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P.R.I.D.E.—preventing respiratory infectious disease exposures: An improvement project in a Northern Californian emergency room

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Background: Preventing respiratory infectious disease exposures is a performance improvement project to reduce the incidence of occupational health exposures among health care workers. This project encouraged registered nurses to quickly identify and isolate potentially infectious patients in the emergency room, to prevent exposures to airborne and droplet transmitted communicable diseases, including meningitis, tuberculosis, and measles.

Methods: This pre- and postintervention model implemented a quasi-experimental designed project in the emergency room (ER). The Centers for Disease Control's empiric transmission-based isolation precautions were implemented to prevent occupational health exposures. Eighty registered nurses (RN's) received education on the new intervention. The assumption of this project was, the new process will decrease occupational health exposures.

Results: Eight ER RNs reported an occupational health exposure, preintervention in quarter 2 of 2019, compared to zero occupational health exposures, postintervention in quarter 3 of 2019. A χ^2 independence test was used to determine if the categorical variables of the capstone intervention and disease exposure were related in the same RN population. An association between the capstone intervention and disease exposure was observed, $X^2(1) = 8.421, P = .004$, indicating the result is statistically significant.

Conclusions: The preventing respiratory infectious disease exposures project effectively reduced occupational health exposures to airborne and droplet transmitted diseases in the emergency room by 100%. These results should encourage Infection Preventionists to adapt the Centers for Disease Control's empiric transmission isolation precautions in their emergency rooms and urgent cares to prevent airborne and droplet transmitted disease exposures.

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Unidentified, potentially infectious, emergency room (ER) patients pose a health risk to health care workers (HCW), patients, and visitors. The preventing respiratory infectious disease exposures (P.R.I.D.E.) program prepared front-line emergency room Registered Nurses (RNs), to promptly identify and isolate potentially infectious patients. This study consisted of a quasi-experimental design with a pre- and postintervention model, and a quantitative approach, to evaluate the prevention of occupational health exposures related to airborne and droplet transmitted diseases such as Tuberculosis (TB), Pertussis, Influenza, and Measles.

ER patients often present with signs and symptoms of highly infectious communicable diseases. Measles is a highly contagious disease and unvaccinated individuals, including those too young to be vaccinated for Measles, have caused outbreaks in various countries.¹ This topic is a timely and relevant public health concern. According to Ryan et al,² hospitals in the United States (U.S.) are at risk for a Measles outbreak to occur due to an increasing number of parents refusing to allow their children to receive childhood immunizations. Additionally, some HCW's do not accept vaccinations or booster shots upon hire.³ This issue is further complicated by a health care provider's inexperience to identify diseases once considered eliminated in the U.S., such as Measles.⁴

According to Spencer-Henshall et al,⁵ many individuals do not consider themselves at risk for TB, and health care professionals need to become familiar with signs and symptoms of communicable

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diseases to recognize and prevent potential occupational health exposures. A quick patient assessment by the RN in the ER during the triage period will help identify potentially infectious patients and is essential to reducing the incidence of occupational health exposures.

Early identification and isolation of potentially infectious patients is the aim of the P.R.I.D.E. project, and this was achieved by applying Centers for Disease Control's (CDC's) empiric transmission-based isolation precautions, thereby reducing the risk of occupational health exposures to airborne and droplet transmitted diseases. The P.R.I.D.E. project implemented isolation precautions based on clinical symptoms and likely pathogens during the first contact with an ER RN. For example, when a patient presents in the emergency room with a fever and rash, the patient would be considered a measles suspect and asked to wear a surgical mask in the waiting room.

P.R.I.D.E. PROJECT DESCRIPTION

Previously, this organization did not have a structured process to aid RNs' to promptly identify and isolate infectious patients in the ER. When clinicians misidentify potentially contagious patients, the employees, patients, and visitors are at risk for disease transmission and health complications.⁶ The P.R.I.D.E. project prepared RNs to identify and isolate patients with the most common highly communicable diseases seen in the emergency room, such as TB, *Neisseria Meningitis*, Pertussis, and Measles. Additionally, RNs are now prepared to identify and isolate uncommon highly infectious diseases such as Ebola, Severe Acute Respiratory Syndrome, and Middle East Respiratory Syndrome Coronavirus.

This project assisted in filling this identified gap of knowledge deficit and lack of a transparent process to promptly isolate potentially infectious patients in the ER. Unprotected employee exposures in the ER are a known risk, which is often accepted by HCW.⁷ While general information regarding personal protective equipment (PPE) to avoid occupational health exposures is provided to all employees upon hire, the ER is a high-risk area that requires specific interventions and training to prevent communicable disease exposures from occurring (California Department of Public Health, 2019).⁸ This project assisted in filling this identified gap of knowledge deficit and lack of a transparent process to promptly isolate potentially infectious patients in the ER.

Historically at the organization, HCW, visitors, and other patients were potentially exposed to infectious patients, when they arrive in the emergency room. Exposures occurred because patient isolation does not begin until the patient is examined by a physician or mid-level health care professional, such as a physician's assistant or nurse practitioner. This practice could result in hours of unnecessary exposure to TB, influenza, measles, mumps, varicella-zoster, and pertussis in the waiting room and other patient care areas. During the years of 2017 and 2018, the occupational health department reported 17 cases and 3 cases respectively, of unprotected occupational exposures in the emergency room to airborne or droplet communicable diseases including TB, pertussis, and *Neisseria meningitidis*.

CDC recommends implementing measures to assist with early identification and isolation of potentially infectious individuals at the initial point of encounter in the health care setting.⁹ In the CDC's guide for Isolation Precautions, there is a table of clinical syndromes or conditions that warrant the use of empiric transmission isolation precautions.⁶ The guide lists the potential disease, clinical symptoms, potential pathogen, and empiric transmission-based precautions that should be implemented to prevent disease transmission.⁶

During the P.R.I.D.E. project, the CDC table was a tool to educate RNs to identify and isolate infectious patients. For example, within the table, under the column for clinical syndrome or condition, petechial/ecchymotic rash with fever is listed as sign and symptoms, for the potential pathogen known as *Neisseria meningitidis*.⁶ Moreover,

the recommendation of empiric precautions to prevent disease transmission is placing a surgical mask on the patient and then placing the patient in droplet isolation as a precaution for the first 24 hours of effective antimicrobial therapy.⁶

The P.R.I.D.E. project also provided education and empowered RNs to assess the need for PPE or patient isolation within the emergency room environment. The broader impact of this capstone project is the prevention of ongoing disease transmission. RNs in the emergency room have close contact with many individuals daily. When occupational health exposures are prevented, RNs will not expose others to a communicable disease, including their patients who may already be in a frail state of health.¹⁰ Ultimately, the P.R.I.D.E. project provided a new process to encourage HCW to protect themselves from occupational health exposures and reduce the likelihood of ongoing disease transmission.

METHODS

To reduce unprotected exposures to communicable diseases in the ER, the P.R.I.D.E. intervention promoted early identification and isolation of patients with signs and symptoms of diseases that are transmitted via droplets and aerosolization. Previously, the RN waited for the physician to assess the patient in the ER to determine if isolation precautions are necessary. The delay in diagnosis could result in hours of unprotected exposures to other patients, visitors, and employees as well as environmental contamination.¹¹

Practice changes included utilization of the CDC's recommendation to implement empiric transmission-based precautions to patients based on clinical symptoms and likely pathogens upon entry to the facility to prevent occupational health exposures.⁶ The organization's Intuitional Review Board approved the P.R.I.D.E. project as nonhuman subject research. During this project, the CDC's empiric transmission-based precaution guideline was used to quickly identify symptoms and determine what type of isolation is needed to prevent transmission of the suspected disease. This 3-page guideline was made available at the nurses' station and patient triage area.

INTERVENTION

The P.R.I.D.E. study with a quasi-experimental design including pre- and postintervention model which used a quantitative approach to evaluate the prevention and control of occupational health exposures related to airborne and droplet transmitted diseases. The setting is the ER department at a 300-bed acute care hospital in Northern California. This hospital is considered the county hospital of this region and serves the poor and vulnerable populations in the area. The intervention included the utilization of the CDC's isolation transmission-based precautions for all patients entering the ER.

The inclusion criteria involved RNs assigned to the ER. Physicians and other HCW were excluded from the intervention portion of the study, as they are not usually the first point of contact with patients in the ER. All RNs working in the ER were included in the sample size for occupational health exposures related to airborne and droplet transmitted diseases.

The P.R.I.D.E. project included a quick patient screening based on the CDC guideline during the RN triage assessment. The CDC tool screened for symptoms of communicable diseases and prompted initiation of isolation at the triage area of the ER. In the case of a patient suspected to have influenza, empiric isolation precautions would consist of placing a surgical mask on the patient. In a suspected Ebola patient, isolation empiric isolation precautions would include contact and airborne precautions in a negative pressure room.

The patient screening tool is the CDC's empiric transmission-based precaution guideline which outlines what type of isolation intervention is needed.⁶ This organization has a unique program called the "First

Nurse” in which a registered nurse is the first point of contact at a desk as you enter the emergency room. The First Nurse Program was put into place to identify patients with chest pain and transfer them immediately to the chest pain unit. When the first nurse records the patient's chief complaint, they could also quickly screen for symptoms of communicable diseases and implement isolation precautions to prevent disease transmission. This intervention was applied on all shifts, and the goal is to promptly identify patient symptoms such as cough, rash, stiff neck, associated with the most common communicable diseases, unprotected exposures, such as measles, influenza, pertussis, TB and meningitis and isolate the patient before an exposure occurs.⁶

STUDY OF THE INTERVENTION

The organization's occupational health airborne and droplet transmitted disease exposure incidents were used to determine if the intervention of early identification and isolation of infectious patients was effective during this capstone project. Historically, at this organization, when a patient was diagnosed with an airborne or droplet transmitted disease, the infection prevention department notifies the occupational health nurse of the potential exposure. The infection prevention department then reviews the electronic medical record (EMR) for documentation of patient isolation during their hospitalization.

Additionally, the occupational health nurse interviews the HCW who cared for the patient and inquiries about patient isolation precautions to determine if an occupational health exposure occurred. To evaluate the effectiveness of the P.R.I.D.E. project, the PPE and isolation precautions taken during the exposure period, determined if the capstone intervention was the causative factor in reducing the incidence in occupational health exposures. This evaluative method allowed us to determine if an occupational health exposure occurred, and this data was compared to the previous quarter at this organization.

Upon reflection, the P.R.I.D.E. project brought awareness of the increased risk of occupational health exposures to airborne and droplet transmitted diseases in the ER. During this project, the proposed change in practice was to improve a RNs ability to identify and isolate potentially infectious patients. This change was accomplished; however, documentation of these actions was lacking and complicated the efforts of the occupational health nurse to determine if an exposure occurred. Moreover, the possibility of recall bias from the nurse affected was introduced because of the lack of documentation of PPE usage and patient isolation practices.

MEASURES

For this project, a quasi-experimental design of pre and post-intervention model utilizing a quantitative approach to decrease the incidence of occupational health exposures related to airborne and droplet transmitted diseases in the emergency room was used. Historically at this organization, the raw number of occupational health exposures were recorded, but a rate of exposure levels was not tracked year over year. Beginning in 2019, the occupational health nurse calculates exposure rates for sharps injuries (SI) and mucocutaneous exposures using the Expo Stop recommendations. The Expo Stop calculation involves taking the number of exposures/numbers of full-time employees (FTE) $\times 100 =$ rate of exposures.¹² This calculation will be utilized to obtain a quarterly occupational health exposure rate to airborne and droplet transmitted communicable diseases. Due to the lack of annual rates, a quarterly rate will be calculated beginning in 2019.

During the years of 2017 and 2018, the number of occupational health exposures to droplet and airborne transmitted diseases at this organization were 17 and 3, respectively. During quarter 2 of 2019, which includes the months of April, May, and June, the communicable disease exposure rates among emergency room registered nurse was 8ten exposures/ 80 RN full time employees (FTE) $\times 100 = 10$ per

100 FTE's. The P.R.I.D.E. project intervention occurred during the third quarter of 2019, which included the months of July, August, and September, and this occupational exposure rate was compared to the second quarter of 2019 rate of zero.

To ensure the planned change occurred, during this project, the quick reference folder was placed at the triage station and the nurse's station. Additionally, the infection preventionist's cell phone number was available in the folder for any questions about what type of isolation was required. During the evaluation process, the infection preventionist viewed the RN's documentation to determine if the infectious patient was promptly identified and isolated.

ANALYSIS

The data collection tool produced ratio data to determine the effectiveness of the P.R.I.D.E. project. Quantitative methods were utilized to draw inferences from the data. Eight emergency room registered nurses, or 10% of the ER RN workforce experienced occupational health exposures, preintervention in quarter 2 of 2019, compared to zero occupational health exposures post- intervention in quarter 3. Regarding disease distribution, mumps accounted for 4 cases or 5% of the exposures, and meningitis represented the remaining four cases 5% exposures. Using IBM SPSS Statistics 25, a χ^2 independence test was used to determine if the categorical variables of the capstone intervention and disease exposure occurrences are related in the same registered nurse population. An association between capstone intervention education and disease exposure was observed, $X^2(1, N = 160) = 8.421, P = .004$, indicating the result is statistically significant. Cramer's V value was also significant, Cramer's V 0.229, $P = .04$ and it indicated a moderate strength of the association (Tables 1–5).

Zero occupational health exposures related to airborne or droplet transmitted diseases occurred during quarter 3 of 2019. Analysis of the results was conducted using a χ^2 test and found to be statically significant. The initial steps of the intervention included increasing awareness of a potentially infectious patient and educating RNs to use PPE and methods of isolation to prevent occupational health exposures. Upon review of the data, the ER did not experience any patients with laboratory-confirmed airborne or droplet transmitted

Table 1
Exposures by quarter-2019

		Exposed	Not exposed	Total	
Quarter	q2	Count	8	72	80
		% within quarter	10.0%	90.0%	100.0%
q3	Count	0	80	80	
		% within quarter	0.0%	100.0%	100.0%

Table 2
 χ^2 test nursing exposures in the ER between quarters 2 and 3

	Asymptotic significance		
	Value	Df	(2-sided)
Pearson χ^2	8.421 ^a	1	0.004
No of valid cases	160		

Table 3
Cramer's V value

		Value	Approximate significance
Nominal by	Phi	0.229	0.004
Nominal	Cramer's V	0.229	0.004
No of valid cases		160	

Table 4
Airborne or droplet disease exposure distribution by quarter

		Meningitis	Mumps	No exposure	Total	
Quarter	q2	Count	4	4	72	80
		% within quarter	5.0%	5.0%	90.0%	100.0%
	q3	Count	0	0	80	80
		% within quarter	0.0%	0.0%	100.0%	100.0%

diseases during quarter 3 of 2019. However, there were 4 rule-out TB patients in the ER and one rule-out case of mumps during the intervention period. During the retrospective review of the chart, the Infection Preventionist (IP) was unable to locate nursing documentation regarding patient isolation in the ER or the use of PPE. When the IP interviewed the RN, she could not remember if the patient was given a surgical mask to wear in the emergency room or if the patient was placed in airborne isolation precautions. In all 5 cases of potential infectious ER patients, nursing documentation of measures taken to prevent occupational health exposures was lacking.

Sustainability of the P.R.I.D.E. project can be enhanced by adding a communicable disease screening tool, based on the CDC guidelines, in the triage section of the EMR. This tool would embed this practice into the nursing workflow and improve the documentation of symptoms and the initiation of isolation practices. After this occurs, additional studies should be performed, and documentation of isolation compliance could be measured, in addition to reducing the incidence of occupational health exposures.

The key findings of this project included education and ongoing support as an essential intervention of the program. Additionally, documentation of exposure preventions is crucial when determining if an occupational health exposure has occurred. The rationale of this project was that RNs would perform simple interventions to reduce the incidence of occupational health exposures to protect their health and the health of others. The specific aim of the project was to improve the ER RN's ability to identify and isolate infectious patients

promptly. One of the strengths of the project was the close involvement and interaction with front line RNs, which allowed this researcher to dispel the myth, that 4 walls and a door are needed in the ER to isolate potentially infectious patients properly.

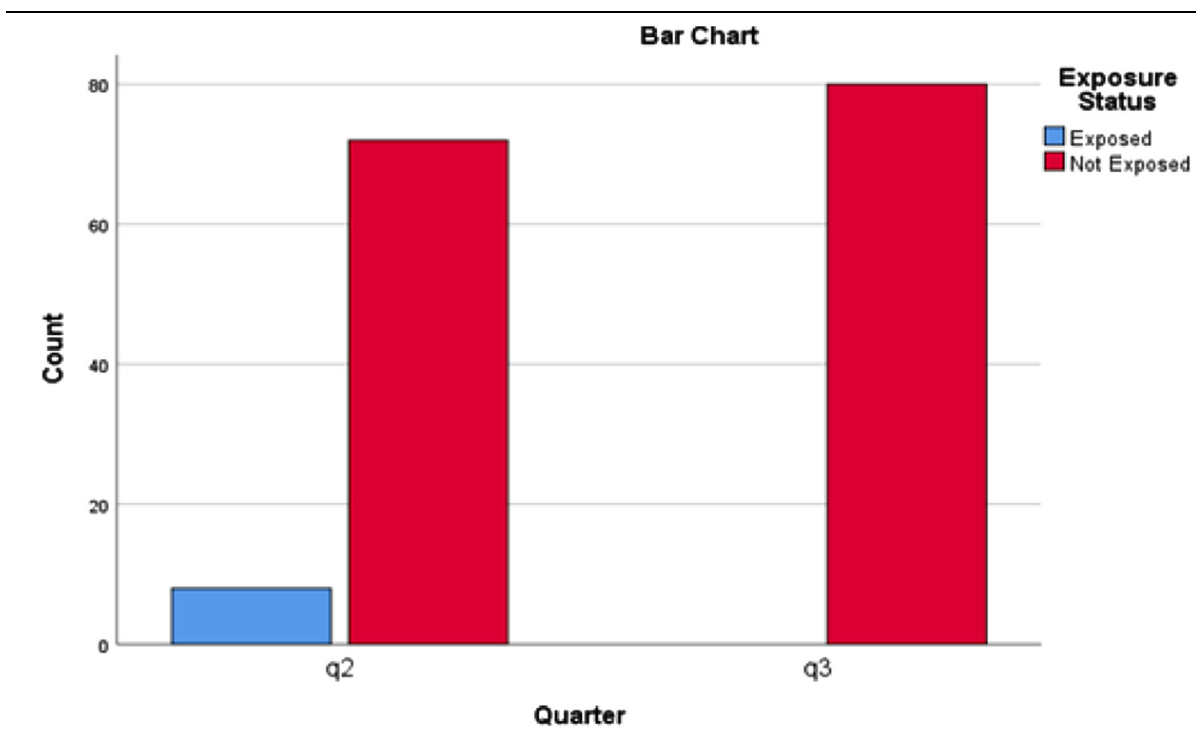
INTERPRETATION

The CDC created the empiric transmission precautions guidelines based on evidence obtained from relevant studies published in English from 1996 to 2006.⁶ Much of the evidence cited in the guidance to prevent transmission of disease in health care settings was obtained from studies using quasi-experimental designs, specifically nonrandomized, pre–post intervention study designs.⁶ One of the studies utilized to create the CDC empiric transmission precautions discussed lessons learned during the Severe Acute Respiratory Syndrome outbreak that occurred in 2003.⁶

Another study utilized as supportive evidence to create the CDC guideline, reviewed the spread of measles from a vigorously coughing child in a pediatric office, which lead to 7 secondary cases of measles due to exposure in the office.⁶ During this case study, researchers conducted airflow studies to demonstrate how droplet nuclei generated in the clinic exam room could disperse through the entire pediatric office environment.⁶ Researchers concluded that the measles outbreak in this office was supportive evidence that measles can survive for at least 1-hour airborne.⁶

A third study reviewed a pertussis outbreak among HCWs in a pediatric emergency unit.⁶ In this case, to stop the pertussis outbreak, all health care workers with a cough were given antibiotics and given a 5-day sick leave.⁶ Researchers concluded that pertussis is a threat to HCWs, and early identification and isolation of patients with pertussis symptoms could prevention a pertussis outbreak.⁶ These relevant studies and lessons learned, provided the foundation necessary to create the CDC's empiric transmission-based guidelines to prevent disease transmission in health care settings.

Table 5
Number of RN's exposed per quarter



Costs associated with presumptive isolation included the price of PPE, such as disposable gowns for contact isolation rooms and masks for airborne or droplet isolation rooms. This organization has double rooms in the medical-surgical unit. When a patient is placed in isolation, the second bed is closed and cannot be utilized. Therefore, isolating a patient in this hospital results in a financial loss of \$ 2,297 per day on average in the state of California.¹³ At this organization, the IP reviews a list of isolation patients every day, Monday through Friday, to determine if isolation is still necessary or if isolation can be discontinued.

SUMMARY

The key findings of this project included education and ongoing support as an essential intervention of the program. Additionally, documentation of exposure preventions is crucial when determining if an occupational health exposure has occurred. The rationale of this project was that RNs would perform simple interventions to reduce the incidence of occupational health exposures to protect their health and the health of others. The specific aim of the project was to improve the ER RN's ability to identify and isolate infectious patients promptly. One of the strengths of the project was the close involvement and interaction with front line RNs, which allowed this researcher to dispel the myth, that 4 walls and a door are needed in the ER to isolate potentially infectious patients properly.

LIMITATIONS

Generalization of the study findings to other hospitals should be used with caution. Each hospital has a varied level of risk and preparedness to contain airborne and droplet transmitted diseases. The challenges facing this one medium-sized hospital in a high-income region of the country are not the same for hospitals located in different areas of the country. Additionally, the p-value from the χ^2 should be interpreted with caution, as it may be prone to type 1 error, or a false positive. Another potential limitation of this project was the lack of documentation and direct observations to determine competence in isolation and quarantine techniques. This limitation was minimized by reviewing the CDC's instructions for donning and doffing PPE during the educational in-services provided. Last, confounding bias attributed to known confounders can be controlled during data analysis.¹⁴ Potential confounding variables in this study included decreased circulating infectious diseases in the community depending on the time of year.

Moreover, this study utilized a sample of convenience, as opposed to a random sample; therefore, the results cannot be applied generally to a larger population or sample, only suggested. Additionally, inclusive bias may have occurred because the sample represents RNs rather than all HCW's. While the education was provided to nurses only, the benefits of early isolation of infectious patients benefitted all HCWs by preventing exposures.

Another study limitation is the reduced intervention time period. According to Good & Grimmond,¹² ExpoStop exposure rates are calculated annually. This study limitation reduces the ability to compare the capstone quarterly exposure rates to the ExpoStop annual exposure rates. Therefore, in this study, quarter 1 of 2019 exposure rates were compared to quarter 2 of 2019.

CONCLUSIONS

Future studies should incorporate a 12-month study period to accurately compare ExpoStop annual rates of exposure. However,

this study shows that implementing the CDC guidelines of empiric transmission-based isolation precautions effectively reduced occupational health exposures. This change in practice helped prevent disease transmission and protected the health of HCW's and other hospitalized patients. Other Infection Prevention researchers can replicate this research with larger sample sizes to determine if the evidence of from this P.R.I.D.E. project can be substantiated. The interventions could be utilized across this health system to include doctor offices and urgent cares to prevent occupational health exposures. The health system shares the same EMR system, and they have an outpatient infection preventionist who could provide the education to use the CDC guidelines to identify and isolate infectious patients promptly. Finally, this learning could be shared with 97 hospital infection preventionists, at our sister organizations on the monthly corporate infection prevention conference call. If this project were implemented across the enterprise, RNs would be prepared to care for infectious patients, and occupational health exposures in the emergency room would be significantly reduced.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.ajic.2020.07.030>.

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