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Original Research

Active monitoring versus direct active monitoring for Ebola virus disease in the United States: experiences and perceptions of former persons under monitoring in the District of Columbia and Indiana



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ABSTRACT

Objectives: During the 2014–2016 West Africa Ebola outbreak, the Centers for Disease Control and Prevention recommended daily monitoring and surveillance of persons arriving in the United States (US) from impacted areas through either active monitoring (phone calls, online platforms, and so on) or direct active monitoring (in-person or electronic visualization). Intensiveness of policies implemented by state/local jurisdictions varied markedly. To study the experiences and perceptions of active monitoring versus direct active monitoring on former persons under monitoring (FPUMs) in the US, we compared two jurisdictions that utilized distinct polices: the District of Columbia (DC) and Indiana (IN).

Study design: Retrospective assessment survey of FPUMs.

Methods: FPUMs from both jurisdictions (DC 826 and IN 246) monitored from October 2014 to September 2015 were surveyed regarding their overall perception of monitoring, communications with jurisdictional staff, negative consequences experienced, and risk for and concern about Ebola virus disease. A total of 294 DC FPUMs and 52 IN FPUMs responded.

Results: Directly actively monitored FPUMs in IN were more likely to report monitoring was difficult ($P < 0.01$), not being allowed to return to work ($P = 0.01$), and faster response times when reaching out to their assigned health department ($P < 0.01$). Overall all FPUMs, regardless of the monitoring method they underwent, perceived little risk and reported they felt monitoring protected public health.

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Conclusions: Our results display that while FPUMs preferred active monitoring, both polices equally reduced their concern, suggesting that less intensive polices achieve the same level of perceived effectiveness by those monitored while also reducing the amount of negative consequences they may face.

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Introduction

On October 22, 2014, in response to the Ebola virus disease (EVD) outbreak, the Centers for Disease Control and Prevention (CDC) recommended that all United States (US) state and local health departments perform daily active or direct active monitoring of recent travelers arriving from Guinea, Liberia, and Sierra Leone for 21 days following their last potential exposure based on their risks.¹ This was a more stringent recommendation compared to other countries that enacted monitoring programs that did not always require daily active monitoring such as Australia,² Japan,³ and the United Kingdom.⁴ In the US, the CDC provided guidance to state and local health departments for establishing systems to quickly recognize symptomatic travelers from these three Ebola-affected countries (EACs) and enable rapid isolation, testing, and appropriate medical care as required. Between November 3, 2014, and December 27, 2015, nearly 30,000 persons were monitored by 60 jurisdictions: 50 states, two local jurisdictions, and eight territories and freely associated states.⁵ These active monitoring efforts ensured continued surveillance of travelers arriving to the US from EACs after undergoing enhanced airport entry screening at one of the five US airports (New York–John F. Kennedy, Newark, Washington–Dulles, Chicago–O’Hare, and Atlanta Hartsfield–Jackson). Enhanced airport entry screening began in October 2014 and was modified in November to include Mali on the list of EACs⁶ and distribute Check and Report Ebola kits with a prepaid cell phone, thermometer, symptom log, and educational materials. The cell phones distributed by the CDC did not have smartphone capabilities.⁷

During enhanced airport screenings, the CDC would perform an EVD risk assessment and assign a risk classification to travelers arriving from EACs based on their activities while in-country. Travelers were deemed ‘high risk’ if they had a confirmed EVD exposure without proper personal protective equipment (PPE) (i.e. a physician or nurse with a confirmed PPE failure while treating patients with EVD), with recommended isolation and direct active monitoring (DAM) either in-person or through electronic means (FaceTime, Skype, and so on). Travelers were deemed ‘some risk’ if they were exposed to EVD but while utilizing proper PPE (i.e. a physician or nurse without a PPE failure while treating EVD patients), with recommended quarantine and DAM either in-person or through electronic means (FaceTime, Skype, and so on). Travelers were deemed ‘low risk (but not zero)’ if they were in a country while active EVD transmission was occurring (i.e. a resident of the country or a non-resident traveling to the country for any reason), with recommended indirect active monitoring through either phone calls or electronic means (email, text message, and so on).^{1,5–7}

The active monitoring programs (AMP) implemented in the US by various state and local health departments varied significantly,^{8,9} as did the overall number of persons monitored by each jurisdiction.⁵ From November 3, 2014, to December 27, 2015, some jurisdictions monitored fewer than 10 travelers, while others monitored more than 2000 travelers.⁵ Some jurisdictions enacted monitoring policies that were more intensive than CDC recommendations, while others developed policies that were less intensive.⁹ Only a few jurisdictions have published reports describing their AMP and the characteristics of those monitored, and none have directly compared how the various intensiveness of monitoring policies impacted travelers.^{10–13} In this report, we compared the experiences of persons who underwent monitoring (‘former persons under monitoring’ [FPUMs]) in the District of Columbia (DC) with FPUMs monitored in Indiana (IN) to better understand the significance and impact of monitoring policies on travelers because these jurisdictions used two distinct approaches with different degrees of intensity. A detailed comparison of the DC and IN AMPs is shown in [Table 1](#). To determine if the intensity of the monitoring program impacted the FPUM’s experiences and perceptions, the DC Department of Health (DC Health) and the Indiana State Department of Health (ISDH) surveyed FPUMs in their respective jurisdictions about their knowledge and perception of the monitoring process, interaction with health department staff, and perceived risk of and concern about EVD.

Methods

DC Health survey development and administration

Survey questions were developed by DC Health epidemiologists who monitored travelers and then pilot tested by public health officials in other jurisdictions.¹¹ The following aspects of the monitoring program were assessed: FPUM perception and understanding of the monitoring program, negative consequences experienced as a result of EVD monitoring, overall concern for developing or transmitting EVD, perception of the US AMP as a whole, and impact of monitoring on future travel between the US and an EAC or willingness to assist with EVD outbreak response activities.

DC FPUMs were eligible to take the survey if they were monitored during October 2014–September 2015, were monitored by the DC Health and not another agency or individual, were classified as ‘low risk (but not zero),’ were at least 18 years of age during monitoring, and had a valid and unique email address. In DC, ‘low-risk (but not zero)’ travelers were monitored using an active monitoring protocol (communication via telephone, email, or text message), whereas

Table 1 – A comparison of the District of Columbia Department of Health (DC Health) and Indiana State Department of Health (ISDH) Ebola-monitoring protocols.

	District of Columbia (DC)	Indiana (IN)
Earliest date received a notification about a traveler arriving from an EAC	October 17, 2014	October 15, 2014
Time range of entire Ebola-monitoring program	October 27, 2014–December 29, 2015	October 15, 2014–December 20, 2015
Number of unique individuals classified as ‘low risk (but not zero),’ ‘some risk,’ or ‘high risk’ monitored during time period covered by the survey	929 low risk (but not zero), 10 some risk, 0 high risk	236 low risk (but not zero), 10 some risk, 0 high risk
Total number of unique monitoring events during time period covered by the survey ^a	1100	337
Protocol for initial contact with PUMs for risk assessment	<ul style="list-style-type: none"> • DC Health phoned the traveler • Call included an interview and risk assessment, explanation of the monitoring protocol, collection of information about future travel plans, and explanation of what to do if they experienced symptoms • An informational email summarizing all information explained during the phone call was sent immediately following the call 	<ul style="list-style-type: none"> • A representative from the state and local health department visited the traveler’s residence • Visit included a risk assessment, documentation of traveler temperature and symptoms, review of the monitoring process and expectations, an explanation of what to do if they experienced symptoms, and obtaining signed paperwork acknowledging receipt of EVD information • In addition to the CDC provided CARE phone, travelers were given a phone by ISDH with live visualization functionality if they did not have one
Protocol for daily follow-up of ‘low-risk (but not zero)’ travelers	<ul style="list-style-type: none"> • Active monitoring daily: PUMs were given the option to report once or twice daily via text, email, or phone, based on their preference 	<ul style="list-style-type: none"> • Direct active monitoring (e.g., video conferencing) twice daily before October 2, 2015 • Active monitoring twice daily beginning October 2, 2015 • Twice daily reporting was mandated
Protocol for daily follow-up of ‘some-risk’ and ‘high-risk’ travelers	<ul style="list-style-type: none"> • A combination of active and direct active monitoring: one report could be via text, email, or phone and one report was done by direct active monitoring (e.g., video conferencing) • Twice daily reporting was mandated 	<ul style="list-style-type: none"> • Direct active monitoring (e.g., video conferencing) • Twice daily reporting was mandated
Process for giving PUMs instructions about traveling while under monitoring	<ul style="list-style-type: none"> • Process explained during initial phone interview and described in an informational email sent following the initial interview • Traveler was asked about future travel plans during the initial interview and to report any new travel plans to the person conducting their monitoring prior to travel 	<ul style="list-style-type: none"> • Traveler was provided an ‘Acknowledgement of Receipt of EVD Information’ which contained the packet with the CDC CARE Kit and ISDH instructions containing information on the monitoring process and who to call with questions along with what to do if symptoms occur
Instructions given about what to do if the PUMs experienced symptoms consistent with EVD	<ul style="list-style-type: none"> • During the initial phone interview, PUMs were instructed to first call the person monitoring them, and if there was no response, the DC Health 24-h call center • These instructions were included in the informational email sent to the PUMs immediately following the initial interview 	<ul style="list-style-type: none"> • During the initial in-person visit, PUMs were instructed to first contact the local health department, and if there was no response, the state health department • They were instructed to call 911 if they had a medical emergency • This information was explained during the visit to the traveler’s residence and in documents they received
Earliest, latest month of monitoring reported by a survey respondent	October 2014, November 2015	October 2014, December 2015 ^b

CDC, Centers for Disease Control and Prevention; EVD, Ebola virus disease; EAC, Ebola-affected country; ISDH, Indiana State Department of Health; PUM, person under monitoring; CARE, Check and Report Ebola.

^a Unique monitoring event is defined as a person entering the US from an EAC and starting a monitoring period. Some PUMs were monitored more than once due to multiple trips.

^b IN PUMs monitored from October 2015 through December of 2015 were excluded during the final analysis due ‘low-risk (but not zero)’ PUMs undergoing active monitoring protocols and not direct active monitoring protocols.

Table 2 – Characteristics of survey respondents by jurisdiction: Oct. 2014–Sept. 2015.

	No. (%) of respondents			P-value
	All survey respondents	DC respondents	Indiana respondents	
Gender^a				
Male	185/334 (55.4)	150/282 (53.2)	35/52 (67.3)	0.06
Female	149/334 (44.6)	132/282 (46.8)	17/52 (32.7)	
Age in years^b				
<29	32/344 (9.3)	28/292 (9.6)	4/52 (7.7)	<0.01
30–39	113/344 (32.8)	106/292 (36.3)	7/52 (13.5)	
40–49	95/344 (27.5)	74/292 (25.3)	18/52 (34.6)	
50–59	64/344 (18.6)	52/292 (17.8)	12/52 (23.1)	
≥60	43/344 (12.5)	32/292 (11.0)	11/52 (21.2)	
Date active monitoring period started^c				
October 2014–February 2015	88/338 (26.0)	80/294 (27.2)	8/44 (18.2)	0.41
March 2015–July 2015	160/338 (47.3)	138/294 (46.9)	22/44 (50.0)	
August 2015–December 2015	90/338 (26.6)	76/294 (25.9)	14/44 (31.8)	
Citizenship^c				
Citizen of the US or other	249/343 (72.6)	208/291 (71.5)	41/52 (78.8)	0.27
Citizen of EAC	94/343 (27.4)	83/291 (28.5)	11/52 (21.2)	

DC, District of Columbia; EAC, Ebola-affected country.

^a Less than 4% missing data.

^b Less than 1% missing data.

^c Less than 3% missing data.

‘some-risk’ and ‘high-risk’ travelers were monitored using a DAM protocol (i.e., live visualization using video conferencing programs). ‘Some-risk’ and ‘high-risk’ travelers were excluded from the DC survey due to small sample sizes and the difference in monitoring protocols compared to ‘low-risk (but not zero)’ FPUMs. The DC Health administered the survey in English and French during October 10, 2015–November 9, 2015, using SurveyMonkey (Palo Alto, CA). Two reminders were sent to encourage survey participation.

ISDH survey development and administration

The DC Health shared survey questions with the ISDH in December 2015. The ISDH modified some of the sociodemographic questions and monitoring program questions to more closely align with the DAM protocol used to monitor IN FPUMs. The ISDH used identical questions to those of the DC Health for all other questions. IN FPUMs were eligible to take the survey if they underwent DAM during October 2014–December 2015, were at least 18 years of age during monitoring, and had a valid and unique email address. Before October 2, 2015, all IN FPUMs were monitored using the same DAM protocol, regardless of their EVD risk classification (Table 1). However, starting October 2, 2015, ‘low-risk (but not zero)’ travelers were monitored using an active monitoring protocol. As a result, all FPUMs monitored from October 2015 through December 2015 were excluded from the final data set. The ISDH administered the survey in English during February 14, 2016–March 14, 2016, using SurveyMonkey (Palo Alto, CA).

Patient and public involvement

No patients were involved in this study. Data consisted solely of anonymous responses from an electronic survey distributed to FPUMs and completed on a voluntary basis.

Statistical analysis

Associations between responses from FPUMs monitored by the DC Health and ISDH were analyzed using Fisher's exact tests or Chi-squared tests. A P-value <0.05 was considered statistically significant. Analyses were performed by the DC Health using SAS 9.4 (Cary, NC).

Results

Survey respondent characteristics

The surveys were sent to a total of 1072 eligible FPUMs. Among the eligible DC FPUMs (n = 826), 294 completed all or part of the survey, yielding a response rate of 35.6% (n = 294/826). Among the eligible IN FPUMs (n = 246), 52 monitored from October 2014 through September 2015 completed all or part of the survey, yielding a response rate of 21.1% (n = 52/246). DC respondents were significantly more likely to be younger than IN respondents. There were no significant differences between FPUMs from the two jurisdictions in relation to gender, citizenship, or the time period when monitoring occurred (Table 2).

AMP experiences and perception comparisons

IN respondents were more likely to have a negative view of their monitoring experience compared to DC respondents, and the experiences and perception of respondents in each group were significantly different for each measure assessed (Table 3). Although >85% of respondents in each jurisdiction strongly agreed or agreed that reporting instructions were clearly explained and that their questions were answered to their satisfaction, a greater proportion of IN respondents disagreed with these statements. IN respondents were more than

Table 3 – Comparison of monitoring program evaluations between former persons under monitoring in the District of Columbia (DC) or Indiana: Oct. 2014–Sept. 2015.

	No. (%) of respondents			P-value
	All survey respondents	DC respondents	Indiana respondents	
Reporting instructions were explained clearly^a				
Strongly disagree or disagree	13/314 (4.1)	8/265 (3.0)	5/49 (10.2)	<0.01
Neutral	20/314 (6.4)	19/265 (7.2)	1/49 (2.0)	
Agree or strongly agree	281/314 (89.5)	238/265 (89.8)	43/49 (87.8)	
Questions were answered to my satisfaction^a				
Strongly disagree or disagree	14/311 (4.5)	8/262 (3.1)	6/49 (12.2)	<0.01
Neutral	35/311 (11.3)	33/262 (12.6)	2/49 (4.1)	
Agree or strongly agree	262/311 (84.2)	221/262 (84.4)	41/49 (83.7)	
Overall rating of the monitoring process^b				
Very difficult or difficult	26/338 (7.7)	12/289 (4.2)	14/49 (28.6)	<0.01
Neutral	52/338 (15.4)	46/289 (15.9)	6/49 (12.2)	
Easy or very easy	260/338 (76.9)	231/289 (79.9)	29/49 (59.2)	
Time it took the health department to respond when contacted^c				
I never called my contact person	182/284 (64.1)	160/239 (66.9)	22/45 (48.9)	<0.01
<1 h	68/284 (23.9)	51/239 (21.3)	17/45 (37.8)	
>1 h but the same day	30/284 (10.6)	24/239 (10.0)	6/45 (13.3)	
My contact person never responded	4/284 (1.4)	4/239 (1.7)	0/45 (0.0)	
Instructions if you developed symptoms consistent with Ebola^c				
Immediately call your health department contact person	199/324 (61.4)	164/275 (59.6)	35/49 (71.4)	0.29
Selected an incorrect response ^d	48/324 (14.8)	43/275 (15.6)	5/49 (10.2)	
Did not remember instructions	77/324 (23.8)	68/275 (24.7)	9/49 (18.4)	
Instructions if you planned to travel outside of your monitoring jurisdiction for an overnight trip during your active monitoring period^e				
Tell your health department contact person before traveling	241/323 (74.6)	212/276 (76.8)	29/47 (61.7)	0.02
Selected an incorrect response ^e	8/323 (2.5)	8/276 (2.9)	0/47 (0.0)	
Did not remember instructions	74/323 (22.9)	56/276 (20.3)	18/47 (38.3)	

^a Less than 11% missing data.

^b Less than 3% missing data.

^c Less than 8% missing data.

^d Incorrect responses included 'Immediately call 911 (without calling your health department contact person),' 'Immediately go to a healthcare facility (without calling your health department contact person),' and 'Call my health department contact person if my symptoms did not improve after 24 h.'

^e Incorrect responses included 'Tell your health department contact person after traveling,' 'Contact the health department at your final destination without telling your (DC/Indiana state) Department of Health contact person,' and 'Tell the Centers for Disease Control and Prevention and no one else.'

three times as likely as DC respondents to strongly disagree or disagree that reporting instructions were explained clearly (10.2% versus 3.0%; $P < 0.01$) and that their questions were answered to their satisfaction (12.2% versus 3.1%; $P < 0.01$). IN respondents were more than five times as likely as DC respondents to rate the overall monitoring process as very difficult or difficult (28.6% versus 4.2%; $P < 0.01$). When contacting their health department after their initial risk assessment interview with a question, 37.8% (17/45) of IN FPUMs received a response within an hour compared with 21.3% (51/239) of DC respondents ($P < 0.01$). Accurate recall of instructions on how to report EVD-related symptoms (59.6% versus 71.4%; $P = 0.29$) did not vary between DC and IN. Accurate recall of instructions on how to report planned interstate or international travel (76.8% versus 61.7%; $P = 0.02$) during the monitoring period did vary significantly between DC and IN.

Negative consequences

More than a quarter (30.4%) of all respondents reported experiencing at least one negative consequence resulting from travel, most commonly that a friend or family member

chose not to spend time with them (17.9%) (Table 4). While the proportion of respondents who experienced at least one negative consequence did not vary significantly between DC and IN (28.5% versus 41.7%; $P = 0.07$), IN respondents were significantly more likely to report isolating themselves at home without being instructed to do so (17.0% versus 5.9%; $P = 0.01$) and that an employer did not allow them to return to work (13.0% versus 3.3%; $P = 0.01$).

Perception of the US AMP and EVD concern

Regardless of the monitoring jurisdiction, most respondents were unconcerned about becoming ill with EVD (>70%), transmitting EVD to someone else (>75%) and a large EVD outbreak occurring in the US (>80%) and agreed or strongly agreed with statements about the benefits of the US AMP for travelers (>70%; Table 5). No significant differences in perception or the level of concern between jurisdictions were found.

Future plans

Few respondents reported that their monitoring experience caused them to avoid future travel between the US and EACs

Table 4 – Comparison of negative consequences experienced due to travel history by former persons under monitoring in the District of Columbia (DC) or Indiana: Oct. 2014–Sept. 2015.

	No. (%) of respondents			P-value
	All survey respondents	DC respondents	Indiana respondents	
Tried to visit a country (other than the US) and was not allowed to enter^a				
Yes	24/320 (07.5)	21/273 (7.7)	3/47 (6.4)	0.24
No	296/320 (92.5)	252/273 (92.3)	44/47 (93.6)	
Chose to self-isolate at home without instruction to do so^a				
Yes	24/320 (7.5)	16/273 (5.9)	8/47 (17.0)	0.01
No	296/320 (92.5)	257/273 (94.1)	39/47 (83.0)	
Employer did not allow to work^a				
Yes	15/316 (4.7)	9/270 (3.3)	6/46 (13.0)	0.01
No	301/316 (95.3)	261/270 (96.7)	40/46 (87.0)	
Medical appointment or procedure canceled or delayed^a				
Yes	14/319 (4.4)	11/271 (4.1)	3/48 (6.3)	0.21
No	305/319 (95.6)	260/271 (95.9)	45/48 (93.8)	
Friend or family member's medical appointment or procedure canceled or delayed^a				
Yes	6/318 (1.9)	4/271 (1.5)	2/47 (4.3)	0.17
No	312/318 (98.1)	267/271 (98.5)	45/47 (95.7)	
Friend or family member would not spend time with them^a				
Yes	57/319 (17.9)	44/271 (16.2)	13/48 (27.1)	0.07
No	262/319 (82.1)	227/271 (83.8)	35/48 (72.9)	
Experienced at least one negative consequence^a				
Yes ^b	98/322 (30.4)	78/274 (28.5)	20/48 (41.7)	0.07
No	217/322 (67.5)	196/274 (71.5)	28/48 (58.3)	

^a Less than 9% missing data.

^b Among the previously listed negative consequences.

to prevent additional monitoring (<4%) or to avoid assisting with EVD outbreak response activities (<5%). These results did not vary significantly between jurisdictions (Table 5).

Discussion

FPUMs in DC and IN experienced significant differences in their understanding of reporting instructions and perception of the difficulty of the monitoring process. There was also a significant increase in the proportion of IN respondents who chose to self-isolate and whose employer would not allow them to return to work compared to DC respondents. EVD concern and perception of the US AMP as a whole was similar for both groups.

The increased number of steps associated with the DAM process implemented by the ISDH for all IN FPUMs from October 2014 through September 2015, regardless of the level of risk, may explain why IN respondents reported the monitoring process as more difficult. The IN monitoring process during this time required an initial in-person risk assessment, then mandatory face-to-face contact twice daily 12 h apart utilizing FaceTime or Skype, which may have interfered with IN FPUMs' daily routines. In contrast, the DC Health reporting process (i.e., email, text, or phone) for 'low-risk (but not zero)' DC FPUMs did not require face-to-face contact at any point and allowed for once or twice daily reporting based on the FPUM's preference and thus may have been less disruptive.

Use of the video conferencing tools may also have contributed to the perceived complexity of the reporting process as some IN respondents may not have been very familiar with these technologies or had difficulty using them on the phone the ISDH provided. To ease the process, local health departments in IN coordinated with IN FPUMs to prevent reporting from interfering with their daily schedules as much as possible, including asking IN FPUMs to refrain from drinking hot liquids before temperature evaluations. These issues may have contributed to the perception of difficulty IN FPUMs expressed in the survey when compared to DC FPUMs.

IN FPUMs more commonly reported that instructions were not explained clearly and questions were not answered to their satisfaction. Two key differences between the jurisdictions may have impacted this finding: centralization and the total number of FPUMs monitored. The ISDH had to closely collaborate with local health departments to complete monitoring. Additionally, variability between local health departments may have impacted monitoring experiences. In DC, one health department (DC Health) was responsible for all monitoring steps, allowing greater consistency. The DC Health also monitored more people overall compared to the ISDH, giving DC Health investigators more experience in speaking with travelers, initiating the monitoring process, and completing daily monitoring. In contrast, the frequent contact (visually, twice daily) with a lower number of FPUMs allowed IN investigators to devote more time to individual FPUM. This more intensive direct contact may have contributed to IN FPUMs' perception of the monitoring process as difficult and time-consuming when compared to FPUMs who underwent less intensive monitoring protocols.

Another notable finding was the significant difference in response times reported between DC and IN FPUMs if they ever contacted their health department after their initial risk assessment interview, with IN FPUMs reporting quicker responses. The lower number of IN FPUMs, plus jurisdictional differences when compared to DC, may have made it possible for the ISDH to focus more resources on an individual FPUM. However, it is also possible that the DAM approach the ISDH took with all FPUMs, regardless of the level of risk, resulted in IN FPUMs being more familiar with directly reaching out to the health department. Regardless of the cause, this difference should be carefully considered during future outbreaks that warrant AMPs as others have highlighted the high financial cost of implementing such programs and the reduction of cost that can be achieved through targeted, risk-based approaches.¹⁴ Other countries where the intensity of monitoring efforts was more closely based on the level of risk when compared to the US ended up with similar results, detecting few, if any EVD cases.^{2–4,15}

There was no significant difference in the overall frequency of negative consequences experienced by DC FPUMs and IN FPUMs, but IN FPUMs disproportionately experienced some specific consequences more. A higher number of IN FPUMs chose to isolate themselves at home without being instructed to do so and reported not being allowed to return to work. This could potentially be related to a difference in public perception when implementing active versus DAM programs, especially given all IN FPUMs, regardless of the level of risk, underwent an initial in-person risk assessment. However, regional differences in media coverage and the underlying customs and beliefs

Table 5 – Comparison of the level of concern about Ebola virus disease (EVD) and perception of the US EVD active monitoring program in former persons under monitoring in the District of Columbia (DC) and Indiana: Oct. 2014–Sept. 2015.

	No. (%) of respondents			P-value
	All survey respondents	DC respondents	Indiana respondents	
Respondent would become ill with EVD^a				
Not at all concerned	233/325 (71.7)	199/276 (72.1)	34/49 (69.4)	0.61
Slightly concerned	64/325 (19.7)	55/276 (19.9)	9/49 (18.4)	
Moderately, very, or extremely concerned	28/325 (8.6)	22/276 (8.0)	6/49 (12.2)	
Respondent could potentially transmit EVD to someone else^a				
Not at all concerned	253/323 (78.3)	218/274 (79.6)	35/49 (71.4)	0.14
Slightly concerned	44/323 (13.6)	33/274 (12.0)	11/49 (22.4)	
Moderately, very, or extremely concerned	26/323 (8.0)	23/274 (8.4)	3/49 (6.1)	
A large EVD outbreak would occur in the US^b				
Not at all concerned	266/321 (82.9)	229/273 (83.9)	37/48 (77.1)	0.20
Slightly concerned	29/321 (9.0)	25/273 (9.2)	4/48 (8.3)	
Moderately, very, or extremely concerned	26/321 (8.1)	19/273 (7.0)	7/48 (14.6)	
It protects the US public from getting EVD from symptomatic travelers^c				
Strongly disagree or disagree	48/328 (14.6)	40/279 (14.3)	8/49 (16.3)	0.64
Neutral	48/328 (14.6)	39/279 (14.0)	9/49 (18.4)	
Agree or strongly agree	232/328 (70.7)	200/279 (71.7)	32/49 (65.3)	
It helps recent travelers seek treatment faster if they become ill compared to travelers not actively monitored^c				
Strongly disagree or disagree	38/327 (11.6)	28/278 (10.1)	10/49 (20.4)	0.68
Neutral	43/327 (13.1)	35/278 (12.6)	8/49 (16.3)	
Agree or strongly agree	246/327 (75.2)	215/278 (77.3)	31/49 (63.3)	
It rapidly identifies travelers ill with EVD^c				
Strongly disagree or disagree	49/326 (15.0)	37/277 (13.4)	12/49 (24.5)	0.13
Neutral	52/326 (16.0)	45/277 (16.2)	7/49 (14.3)	
Agree or strongly agree	225/326 (69.0)	195/277 (70.4)	30/49 (61.2)	
It caused recent travelers to avoid future travel between the US and EACs to prevent additional monitoring^a				
Yes	12/323 (3.7)	10/276 (3.6)	4/49 (8.2)	0.13
No	311/323 (96.3)	266/276 (96.4)	45/49 (91.8)	
It caused recent travelers to avoid assisting with EVD outbreak response activities in the future^a				
Yes	16/324 (4.9)	12/275 (4.4)	2/47 (4.3)	0.30
No	308/324 (95.1)	263/275 (95.6)	45/47 (95.7)	

EAC, Ebola-affected country.

^a Less than 7% missing data.^b Less than 8% missing data.^c Less than 6% missing data.

between a large cosmopolitan area (DC) and mainly rural state (IN) likely influenced this as well. Regardless of underlying causes, this supports the need for additional education targeting communities and employers to increase their comfort level regarding FPUMs continuing their normal daily activities.

No differences were observed in the level of EVD-specific concern or perception of the US AMP as a whole between the two jurisdictions. This may suggest that both DAM and active monitoring methodologies equally help to alleviate concern in those monitored and further study is warranted. Additionally, the type of monitoring conducted did not impact the future willingness to travel or assist with the EVD outbreak, indicating that even more intensive monitoring methods are not barriers to travel. This reinforces previous findings showing that the US AMP alleviated FPUM concerns, was generally perceived as protective to the US population by FPUMs, and did not discourage outbreak responders from combating EVD.¹¹ However, this study only surveyed FPUMs and not the general public in the US. Therefore, it should not be inferred that the findings from this study represent the US general public's perceptions surrounding Ebola and the outbreak response.

Limitations

Owing to more time passing for FPUMs monitored early in the outbreak versus those toward the end, recall bias could vary within the surveyed population, becoming more profound for those surveyed after a greater amount of time had passed since their monitoring.

In addition to differences in the monitoring protocols, FPUM age and educational status between the jurisdictions could have contributed to some of the differences noted. While the populations of DC FPUMs and IN FPUMs did not vary for most demographics collected, they did vary by age. However, the level of education was not collected in either jurisdiction and therefore could not be studied. Furthermore, each jurisdiction recorded FPUM's travel purpose differently, not making it possible to compare this characteristic and any potential influence on responses.

Neither jurisdiction asked if FPUMs were truthful when-reporting daily symptoms and temperatures, assuming self-reports to be accurate. Over 10% of FPUMs in another US jurisdiction reported giving incorrect symptom and

temperature reports to their health department,¹⁶ and it remains unclear if this occurred in DC or IN and cannot be determined from this study. Another limitation is the implementation of different survey administration protocols between the two jurisdictions. This may have caused the experiences between the groups to differ for reasons unrelated to the active or DAM process they underwent.

Lastly, there was a difference between sample sizes between the two jurisdictions and the lack of national data to compare these findings. This may make our findings ungeneralizable to all FPUMs monitored in the US over the course of the outbreak. However, these are the only findings that directly compare the implementation in the US of an active monitoring policy to DAM policy and the only study simultaneously reporting the findings from two US jurisdictions.

Conclusions

FPUMs who underwent DAM by the ISDH viewed the process as more difficult compared to the experience of FPUMs actively monitored by the DC Health. However, both methods were equally effective at reducing the concern of those monitored, but response times were higher in DC where more people were monitored. This may indicate that active monitoring approaches requiring fewer resources, and are less complicated for PUM to follow, are equally suitable as DAM from the perspective of those monitored. This may allow health departments to move toward less intensive polices during monitoring programs while still achieving the same level of perceived effectiveness among those monitored. These factors should be considered in future outbreaks that require public health staff to actively monitor persons for disease.

Author statements

Ethical approval

This study (IRBPH # 2015-8) was deemed Institutional Review Board (IRB) exempt by the DC Health IRB for Public Health.

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Competing interests

None declared.

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