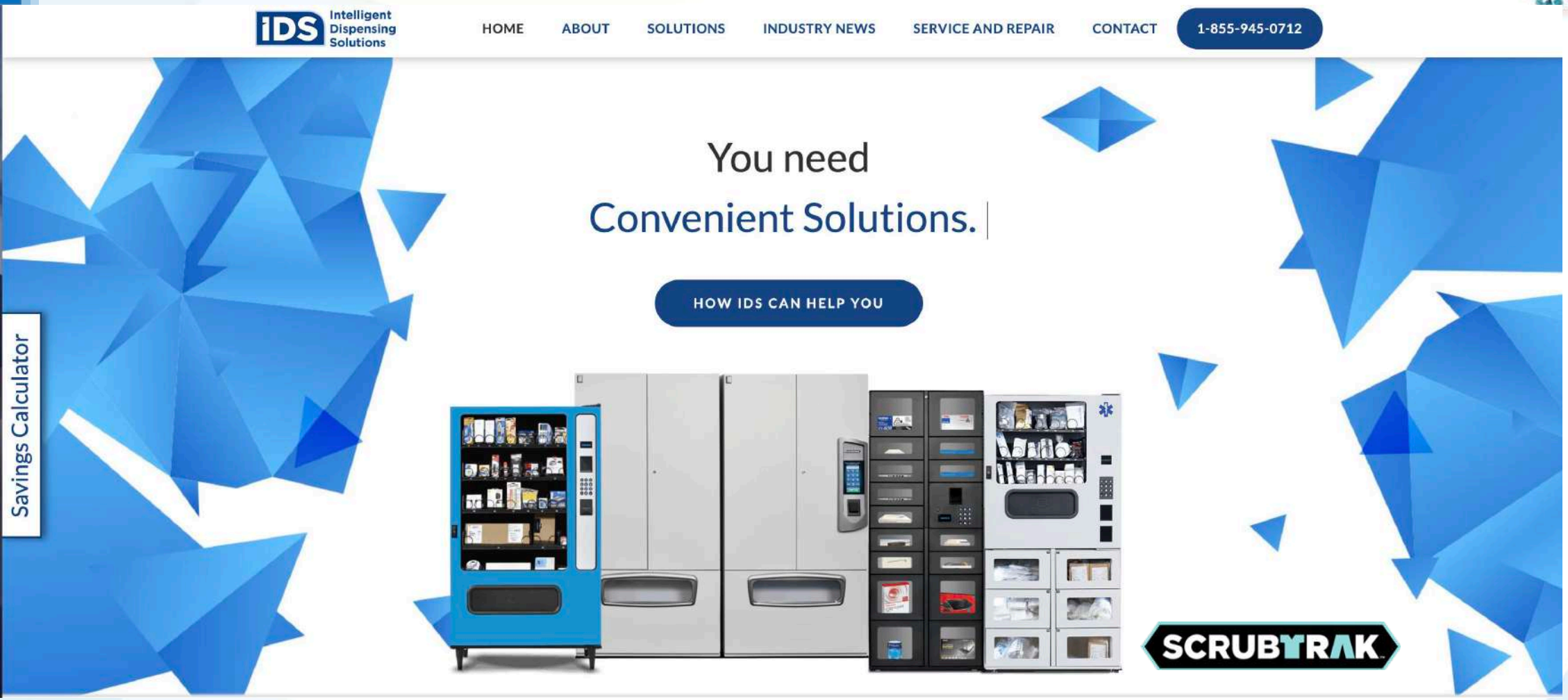
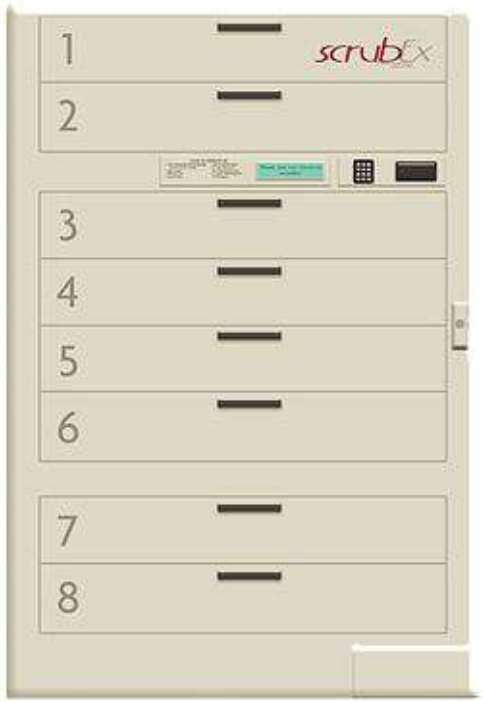
Solutions…distributrices/armoires



On regarde les solutions déployées ailleurs



LARGE VOLUME DISPENSER & RECEIVER
Serves up to 170 users per day

MEDIUM COMBINATION
Serves up to 85 users per day

SMALL COMBINATION
Serves up to 40 users per day

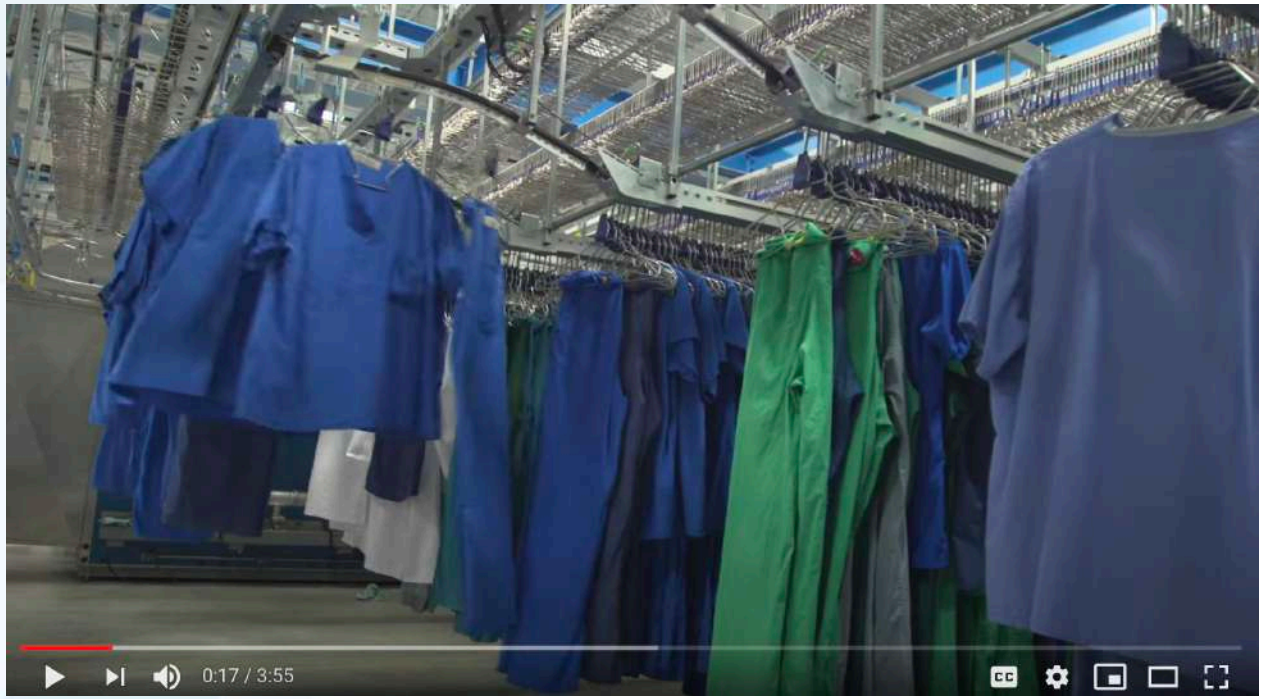
JACKETS
Available in all three sizes

…et on se rend vite compte de la multiplicité des acteurs et des solutions

https://www.autovaletsystems.com/

http://fr.deister.com/solutions/gestion-des-textiles

…on s’intéresse à l’intégration avec les système de distribution & de la logistique de réapprovisionnement



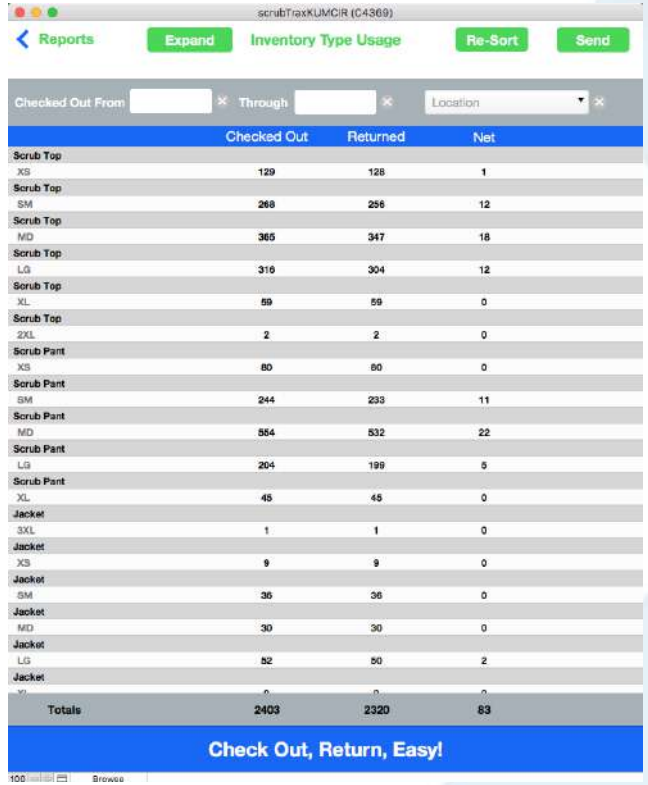
Unitex Automated Scrub Dispensing Program & ScrbEx (2016)

On regarde ce qui se fait ailleurs

https://www.invotech.com/products/uniform-system

On regarde les différents modèles d'affaires

Mobilité & simplicité, mais…



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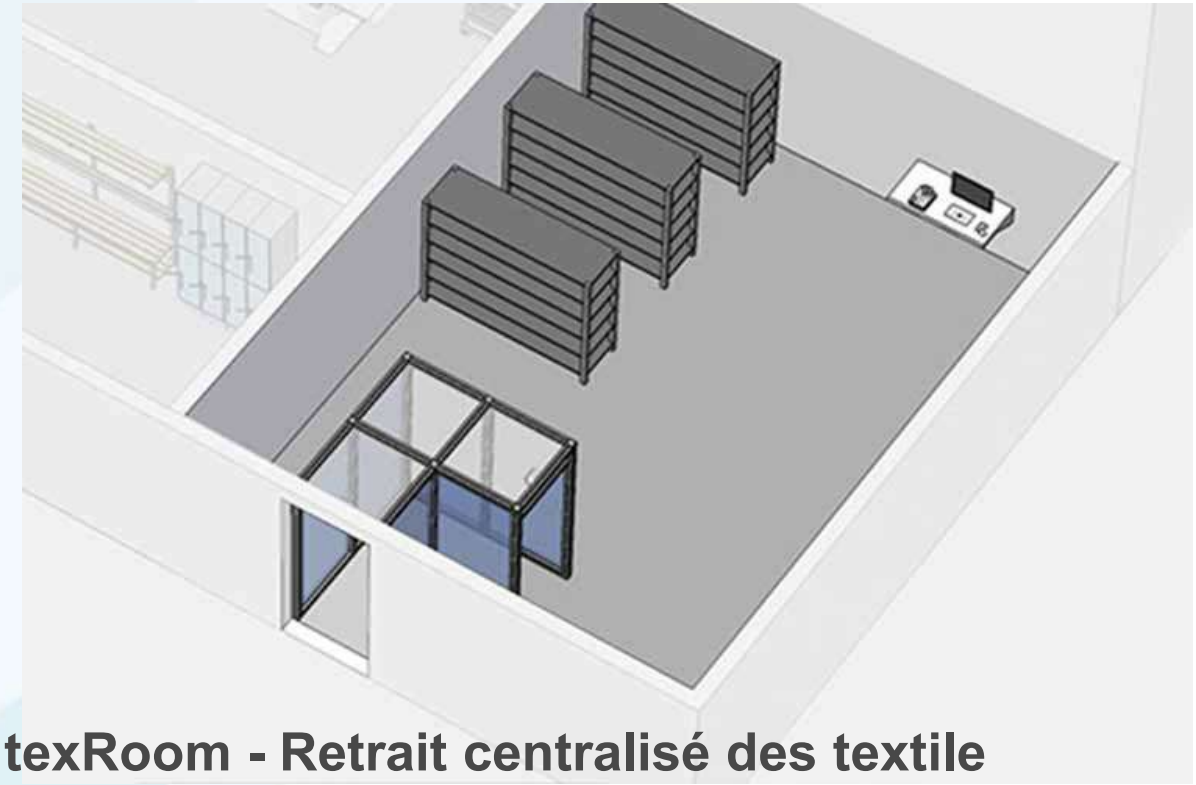
On regarde les différents modèles d'affaires

On pense aux «smat stores»



texRoom - Retrait centralisé des textile

.

Le texCheck est une station d'enregistrement manuel des textiles par l'utilisateur.

La transferGate est un sas de lectures des textiles équipés de tags RFID.

deister electronic France - http://fr.deister.com/solutions/gestion-des-textiles

Cas d’étude
Les EPI_PPE (gestion des scrubs)

L’analyse des options

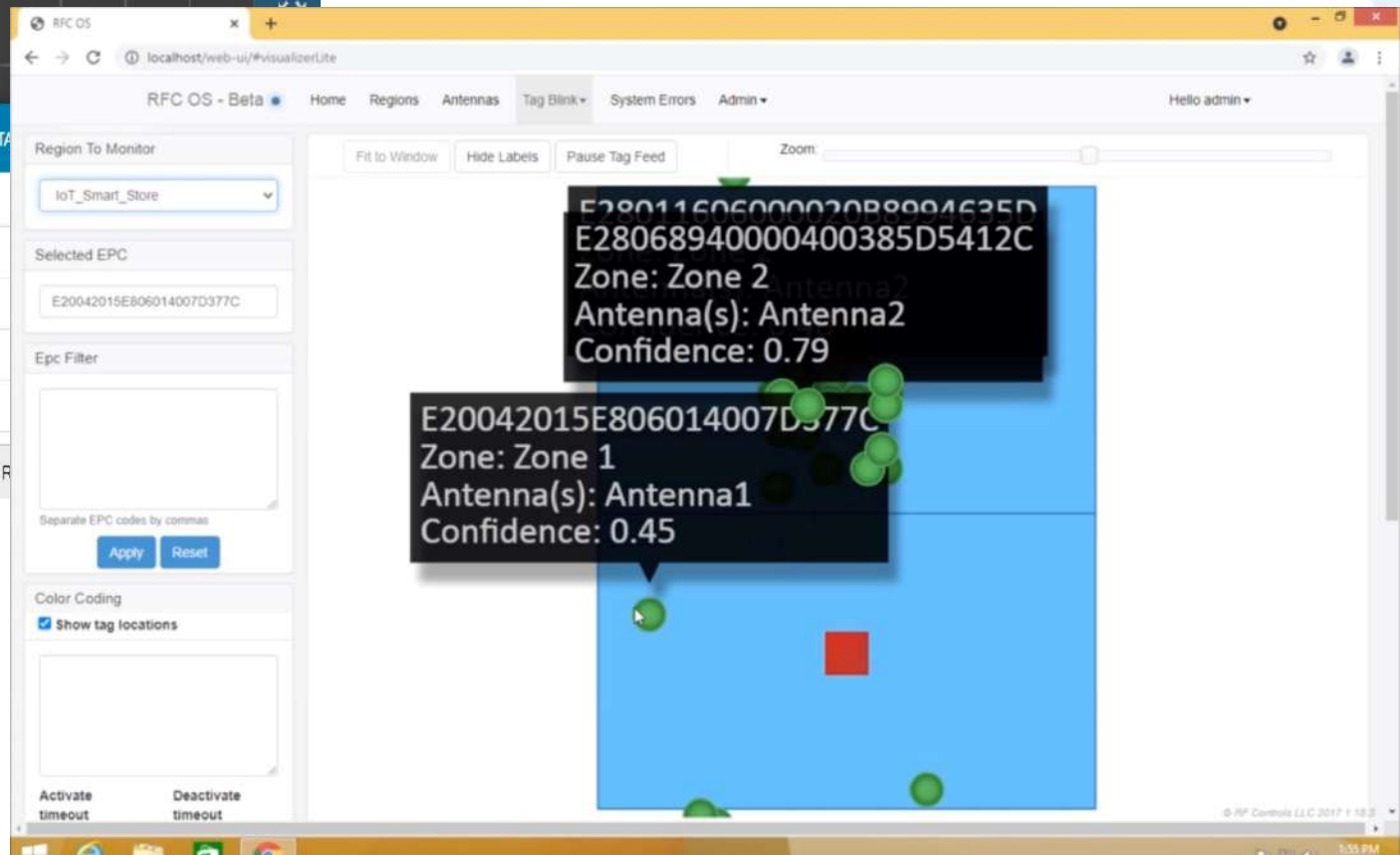
Expérimentation en laboratoire & simulation

Les travaux au lab. IoT

Prototypes d’armoires connectées

Les travaux au lab. IoT

Prototypes zones connectées



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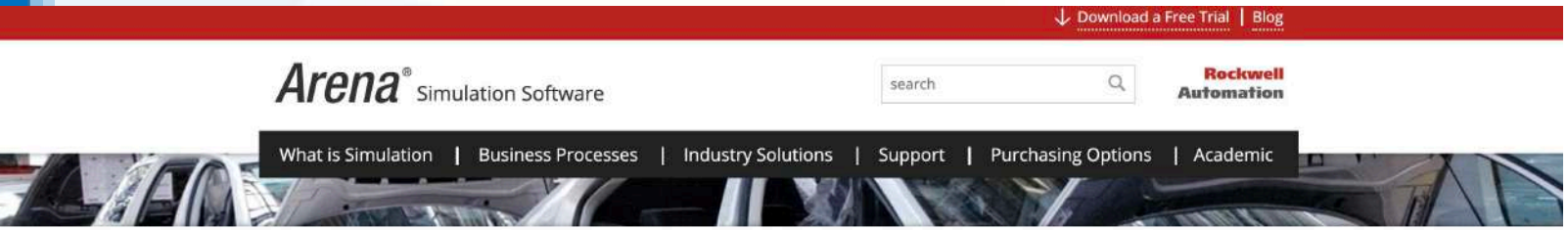
L'approche d'évaluation des options
La simulation

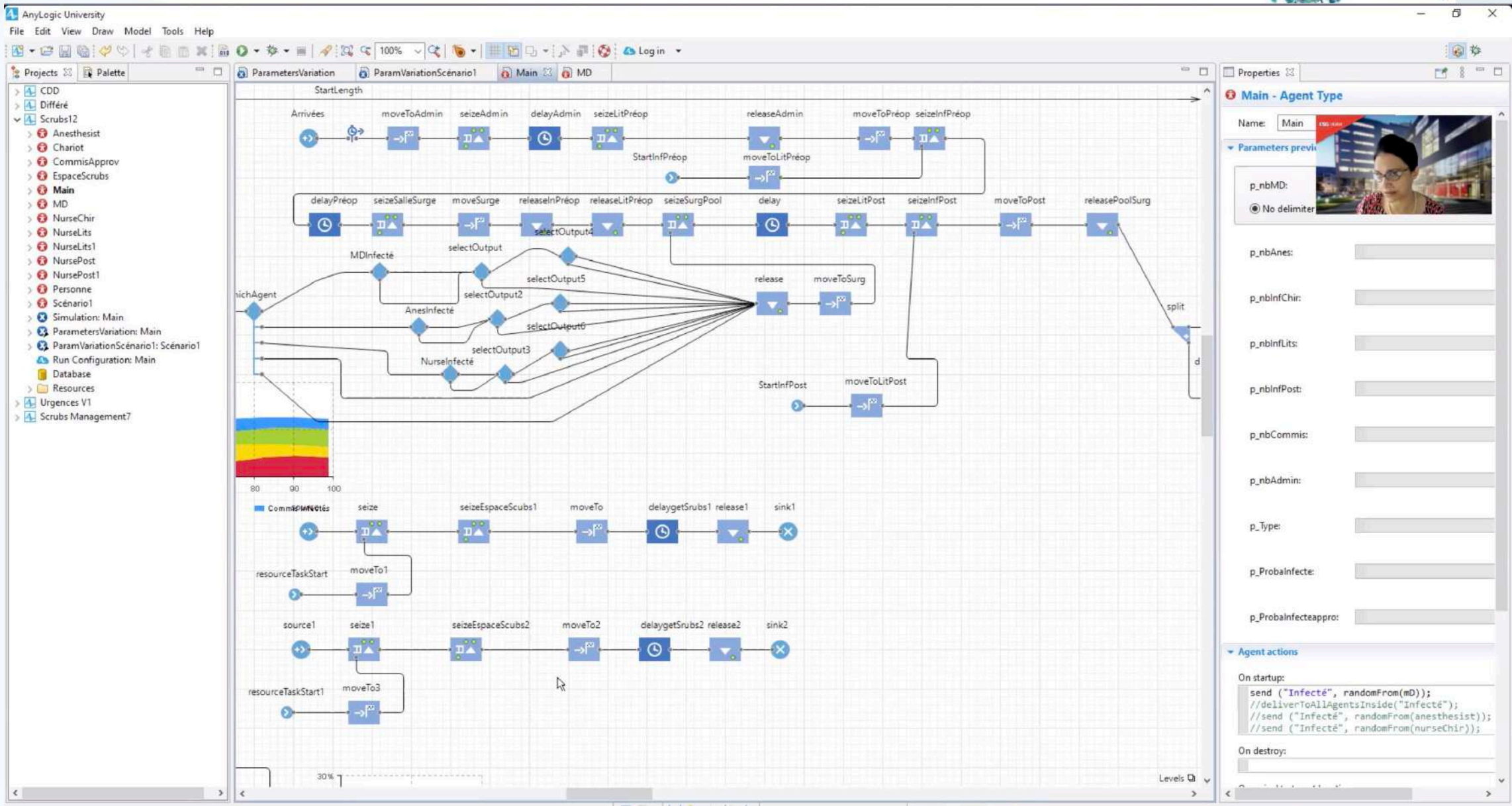


https://www.arenasimulation.com/

https://www.anylogic.fr/

La simulation

On commence par monter le modèle



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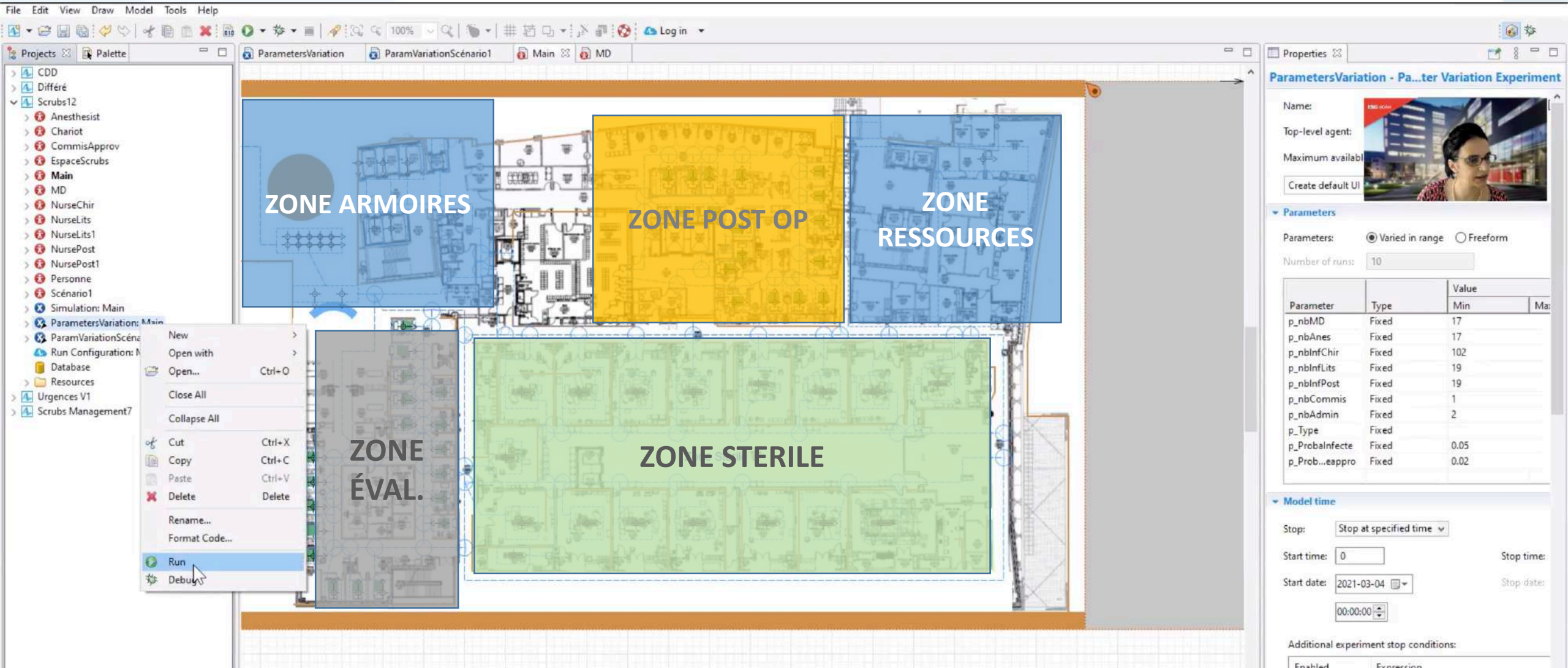
La simulation

On modélise en fonction de l'environnement d'affaires



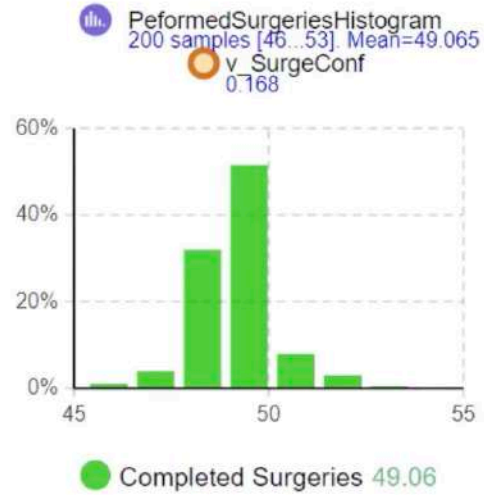
La simulation

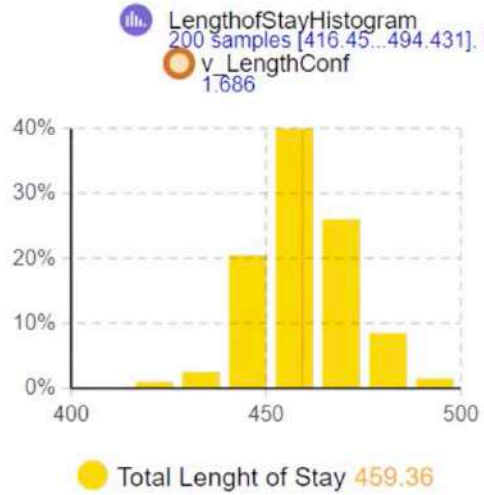
Visualisation 2D et 3D

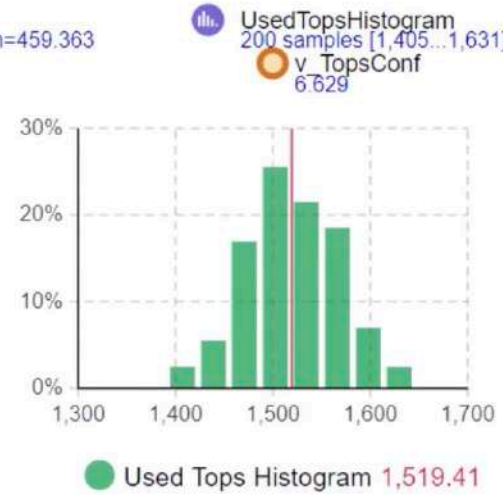
La simulation

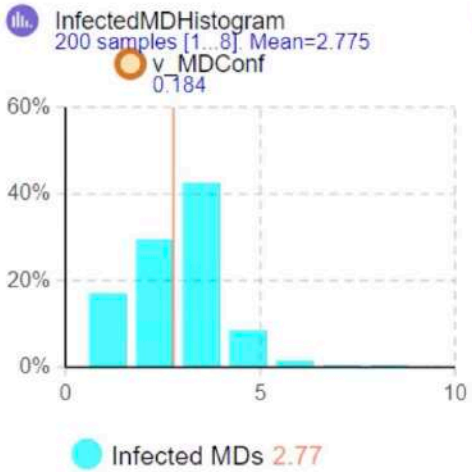
Analyse de la performance actuelle

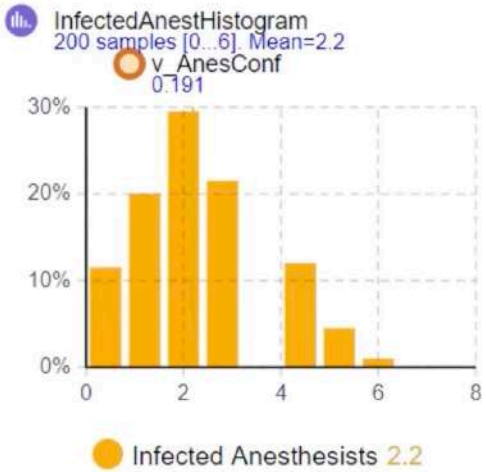
Scrubs12 : ParametersVariation - AnyLogic University Researcher

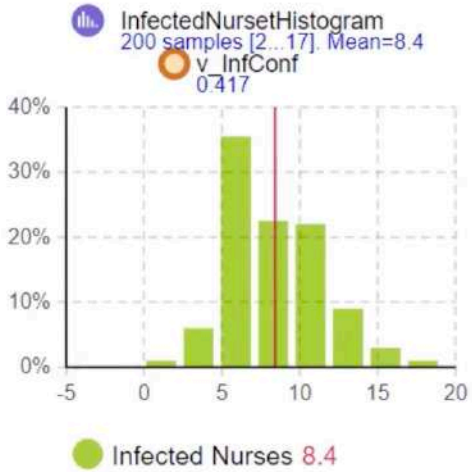


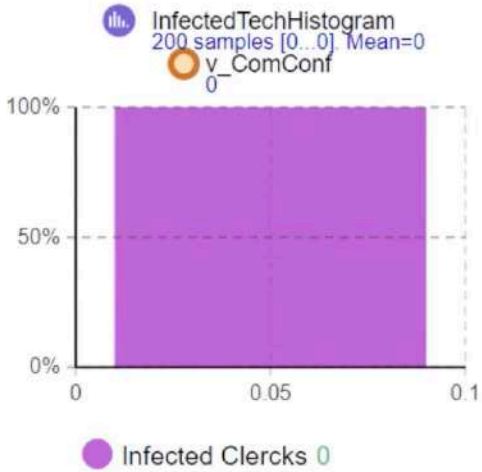






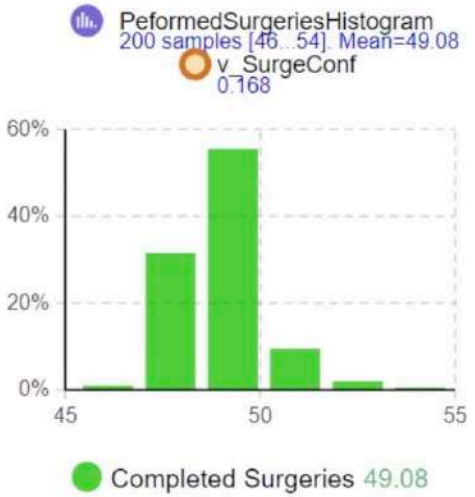


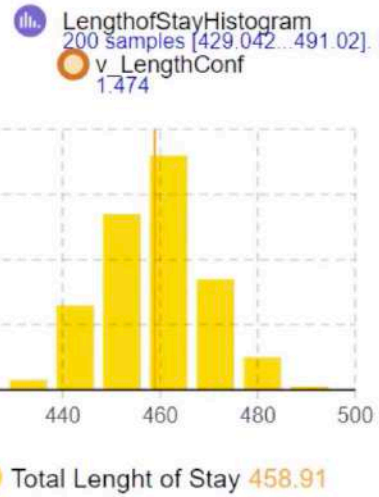


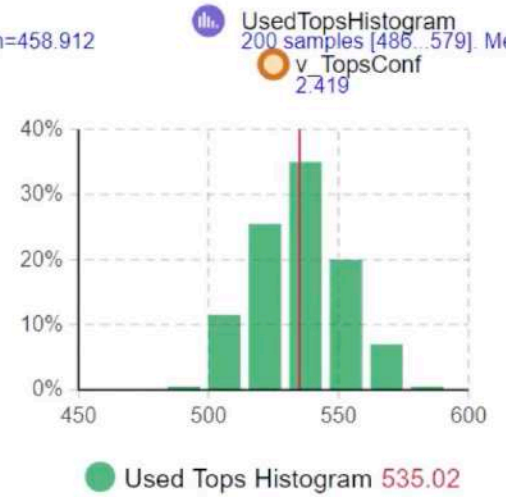


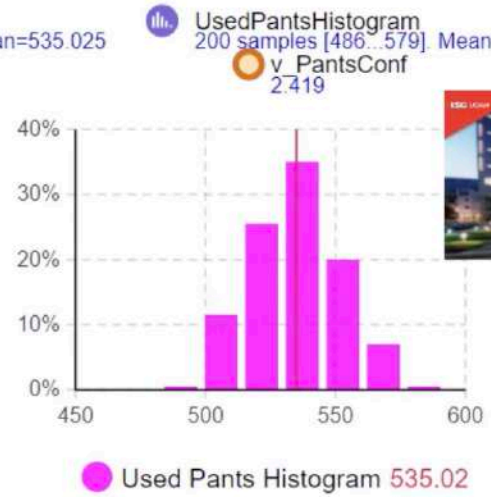
La simulation

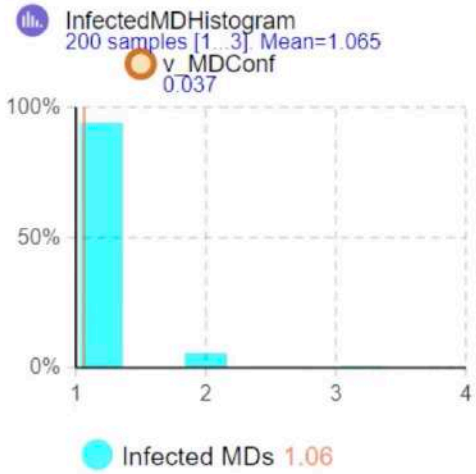
Analyse de la performance avec la solution identifiée

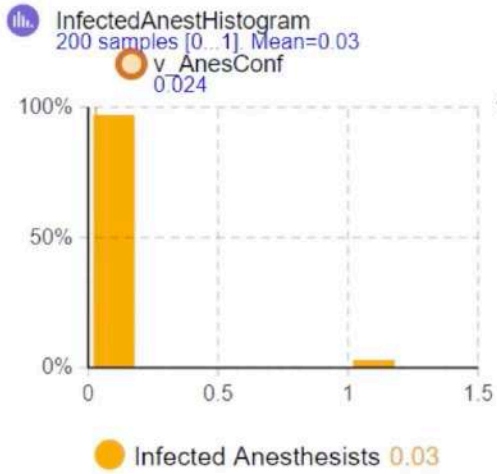


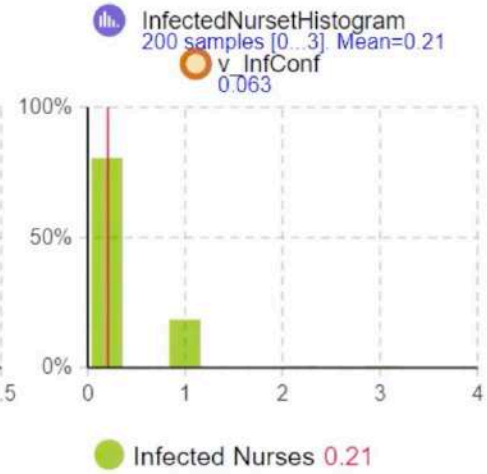


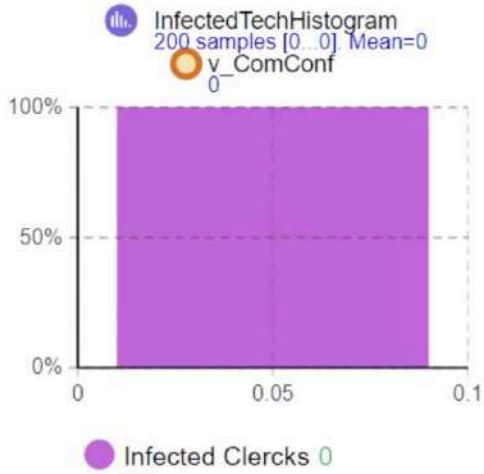












Cas d’étude
Les EPI_PPE (gestion des scrubs)

Les solutions retenues

Technologies RFID passives UHF

Armoires connectées

Distributrices automatisées

Révision des processus

Nouveaux aménagements

Gestion des scrubs
Ligne de produits

Cas d’étude
Les EPI_PPE (gestion des scrubs)

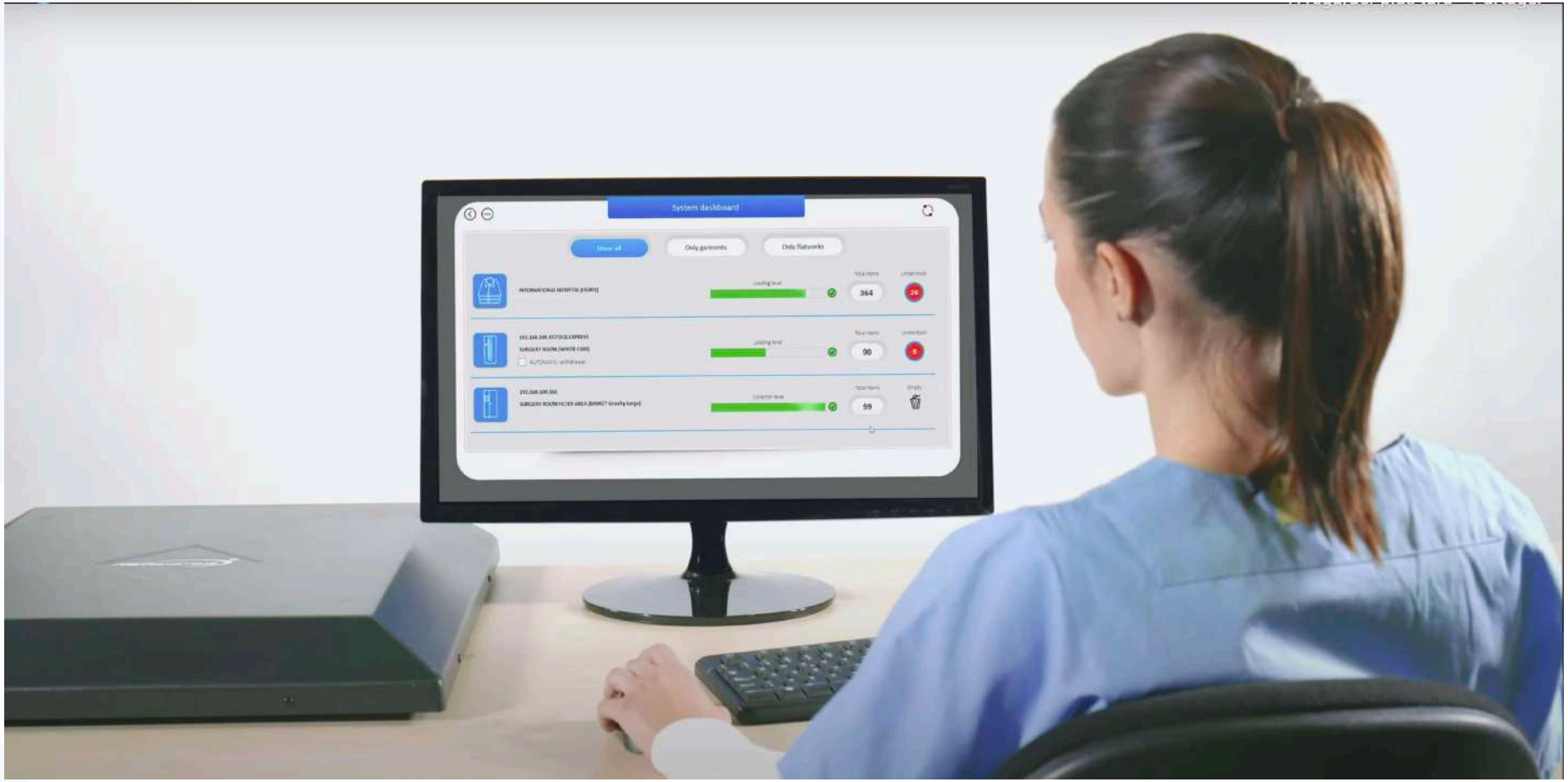
https://www.abgsys.com/portfolio/white-c/

Option 1 : armoires RFID

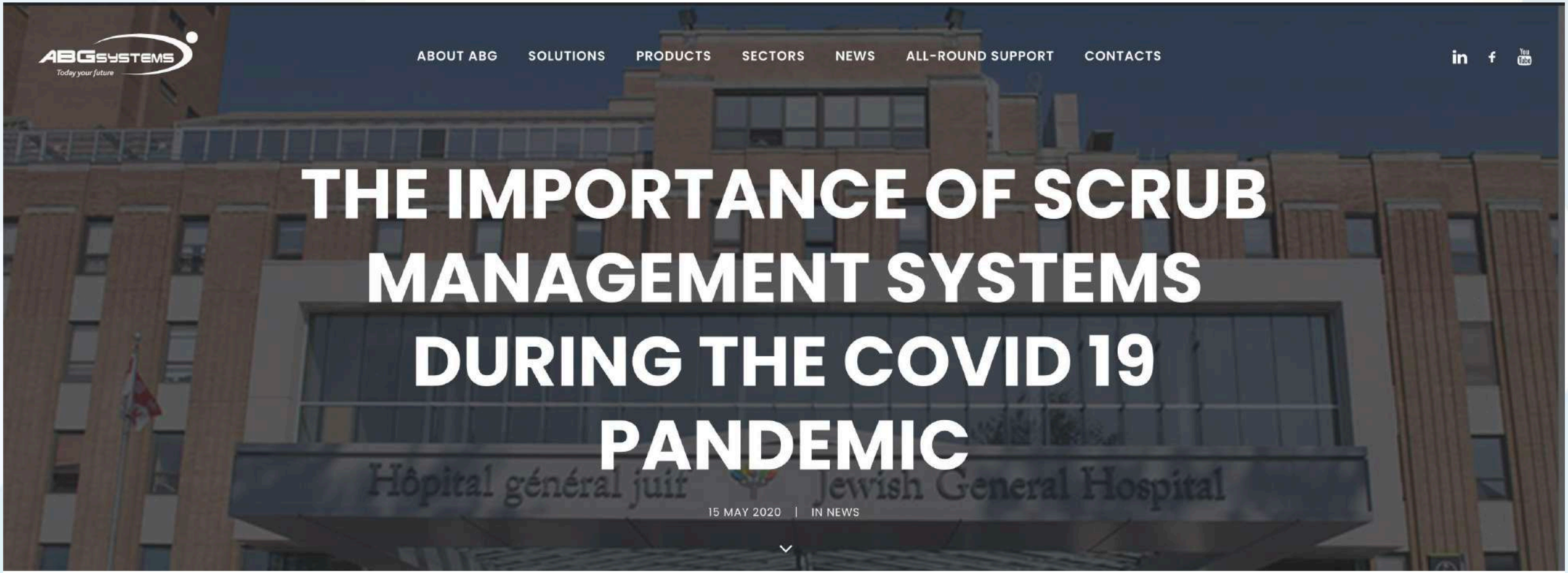
Gestion des uniformes médicaux (suivi des uniformes dans les espaces)

La valeur

Des solutions qui misent sur la capture automatique de données



Étude de Cas
Gestion des uniformes médicaux



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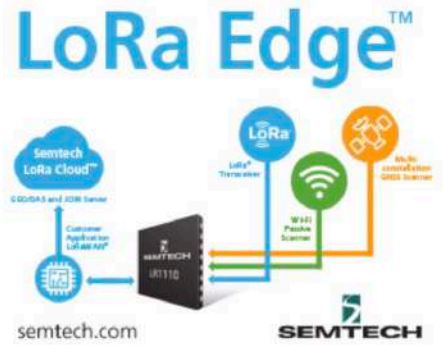

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CASE STUDIES

Hospital Meets High Demand for Scrubs With RFID

BY CLAIRE SWEDBERG

Montreal's Jewish General Hospital leveraged its existing RFID management system for tracking hospital garments to enable an overnight ramp-up of scrubs demands to meet COVID-19 related regulations.

May 24, 2020 Montreal's Jewish General Hospital, along with its technology providers, took a strategic and measured approach when it deployed an RFID-based solution for tracking healthcare workers' uniforms. The medical facility is the largest hospital in a group known as CIUSSS (Le Centre intégré universitaire de santé et de services sociaux), an integrated healthcare provider with multiple centers that employs 10,000 individuals.

In September 2018, the hospital deployed an RFID solution to track scrubs and other healthcare worker clothing from dispensing to laundry, then back into clean cabinets for reuse. The deployment planners spent months examining solutions, piloting the technology and training the targeted users—physicians and nurses in the OR—to employ the system. The result, according to the hospital, was a well-received and effective solution.

https://www.rfidjournal.com/hospital-meets-high-demand-for-scrubs-with-rfid

Publications & presse

- Maizi Y. et Y. Bendavid, (2020). Hybrid simulation modeling for analyzing the impact of RFID scrubs' distribution in operating rooms , MSC-LES 19th International Conference on Modelling and Applied Simulation/ 17th International Multidisciplinary Modeling & Simulation Multiconference, Athens Greece
- Bendavid Y. et Maïzi Y. (2020). Expert View: An Overlooked Use of RFID at Hospitals – Making the case for scrubs-management systems during the COVID-19 pandemic. RFID Journal 6 Mai 2020

- Swedberg C. (2020). Hospital Meets High Demand for Scrubs With RFID. RFID Journal, 24 Mai 2020.
- Roy J. (2021). Internet des Objets – Le jumeau numérique & l'intelligence artificielle, La Presse+
- Letarte. M (2021). L'Internet des objets au service de l'hôpital, le Devoir, (Collaboration spéciale, 13 mars 2021) et la Presse (collaboration spéciale, 20 avril 2021)
- Wong W. (2020). How RFID Solutions Improve Safety During COVID-19, Health Tech, 17 dec. 2020

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4180417/